# Psychometric properties of the Modified Tonic Immobility Scale

Arturo Bados[1]* y Maribel Peró[2]

[1]*Departamento de Personalidad, Evaluación y Tratamiento Psicológicos, Facultad de Psicología, Universidad de Barcelona. Barcelona (Spain)*

[2] *Universidad de Barcelona. Barcelona (Spain)*

**Título:** Propiedades psicométricas de la Escala Modificada de Inmovilidad Tónica.

**Resumen:** La Escala de Inmovilidad Tónica ha sido estudiada sólo en víctimas de abusos y/o agresiones sexuales, pero la inmovilidad tónica (TI) puede darse ante otros eventos traumáticos. En consecuencia, nos propusimos modificar la escala con este fin y estudiar su estructura factorial y otras propiedades psicométricas (consistencia interna y validez convergente, divergente y discriminante) en 392 universitarios, la mayoría de los cuales había padecido uno o más eventos traumáticos de distintos tipos. La subescala de miedo de la Escala Modificada de Inmovilidad Tónica (EMIT) mostró una consistencia interna muy baja y debe ser eliminada o reformulada. Los índices de discriminación de los ítems 5 y 8 fueron muy bajos y dichos ítems deben ser reformulados o eliminados. Después de eliminar los cinco ítems anteriores, la versión abreviada de la EMIT tuvo una estructura unifactorial, aunque el ajuste del modelo no fue totalmente satisfactorio. Esta escala mostró niveles aceptables de fiabilidad, validez convergente con sintomatología postraumática, validez divergente con medidas de depresión y ansiedad, y validez discriminante al diferenciar entre grupos que habían experimentado o no eventos traumáticos. Las propiedades psicométricas de la versión abreviada de la EMIT deben ser más estudiadas. Puede ser aconsejable añadir nuevos ítems de IT para determinar si este es un constructo con más de una dimensión.

**Palabras clave:** Inmovilidad tónica; trauma; escala de inmovilidad tónica; cuestionario de eventos traumáticos.

**Abstract:** The Tonic Immobility Scale has been only studied in abuse and/or sexual assault survivors, but tonic immobility (TI) also occurs after other types of traumatic events. Consequently, we modified the scale for this purpose and studied its factor structure, internal consistency, and convergent, divergent and discriminant validity in 392 university students, most of whom had suffered one or more traumatic events of various kinds. The Fear subscale of the Modified Tonic Immobility Scale (MTIS) showed very low internal consistency, and must be eliminated or reformulated. Discrimination indices of items 5 and 8 were very low, and these items must be reformulated or removed. After removing the five previous items, the shortened version of the MTIS had a one-factor structure, although model fit was not completely satisfactory. This scale showed acceptable levels of reliability, convergent validity with post-traumatic symptomatology, divergent validity with measures of depression and anxiety, and discriminant validity differentiating between groups that had and had not experienced traumatic events. The psychometric properties of the shortened version of the MTIS should be studied further. It may also be advisable to add new items of TI in order to establish whether this is a construct with more than one dimension.

**Key words:** Tonic immobility; trauma; tonic immobility scale; traumatic events questionnaire.

## Introduction

Four defensive responses to the proximity of danger have been described in the literature: attentive immobility, escape, fight and tonic immobility (Gray, 1987; Marx, Forsyth, Gallup, Fusé, & Lexington, 2008). Tonic immobility (TI) is characterized by severe physical and verbal immobility, tremor, muscular stiffness, lowering of body temperature (feeling cold), intermittent eye closure, and numbness or insensitivity to intense or painful stimulation while preserving an awareness of the environment. TI is induced by conditions of fear, physical restriction, and perceived inability to escape (Heidt, Marx, & Forsyth, 2005; Marx et al., 2008; Moskowitz, 2004).

