



Changes in trauma appraisal during brief internet-based exposure and cognitive restructuring treatment for Arabic-speaking people with PTSD

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ABSTRACT

Background: Maladaptive trauma appraisal plays an important role in the development and maintenance of posttraumatic stress disorder (PTSD). While studies have demonstrated the effectiveness of exposure and cognitive treatments for PTSD symptomatology, the effect of such treatments on specific trauma appraisals is still not well understood.

Objective: The study investigated the effect of an exposure and a cognitive restructuring internet-based treatment on specific trauma appraisals in Arabic-speaking participants with PTSD.

Method: 334 participants received either an exposure ($n = 167$) or a cognitive restructuring ($n = 167$) internet-based treatment. PTSD symptom severity (PCL-5) and specific trauma appraisals (TAQ) were assessed at pre- and post-treatment. Changes in specific trauma appraisals within and between the two treatments were analyzed using multi-group change modelling. Associations between changes in PTSD symptom severity and changes in trauma appraisals were evaluated using Pearson product-moment correlation. For both treatments, participants with versus without reliable improvement were compared regarding changes in specific trauma appraisals using Welch tests. Analyses were performed on 100 multiple imputed datasets.

Results: Both treatments yielded significant changes in shame, self-blame, fear, anger, and alienation (all $ps < .001$). Changes in betrayal were only significant in the cognitive restructuring treatment ($p < .001$). There was no evidence of differences between treatments for any specific trauma appraisal. Changes in PTSD symptom severity were significantly associated with changes in trauma appraisals (all $ps < .001$). In both treatments, participants who experienced reliable improvement in PTSD symptom severity showed significantly larger pre- to post-treatment changes in specific trauma appraisals compared to those without reliable improvement. Again, differences in betrayal were only significant in the cognitive restructuring treatment.

Conclusions: The findings indicate that both treatments are effective in reducing trauma appraisals in Arabic-speaking people with PTSD. Changes in trauma appraisal seem to be associated with changes in PTSD symptomatology.

Trial registration: German Clinical Trials Register identifier: DRKS00010245.

Cambios en la valoración del trauma durante un tratamiento breve basado en internet de exposición y reestructuración cognitiva para personas de habla árabe con TEPT

Antecedentes: La evaluación desadaptativa del trauma juega un papel importante en el desarrollo y mantenimiento del trastorno de estrés postraumático (TEPT). Si bien los estudios han demostrado la eficacia de los tratamientos cognitivos y de exposición para la sintomatología del trastorno de estrés postraumático, aún no se comprende bien el efecto de dichos tratamientos en valoraciones específicas del trauma.

Objetivo: El estudio investigó el efecto de un tratamiento de exposición y reestructuración cognitiva basado en Internet, sobre las valoraciones específicas del trauma en participantes de habla árabe con TEPT.

Método: 334 participantes recibieron un tratamiento de exposición ($n = 167$) o de reestructuración cognitiva ($n = 167$) basado en Internet. La gravedad de los síntomas de TEPT (PCL-5 por sus siglas en inglés) y las evaluaciones de trauma específicas (TAQ por sus siglas en inglés), se evaluaron antes y después del tratamiento. Los cambios en las valoraciones específicas del trauma dentro y entre los dos tratamientos fueron analizados

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Estrés postraumático; árabe; Internet; exposición; reestructuración cognitiva; ECA; vergüenza; culpa; miedo; ira

HIGHLIGHTS

- Exposure and cognitive restructuring treatment in Arabic-speaking individuals with PTSD yield significant changes in shame, self-blame, fear, anger, and alienation.
- Changes in PTSD symptoms are positively associated with changes in specific trauma appraisals.
- There is no evidence of differences between both treatments for any specific trauma appraisal.

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utilizando modelado de cambio multi-grupo. Las asociaciones entre cambios en la severidad de los síntomas de TEPT y cambios en las valoraciones del trauma fueron evaluadas usando el coeficiente de correlación de Momento-producto de Pearson. Para ambos tratamientos, se compararon los participantes con mejoría versus sin mejoría confiable respecto a cambios en valoraciones específicas del trauma usando pruebas de Welch. Los análisis se realizaron en 100 conjuntos de datos imputados múltiples.

Resultados: Ambos tratamientos produjeron cambios significativos en la vergüenza, la culpa, el miedo, la ira y la alienación (todos $p < 0,001$). Los cambios en la traición sólo fueron significativos en el tratamiento de reestructuración cognitiva ($p < 0,001$). No hubo evidencia de diferencias entre tratamientos para ninguna valoración específica del trauma. Los cambios en la gravedad de los síntomas del TEPT se asociaron significativamente con cambios en las valoraciones del trauma (todos $ps < 0,001$). En ambos tratamientos, los participantes que experimentaron una mejora confiable en la severidad de los síntomas de TEPT mostraron cambios significativamente mayores de pre a post tratamiento en valoraciones específicas del trauma comparados con aquellos sin mejora confiable. Nuevamente, las diferencias en la traición sólo fueron significativas en el tratamiento de reestructuración cognitiva.