In animals TI may be an adaptive response when there is no perceived possibility of escape or of winning a fight. This is because TI reduces the likelihood that a predator will continue its attack and increases the chance of escape and survival (Bracha, 2004; Moskowitz, 2004). Little research has been conducted on TI in humans, and although it has been argued to have an adaptive value in certain situations of

**\* Dirección para correspondencia [Correspondence address]:**
Arturo Bados. Departamento de Personalidad, Evaluación y Tratamiento Psicológicos, Facultad de Psicología, Universidad de Barcelona. Barcelona (Spain). E-mail: abados@ub.edu

physical or sexual assault when the victim is unable to fight or escape (see Heidt et al., 2005), it has been found that TI predicts the occurrence of intrusive memories (Hagenaars & Putman, 2011), the development of post-traumatic symptomatology (Bovin, Jager-Hyman, Gold, Marx, & Sloan, 2008; Humphreys, Sauder, Martin, & Marx, 2010; Rocha-Rego et al., 2009) and a poorer response to the pharmacological treatment of post-traumatic stress disorder (Fiszman et al., 2008; Lima et al., 2010). Given these potential implications of TI in humans, its study seems important.

TI has been considered a uni-dimensional construct in laboratory studies with animals and humans. Fusé, Forsyth, Marx, Gallup, and Weaver (2007) have distinguished two dimensions within the Tonic Immobility Scale (Forsyth, Marx, Fusé, Heidt, & Gallup, 2000): physical immobility (defined by the above mentioned aspects) and fear. However, the correlation between them was low and, as they themselves acknowledge, most theorists regard fear as distinct from TI. Fear is an antecedent condition that modulates susceptibility to and duration of TI (Marx et al., 2008). Abrams, Carleton, Taylor, Asmundson, and Gordon (2009) have distinguished three dimensions within the Tonic Immobility Questionnaire: physical immobility, fear, and dissociation (e.g., pain analgesia, felt cold). The three dimensions were highly correlated and the authors used both the partial scores and the total score of the questionnaire. However, they did not perform any analysis to see if the three factors loaded on

a higher order factor. Thus, the dimensionality of TI is an open question.

When assessing TI, many studies with human participants have not used well-established measures with good psychometric properties. The Tonic Immobility Scale (TIS; Forsyth et al., 2000) was the first validated self-report instrument available to assess TI. The TIS was designed to evaluate the characteristics of TI and fearful responding in sexual abuse or sexual assault victims and consists of two parts. The first has 10 items in which the person rates from 0 to 6 the extent to which he/she 1) froze or felt paralyzed, 2) was unable to move even without physical restraint, 3) was trembling/shaking, 4) was unable to scream, 5) felt numb or no pain, 6) felt cold, 7) felt feelings of fear/panic, 8) feared for his/her life, 9) felt detached from himself/herself, and 10) felt detached from what was going on around him/her.[1] The second part of the TIS is exploratory and includes a number of questions that can help understand the immobility response and the circumstances of the attack. To date, this second part has not been examined psychometrically and it will not be considered in this article.

Consistent with conceptual models and research on TI in animals, the authors of the TIS anticipated that items 1 to 6 would load together on a single factor of physical immobility. They also anticipated that item 8 ("fear for one's life"), but not item 7 ("feelings of fear/panic"), also would load on this factor, inasmuch as theories and research data on TI suggest that fear will induce fight or flight behavior, whereas more extreme fear, especially fear for one's life, will increase the likelihood of TI. Finally, they hypothesized that item 9 (depersonalization), but not item 10 (derealization), also would load in the same factor. This was based on findings demonstrating that animals remain conscious and actively scan their environment for opportunities to escape during TI (Forsyth et al., 2000; Fusé et al., 2007). The factor structure of the TIS was studied by both exploratory and confirmatory factor analysis in victims of sexual assault (Fusé et al., 2007). Both analyses showed that the TIS has two factors: TI (items 1, 2, 4, 5, 6, 8 and 9) and Fear (items 3, 7 and 10). Only item 3 loaded on a factor that was different from that predicted. In the confirmatory analysis the factor loading of the item 5 ("numbness/absence of pain") was relatively low (.38) and the authors allowed the items 1 and 4 to covary so as to improve the model's fit.

As regards other psychometric properties of the TIS, Fusé et al. (2007) reported a Cronbach's α of .86 for the TI subscale and .65 for the Fear subscale, whereas Bovin et al. (2008) found lower values of .80 and .44, respectively. The two subscales have correlated significantly and moderately

with post-traumatic symptomatology (Bovin et al., 2008; Heidt et al., 2005; Humphreys et al., 2010).

The Tonic Immobility Questionnaire (Abrams et al., 2009) is the second instrument available to assess TI. It is a 12-item self-report measure developed, in part, on the item content of the TIS to assess TI across a range of traumatic events. Exploratory factor analysis has supported a three-factor solution: physical immobility, fear, and dissociation. The three subscales have good internal consistency and correlate significantly with post-traumatic symptomatology and other related measures. This questionnaire was not published when we began our data collection.

Using the above two questionnaires and other measures of TI (some of them derived from the TIS), several studies have found significant correlations between physical immobility and/or TI, and other measures. Moderate correlations (≥ 30) have been found with post-traumatic symptomatology (Abrams et al., 2009; Abrams, Carleton, & Asmundson, 2012; Bovin et al., 2008; Heidt et al., 2005; Humphreys et al., 2010; Rocha-Rego et al., 2009) and predictors of post-traumatic stress disorder such as dissociation (Abrams et al., 2009, 2012; Heidt et al., 2005). Correlations have been generally lower with measures of trait anxiety (Abrams et al., 2012; Schmidt, Richey, Zvolensky, & Maner, 2008; Heidt et al., 2005). Physical immobility has been significantly higher in people who had suffered traumatic events than among those who had not (Bados, Toribio, & Garcia-Grau, 2008).

An important aspect to note is that although TI appears in a significant percentage of victims of sexual abuse and/or sexual assault (Fusé et al., 2007; Heidt et al., 2005) it also occurs after other types of traumatic events such as robbery or physical assault, traffic accidents, natural and industrial disasters, and hearing of the violent or unexpected death of someone close (Abrams et al., 2009; Bados et al., 2008; Fiszman et al., 2008; Leach, 2004). In the studies of Bados et al., Fiszman et al. and other reports (Portugal et al., 2012; Rocha-Rego et al., 2009; Volchan et al., 2011) the TIS was modified to assess TI in a range of traumatic events, but the psychometric properties of the modified version of the TIS are unknown. It therefore seems important to examine the factor structure and other psychometric properties of the modified TIS in a sample that includes participants who have suffered one or more traumatic events of various types.

In light of the above, the purposes of the present study were to study the factor structure of the modified scale, and analyse the internal consistency of its subscales, its discriminant validity (differentiating between groups according to whether or not they had experienced a traumatic event) and its convergent and divergent validity in relation to other measures of post-traumatic symptomatology, anxiety and depression. Based on previous findings, we expected that: a) the modified TIS would have two correlated factors (TI and Fear), b) the TI and Fear subscales would correlate moderately with post-traumatic symptomatology, c) the TI and Fear subscales would correlate lower with measures of anxiety and depression, and d) the TI and Fear subscale scores

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[1] The Spanish translation, in shortened form, was: 1) quedarse inmóvil o sentirse paralizado, 2) incapaz de moverse, incluso sin restricción física, 3) tener temblores o sacudidas, 4) incapaz de gritar o chillar, 5) sentirse entumecido o no sentir ningún dolor, 6) sentir frío, 7) sentir miedo o pánico, 8) temer por la propia vida, 9) sentirse separado o desconectado de uno mismo, and 10) sentirse separado de lo que ocurría alrededor.

would be significantly higher in people who had suffered traumatic events than among those who had not.

## Method

### Participants

Participants were 432 third-year psychology students at the University of Barcelona, all of whom were enrolled in the same core subject. They were asked to participate during the second half of the course. Of the 432 initial participants, 40 were eliminated for the following reasons: one did not indicate whether he/she responded to the traumatic event with intense fear, helplessness or horror, 13 denied having suffered a traumatic event or a stressful experience, 18 did not complete the modified TIS, 2 left unanswered items on the modified TIS and 6 did not fill in the Purdue PTSD Scale-Revised because, by mistake, it was not included in the booklet given to them. The remaining 392 participants had a mean age of 23 years (*SD* = 4.7), 84.4% were female and 85.2% were unmarried.