Conclusiones: Los hallazgos indican que ambos tratamientos son efectivos para reducir las valoraciones del trauma en personas de habla árabe con TEPT. Los cambios en la valoración del trauma parecen estar asociados con cambios en la sintomatología del TEPT.

1. Introduction

Posttraumatic stress disorder (PTSD) is a mental health disorder that can develop in the aftermath of exposure to traumatic events (Bryant, 2019). People who develop PTSD often suffer from persistent symptoms (Kessler et al., 2017) and comorbid mental health problems (Galatzer-Levy et al., 2013), causing significant distress and impairment in several areas of life. According to the World Mental Health Survey, the cross-national lifetime prevalence of PTSD lies at 3.9% (26 population surveys; Koenen et al., 2017). Similarly, in a meta-analysis including only studies with people from countries located in the Eastern Mediterranean region, lifetime prevalence rates were estimated at 3.3% (Zuberi et al., 2021).

Traditionally, PTSD has been conceptualized as a disorder within the fear/anxiety spectrum, characterized by symptoms of elevated arousal, re-experiencing, and avoidance behaviour (Pai et al., 2017). Early behavioural models highlighted the role of conditioning in fear acquisition for the development of PTSD, while later theories such as the emotional processing theory emphasize the role of a fear structure in the development and maintenance of the disorder (Foa & Kozak, 1986). A pathological fear structure can be triggered by various harmless stimuli associated with a traumatic event (e.g. Foa et al., 1989). Based on the principles of fear learning and emotional processing theory, several treatment approaches have been developed, such as prolonged exposure (McLean & Foa, 2011). Exposure treatment approaches help to activate the fear structure, in the absence of avoidance. This activation of the fear structure without the feared outcome provides new information that is incompatible with the pathological fear structure (McLean & Foa, 2011). In turn, this contributes to a reorganization of

autobiographical memory narratives, with a better distinction between past and present experiences of the trauma and thus a reevaluation of trauma-related meanings (i.e. experience of current threat) (McLean & Foa, 2011).

Over the last decades, the conceptualization of PTSD has shifted away from a solely fear-based disorder, with cognitive processes and a broader range of emotions such as shame and guilt, as secondary emotions resulting from trauma appraisals, nowadays being seen as essential for understanding the disorder. Cognitive models emphasize the importance of maladaptive cognitive appraisals. For instance, the cognitive model by Ehlers and Clark (2000) proposes that a sense of current threat plays an important role in the persistence of PTSD. According to the authors, this sense of threat arises as a consequence of maladaptive appraisals of the trauma and/or its consequences (i.e. for the world, oneself, one's relationship with others) and a disruption of autobiographical memory, as well as ineffective coping strategies like avoidance (Ehlers & Clark, 2000). Dysfunctional appraisals related to the trauma and/or its consequences can further lead to negative emotions and associated maladaptive avoidance behaviours, which in turn maintain the overestimation of threat and perpetuate PTSD symptoms (Ehlers & Clark, 2000).

In line with this, a meta-analysis by Gomez de La Cuesta et al. (2019) found strong associations between trauma appraisal and PTSD symptoms. The largest effect was found for the relation between PTSD and trauma-related appraisals of the self, e.g. 'I am a weak person'. Moreover, negative appraisals have been found to be predictive of the persistence of PTSD symptoms (Halligan et al., 2003). Concerning cross-cultural differences, there is evidence indicating variations in cognitive trauma appraisal based on

culture (Bernardi & Jobson, 2019; Jobson & O’Kearney, 2009). However, when examining the direct correlation between trauma appraisal and PTSD, Engelbrecht and Jobson (2014) identified culturally similar relationships. In research conducted with Arabic-speaking trauma survivors, negative beliefs about the self, the world and self-blame were also found to be significantly correlated with PTSD symptomatology, with the highest association found for negative trauma-related appraisal of the self and the lowest for self-blame (Berzengi et al., 2017; van Heemstra et al., 2020).

Other research points to the importance of investigating specific trauma appraisals, including their cognitive, affective, and behavioural components. DePrince et al. (2010) defined an appraisal as the assessment of thoughts, feelings, and behaviours, and identified six categories of trauma-related appraisals: fear, anger, shame, self-blame, betrayal, and alienation. A meta-analytic study reported a significant positive association between trauma-specific shame and PTSD symptoms across different samples and trauma types (Shi et al., 2021). Furthermore, shame seems to contribute to the course of PTSD symptoms in survivors of violent crime (Andrews et al., 2000), and meta-analyses have revealed moderate positive correlations between trauma-specific guilt and PTSD symptoms (Kip et al., 2022; Shi et al., 2021). A meta-analytic review found a strong positive association between the specific trauma appraisal of alienation and PTSD symptoms (McIlveen et al., 2020), and a study on trauma-related anger, fear, guilt, and shame demonstrated a high prevalence of these specific emotional states among individuals with PTSD (Badour et al., 2017). Although the majority of previous research in this area has focused on Western samples, there are some initial studies that suggest positive associations of specific trauma appraisals, i.e. betrayal, shame, and guilt, with PTSD symptoms in non-Western populations from unstable and conflict-shattered countries (Nickerson et al., 2022; Stotz et al., 2015). The importance of considering specific trauma-related appraisals after a traumatic event (i.e. cognitive–affective appraisals) is also reflected in the latest edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), with the inclusion of a new PTSD symptom cluster accounting for negative alterations in mood and cognition after a traumatic event.