Of the participants, 249 had experienced one or more traumatic events, according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR, American Psychiatric Association, 2000), and 143, not, although they provided information about their most stressful experience. These groups did not differ significantly in age (23.1 vs. 22.6), sex (85.9% vs. 81.8% female) or marital status (82.7% vs. 89.5% unmarried). The worst traumatic events that participants experienced in the first group were: news of serious injury or violent or unexpected death of someone close (29.7% of participants), serious physical/sexual abuse or forced sex (15.7%), serious accidents or natural disasters (11.0%), witnessing someone seriously injured or violently killed (8.9%), violent crime (8.5%), another very traumatic event (8.0%), witnessing a serious accident (6.8%), traumatic experience that respondents feel unable to talk about (6.8%), and serious danger of losing life or of being seriously injured (4.7%).

### Measures

Traumatic Events Questionnaire (TEQ; Vrana & Lauterbach, 1994; modified by Bados, Greco, & Toribio, 2012). The original questionnaire assesses experiences in relation to 11 specific types of trauma, which in the modified version used in this study have been extended to 15. These include serious accidents, natural disasters, violent crime, serious physical abuse, sexual abuse, forced sex, witnessing someone seriously injured or violently killed, serious danger of losing life or of being seriously injured, news of serious injury or violent or unexpected death of someone close, witnessing a serious accident, another very traumatic event, and traumatic experience that respondents feel unable to talk about. If respondents answer "yes" to one or more event they have to indicate which the most traumatic event was. If respondents

answer "no" to all events they have to describe briefly the most stressful thing that has happened to them. Among other things, respondents had to indicate if they had experienced any of the above traumatic events, and if so, whether or not they responded to the event with intense fear, helplessness or horror. An event was considered as traumatic when the person answered yes to it and reported having responded with intense fear, helplessness or horror, i.e. the event met criteria A1 and A2 for post-traumatic stress disorder according to the DSM-IV-TR. This information was used to form the groups that had and had not experienced traumatic events. Both the original and modified TEQ present a satisfactory validity. Respondents with at least one traumatic event reported significantly more depression, anxiety, stress and posttraumatic symptomatology than those who did not report exposure to any traumatic events. Further, the number of traumatic events was a significant predictor of these variables (Bados et al., 2012, 2013; Vrana & Lauterbach, 1994).

Purdue PTSD Scale-Revised (PPTSD-R; Lauterbach & Vrana, 1996; Spanish version by Bados et al., 2012). This measure evaluates (from 1 to 5) the frequency during the previous month of 17 post-traumatic stress disorder symptoms according to criteria B, C and D of DSM-IV-TR. The PPTSD-R has three subscales (re-experiencing, avoidance and arousal) and a total score. Only the total score was used in the present study as this was sufficient to analyze the convergent and divergent validity and reduced the number of comparisons. The scale was answered by referring to the worst traumatic event experienced or, in the case of people who had not suffered any traumatic event, to the worst stressful experience. The PPTSD-R has excellent internal consistency, adequate test-retest reliability, and good convergent and divergent validity with other measures of posttraumatic symptomatology, depression and anxiety. In addition, the scale has discriminated between groups who have and have not experienced traumatic events (Bados et al, 2012, 2013; Lauterbach & Vrana, 1996). Internal consistency for the current sample was good (α = .92).

Tonic Immobility Scale (TIS; Forsyth et al., 2000). The part of the TIS analysed in this study assesses the degree to which a person experienced several aspects of the TI response during the most recent forced sexual activity. The instructions and the items of the TIS were modified so that instead of referring to the most recent sexual abuse or forced sexual activity they referred to the worst traumatic event experienced or, in the case of people who had not suffered any trauma, to the worst stressful experience. We refer to this modified version as MTIS.

Depression, Anxiety and Stress Scales, 21-item version (DASS-21, Lovibond & Lovibond, 1995; Spanish version by Bados, Solanas, & Andrés, 2005). Respondents evaluate from 0 to 3 the severity/frequency with which they have experienced each of the 21 negative emotional symptoms during the previous week. The DASS-21 contains three 7-item scales (Depression, Anxiety and Stress) that are moderately correlat-

ed with each other. Only the first two were used in this study. These scales have good internal consistency, and have discriminated between university students and patients with anxiety and/or depression disorders. Further, they have satisfactory convergent validity and acceptable divergent validity with other measures of anxiety and depression (Bados et al., 2005; Lovibond & Lovibond, 1995). Internal consistency for the current sample was good or acceptable for the subscales of depression (α = .86) and anxiety (α = .73).

### Procedure

The Spanish version was used for all the questionnaires. In the case of the TIS, this was translated into Spanish independently by two Spanish clinical psychologists with good knowledge of English. Subsequently, a professional English translator with good knowledge of psychology made the back-translation. This translation was compared with the original TIS and no significant difference was found. There were only three minor changes: the translator used synonyms of the original words in English (e.g. "shout" instead of "call out"). In a pilot study the MTIS was administered in group, along with other two questionnaires, to 104 third-year psychology students who were asked to write any difficulties in understanding the instructions or the items. No problem was detected with the MTIS.

Questionnaires were answered in class in a single session, ensuring an appropriate separation between students. The response rate was 98% (432 of 440). Students were told that we were conducting a study about certain emotions that people experience normally to events that occur throughout life, some of which may be traumatic, and also about the reactions to these events. The voluntary nature of the study and the anonymity of responses were highlighted. Students did not receive any credits or recompense for participating in the study. The order of questionnaire administration was DASS-21, TEQ-modified, PPTSD-R and MTIS. The research was approved by the Bioethics Committee of the University of Barcelona (reference IRB00003099).

### Statistical analysis

The internal consistency of the TI (items 1, 2, 4, 5, 6, 8 and 9) and Fear (items 3, 7 and 10) subscales was assessed by Cronbach's α. In order to analyze the structure of the MTIS by means of a confirmatory factor analysis, we used the statistical package EQS 6.1 (Bentler & Wu, 2005). The correlation matrices were analyzed using the elliptical estimation method, because the items had a biased distribution. The fit of the model was evaluated by means of the following indexes: a) $\chi^2$ goodness of fit statistic; b) the ratio $\chi^2/df$ (degrees of freedom); c) non-normed fit index (*NNFI*); d) comparative fit index (*CFI*); e) Bollen fit index (*IFI*), f) standardized root mean square residual (*SRMR*), and g) root mean square error of approximation (*RMSEA*). To interpret these indices the following criteria were used: $\chi^2/df$ ratio < 2 (excellent); $\chi^2/df$ < 3 (good); $\chi^2/df$ < 5 (acceptable); *NNFI* ≥ .90; *CFI* ≥ .90; *IFI* ≥ .90; *SRMR* ≤ .05; and *RMSEA* ≤ .06 (Hu & Bentler, 1999). According to Browne and Cudeck (1992) and Hu and Bentler (1999), *RMSEA* ≤ .08 and *SRMR* ≤ .08 indicate an acceptable fit.

The comparison of groups that had and had not experienced a traumatic event was made by means of the Student's t-test, with the effect size (coefficient *r*) being calculated using the formula given by Field (2009). Correlations were assessed by the Pearson correlation coefficient. The pairs of correlations in the analysis of divergent validity were compared by means of the *z* statistic of Meng, Rosenthal and Rubin (1992). To minimize the probability of Type I and Type II error, a modified Bonferroni procedure (Jaccard & Wan, 1996) was used. According to this procedure the observed levels of significance are ordered by size and the lowest value must exceed the traditional Bonferroni level (.05/number of comparisons), while for each subsequent value .05 is divided by a number that is one fewer.

## Results

### Analysis of reliability

In the total sample internal consistency (Cronbach's α) was very low for the Fear subscale (α = .45). In this case, correlations among items were low (.14, .25, .26), as were the discrimination indices (.25, .26, .34). Internal consistency was acceptable for the TI subscale (α = .72). Discrimination indices ranged from .32 to .65 except in the case of item 5 (.17). By eliminating this item, Cronbach's α was .75.

In the participants who had experienced one or more traumatic events internal consistency was even lower for the Fear subscale (α = .32). Cronbach's α was .68 for the TI subscale. Discrimination indices ranged from .40 to .60 except in the case of items 5 (.17) and 8 (.21). By eliminating both items, Cronbach's α was .73.

Given the low internal consistency of the Fear subscale in both samples, it made no sense to keep this subscale, so it was omitted from subsequent analyses. In addition, according to the data obtained in the total sample and/or participants with traumatic events, we decided to remove items 5 and 8 for two reasons: their low discrimination indices and the increased internal consistency when removing the items. Thus, the MTIS was reduced to five of the seven items of the TI subscale of the TIS. We will refer to this shortened version of the MTIS as MTIS-Brief.

### Analysis of validity

#### *Analysis of validity based on factor analysis*

In view of the above results, it made no sense to conduct confirmatory factor analysis based on two correlated factors. Since the five items in the MTIS–Brief seemed to correspond to a TI factor, we decided to conduct an exploratory

factor analysis (principal axis factoring) with half of the sample, randomly selected. Internal consistency was acceptable in this subsample ($\alpha$ = .75). Eigenvalues > 1, the Cattell scree plot, and parallel analysis (Pallant, 2005) suggested one factor. The Kaiser-Meyer-Olkin measure of sampling adequacy was acceptable (.724) and Bartlett's test of sphericity was significant [$\chi^2$ (10) = 308.67 ($p$ < .0001)], thereby justifying the application of factor analysis. The factor extracted accounted for 43.27% of the variance. Factor loadings ranged from .36 to .88, and items 1 (frozen or paralyzed) and

2 (unable to move) had the highest loadings (see Table 1). This factor may be labeled Physical Immobility or, more broadly, Tonic Immobility. When we conducted the exploratory factor analysis with those participants in the half of the sample who had experienced traumatic events, the results were very similar to that observed in the half of the randomly selected sample, although the variance accounted for (39.25%) and the factor loadings of items 4 (unable to call out) and 10 (detached from self) were somewhat lower (see Table 1).

**Table 1**. Factor loadings of the Modified Tonic Immobility Scale–Brief in the exploratory factor analysis with two subsamples.

| | Frozen/paralyzed | Unable to move | Unable to call out | Felt cold | Detached from self |
|---|---|---|---|---|---|
| First half of the randomly selected total sample ($n$ = 196) | .860 | .875 | .518 | .364 | .509 |
| Participants in the first half of the sample who had experienced traumatic events ($n$ = 124) | .878 | .848 | .421 | .334 | .430 |

We conducted a confirmatory factor analysis with the second part of the sample. The model to be confirmed was that found in the exploratory factor analysis, i.e., a one-factor model. Internal consistency was acceptable in this subsample ($\alpha$ = .76). The one-factor model did not show a good fit according to the chi-square test [$\chi^2$(5, $n$ = 196) = 16.660, $p$ = .00519]. According to other indices, the model showed a good or acceptable fit [$\chi^2/df$ ratio = 3.33, *NNFI* = .925, *CFI* = .963; *IFI* = .963; *SRMR* = .059], although the fit was not good according to the root mean square error of approximation [*RMSEA* = .109 (90% *CI*: .054 -.169)]. Table 2 shows

the factor loadings for the model, which were statistically significant and equal to or greater than .40, except for one item. Squared multiple correlations ranged from .11 ("detached from self") to .80 ("unable to move"). We also conducted the confirmatory factor analysis with those participants in the half of the sample who had experienced traumatic events. The model fit was slightly worse: $\chi^2/df$ ratio = 3.51, *NNFI* = .865, *CFI* = .932; *IFI* = .934; *SRMR* = .074 and *RMSEA* = .142 (90% *CI*: .074 -.217). Table 2 shows the factor loadings for the model, which were statistically significant.

**Table 2.** Factor loadings of the Modified Tonic Immobility Scale–Brief in the confirmatory factor analysis with two subsamples.

| | Frozen/paralyzed | Unable to move | Unable to call out | Felt cold | Detached from self |
|---|---|---|---|---|---|
| Second half of the randomly selected total sample ($n$ = 196) | .894 | .895 | .546 | .405 | .331 |
| Participants in the second half of the sample who had experienced traumatic events ($n$ = 124) | .887 | .852 | .483 | .419 | .341 |

*Analysis of convergent and divergent validity*

The MTIS–Brief showed significant but low correlations with the depression and anxiety subscales of the DASS-21, and correlated significantly and moderately with the

PPTSD-R (see Table 3). The latter suggests convergent validity. Regarding divergent validity, the MTIS–Brief correlated higher with post-traumatic symptoms than with depression and anxiety. These two differences remained significant after applying the correction of Jaccard and Wan (1996).

**Table 3**. Correlations between the Modified Tonic Immobility Scale–Brief and other questionnaires.

| | Modified Tonic Immobility Scale–Brief |
|---|---|
| Purdue PTSD Scale-Revised | .372 |
| DASS-21: depression | .223 |
| $\quad$ Z statistic [a] | $z$ = 2.78, $p$ < .005* |
| Purdue PTSD Scale-Revised | .372 |
| DASS-21: anxiety | .269 |
| $\quad$ Z statistic [a] | $z$ = 1.97, $p$ = .049* |

*Note.* N = 392. DASS-21 = Depression, Anxiety and Stress Scales, 21-item version. All correlations are significant ($p$ < .00001).
[a] $z$ statistic of Meng et al. (1992) to compare pairs of correlations.
* Significant value after applying the correction of Jaccard and Wan (1996).

### Analysis of discriminant validity

Table 4 shows the means and standard deviations obtained on the MTIS–Brief for participants who had and had not experienced traumatic events. The two groups differed on that scale [$t(390) = 4.808$, $p < .00001$, $r = .24$]. According to the criteria of Cohen (1988) the effect size was low.

**Table 4**. Means (with Standard Deviations in parenthesis) on the Modified Tonic Immobility Scale–Brief of participants who had and had not experienced traumatic events.

|  | Modified Tonic Immobility Scale–Brief |
|---|---|
| Participants with traumatic events | 12.57 |
| ($N = 249$) | (6.81) |
| Participants without traumatic events | 7.76 |
| ($N = 143$) | (6.14) |

## Discussion

We could not conduct the confirmatory factorial analysis of the MTIS because the internal consistency of the Fear subscale was very low. In their second study Fusé et al. (2007) also found a relatively low reliability for the Fear subscale of the TIS (which coincides with the MTIS Fear subscale), and this reliability was even lower and unsatisfactory in the work of Bovin et al. (2008). This low reliability may be because the subscale is composed of loosely connected elements (trembling, fear/panic, and feeling detached from what is going on around). Indeed, the inter-correlations between the three items were low in our study, as was the discrimination index of each item. Consequently, to maintain a Fear subscale it would be necessary to develop more representative items of the fear dimension, such as Abrams et al. (2009) have done in the Tonic Immobility Questionnaire. The three items of the fear factor in this questionnaire are "I felt horrified", "I felt frightened" and "I felt helpless".

There is also evidence that casts doubt on whether fear, as defined in the TIS and the MTIS, is an integral component of the TI response. In a study conducted with women who had experienced childhood sexual abuse, Heidt et al. (2005) showed that the level of TI, but not the level of fear, was higher when the abuse involved attempted or completed sexual intercourse, and also when the sample consisted of inpatients rather than university students. Similarly, Hagenaars and Putman (2011) found that the TI subscale, but not the Fear subscale, was associated with intrusive memories after seeing a film of traumatic scenes. Fear is a necessary condition for TI, but distinct from it. As stated by Marx et al. (2008), "fear on the part of prey is an integral antecedent condition that modulates susceptibility to and duration of the response [TI]".

Analysis of reliability also suggested the advisability of eliminating items 5 and 8. The problems with item 5 ("felt numb or felt no pain"; in Spanish: "*te sentiste entumecido o no sentiste ningún dolor*") may be related to the use of the word "numb" ("*entumecido*"). In a survey conducted after the study we found two problems with this term. Some people were confused about its meaning, while others interpreted it as emotional rather than physical numbness. Although no problem was identified in the pilot study, this may be be-

cause the students had to write about three questionnaires in a group situation rather than answer a face to face interview on a particular item. Fusé et al. (2007) also reported that some of their participants may have misinterpreted item 5. Possible solutions would be to change "numb" to "physically numb" ("*físicamente insensible*") or to write the item in such a way that it is clear that it refers only to not experiencing physical pain.

Regarding item 8 ("feared for your life or felt as though you were going to die"; in Spanish: "*temiste por tu vida o sentiste como si fueras a morir*"), the problem lies elsewhere. The authors of the TIS (Forsyth et al., 2000; Fusé et al., 2007) anticipated that item 8 would load on the physical immobility factor, inasmuch as theories and research data on TI suggest that extreme fear, especially fear for one's life, will increase the likelihood of TI. Fuse et al. (2007) confirmed this prediction working with female sexual assault survivors. However, when the range of traumatic events is extended, as in the MTIS, one must keep in mind that not all of them involve a fear for one's life. This would be the case of events such as news of serious injury or violent or unexpected death of someone close, witnessing someone seriously injured or violently killed, and witnessing a serious accident. These events were the worst for at least 45% of our sample. Under these conditions, one would not expect that item 8 correlate very high with the other items of TI. In fact, Abrams et al. (2009) did not include this item in their Tonic Immobility Questionnaire, which is intended to assess TI across a range of traumatic events. Moreover, in another study with victims of urban violence, Rocha-Rego et al. (2009) did not find in an exploratory factor analysis of the TIS that item 8 loaded on a physical immobility factor (no further information about this item is given by the authors). Thus, it seems advisable to remove the item 8, at least when the goal is to assess TI across a range of traumatic events.

After removal of items 3, 5, 7, 8 and 10, the MTIS was reduced to five of the seven items of the TI subscale of the TIS. This shortened version (MTIS-Brief) had a one-factor structure according to an exploratory factor analysis conducted with half the sample. A confirmatory factor analysis with the second half of the sample indicated an acceptable or marginal fit for the one-factor model. The structure was the same in participants who had experienced a traumatic event. Physical immobility items (frozen/paralyzed and unable to

move) had the highest loadings on this single factor, which can be labeled Tonic Immobility. However, the model fit was not completely satisfactory, and one possibility, as indicated by the results of Abrams et al. (2009), is that TI may be characterized at least by two dimensions: a) physical immobility, constituted by the above two items and other similar items (unable to call out, muscle weakness or trembling), and b) "dissociation", which would include items such as "detached from self", "felt cold", "diminished ability to feel pain", and "trouble keeping eyes open". This could be investigated in other study with new items added to the MTIS-Brief.

The MTIS–Brief showed good or acceptable levels of reliability, convergent validity with the PPTSD-R**,** divergent validity with the depression and anxiety subscales of the DASS-21, and discriminant validity differentiating between groups that had and had not experienced traumatic events, although the effect size was low. A more adequate study of convergent and divergent validity would have involved the use of other measures of TI, such as the Tonic Immobility Questionnaire (Abrams et al., 2009), but this was not possible because it had yet to be published when we began our data collection.

This study has several limitations. First, it uses a retrospective design, with the recall bias that this implies. Thus, TI may be remembered as being more or less intense than it

actually was. Studies are therefore needed to assess its occurrence immediately or as soon as possible after the occurrence of trauma. Second, we did not study the test-retest reliability of the MTIS–Brief. Finally, the sample consisted of psychology students, a group in which socioeconomic status is middle or high, and in which males were underrepresented, thereby limiting the generalizability of the results.

Despite limitations, our findings indicate that: a) the Fear subscale of the MTIS showed very low internal consistency and must be eliminated or reformulated; b) the discrimination index of item 5 was very low and this item must be reformulated; c) the discrimination index of item 8 was very low and this item must be removed; d) after removing the five previous items, exploratory and confirmatory factor analyses of the shortened version of the scale resulted in a one-factor solution (Tonic Immobility), although the model fit was not completely satisfactory; and e) this shortened version showed acceptable levels of reliability, and convergent, divergent and discriminant validity. The psychometric properties of the MTIS–Brief should be studied further. Especially, it may also be advisable to consider the addition of new items of TI in order to establish whether this is a construct with more than one dimension as others have suggested (Abrams et al., 2009).

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