In contrast to exposure-based methods, which were originally developed to target the fear component of PTSD, cognitive treatment methods are designed to target cognitive distortions by recognizing and questioning maladaptive appraisals and to develop more functional and realistic appraisals of the traumatic experience and/or its consequences (Ehlers et al., 2005; Resick et al., 2017). Research shows that trauma-focused exposure and cognitive methods are

both efficacious in the treatment of PTSD (Lewis, Roberts, Andrew, et al., 2020), with no differences between the two approaches in terms of changes in PTSD symptoms (Hoesch et al., 2017).

Research conducted with Western populations further suggests that both treatment methods have an impact on trauma appraisals that are not directly targeted in the treatments. For instance, studies have reported significant reductions in non-fear emotions such as trauma-related shame, guilt, and internalized anger after prolonged exposure (e.g. Langkaas et al., 2017; Øktedalen et al., 2015). Changes in maladaptive posttraumatic cognitions seem to represent a general mechanism of change across various PTSD treatment approaches (Kangaslampi & Peltonen, 2022). A recent review by Serfioti et al. (2022) encompassing 15 studies indicated that both exposure-based and cognitive-based treatments led to significant reductions in guilt and anger, while an effective reduction in shame was only found in the exposure-based treatments (Serfioti et al., 2022). However, the review only included two studies conducted in non-Western countries (Northern Uganda and the Eastern Democratic Republic of Congo), which revealed mixed findings on trauma-related guilt. Over the past two decades, cognitive-behavioural methods, including exposure-based and cognitive techniques for the treatment of PTSD, have been adapted for delivery in web-based settings (e.g. Böttche et al., 2021; Spence et al., 2014; Stein et al., 2023). Providing treatment to individuals experiencing mental health problems through the internet presents significant advantages, particularly for those with limited access to face-to-face treatment. These advantages include the flexibility of location and time for both therapist/counsellor and patient, as well as a heightened level of anonymity (Stein & Knaevelsrud, 2018). Meta-analyses indicate the feasibility and efficacy of cognitive and/or behavioural interventions delivered via the internet in treating PTSD across various samples (Kayrouz et al., 2018; Simon et al., 2021). A meta-analysis focusing on the efficacy of cognitive-behavioural treatment for Arabic-speaking individuals with PTSD, anxiety, or depression revealed substantial effect sizes (e.g. $g = 2.08$ for PTSD) and demonstrated a reduction in psychopathological symptoms for all five internet-based cognitive-behavioural interventions included in the meta-analysis (Kayrouz et al., 2018).

In sum, there is already strong evidence that exposure- and cognitive-based treatments reduce PTSD symptoms in different trauma samples, including Arabic-speaking people. Some empirical studies further suggest a reduction in non-fear appraisals such as guilt and shame in both treatment types (e.g. Serfioti et al., 2022). To date, studies investigating the impact of exposure and cognitive treatments on trauma appraisal in civilian samples have been small and mainly conducted in the United States or

European countries. To our knowledge, there are no such studies in Arabic-speaking people with PTSD, meaning that little is known about the impact of internet-based exposure and cognitive treatments on specific trauma-related appraisals including shame, self-blame, anger, fear, alienation, and betrayal in these individuals. However, such studies are essential in order to understand the potential impact of these treatments and ultimately guide decisions regarding individual person-centered treatment methods.

1.1. Study aim

The present study is a secondary analysis of a randomized clinical trial that examined the efficacy of an internet-based exposure treatment and a cognitive restructuring treatment on PTSD symptomatology and comorbid mental health problems in 365 Arabic-speaking people with PTSD (Stein et al., 2023). Results of this trial have shown that both treatment conditions led to a significant decrease in PTSD symptomatology as well as all comorbid mental health symptoms like depression and anxiety from baseline to post-treatment (all $p \leq .001$, $d = -0.41$ to $d = -1.10$) and were significantly superior to the waitlist control group regarding overall PTSD symptom severity ($p < .001$, $d = 0.89$ for exposure treatment versus waitlist control group; $d = 0.98$ for cognitive restructuring treatment versus waitlist control group) and most other comorbid mental health symptoms ($d = 0.34$ to $d = 0.86$). Differences between the two treatments in the magnitude of change for all outcomes were not significant. The purpose of the present study was to investigate the effect of the internet-based exposure treatment and the internet-based cognitive restructuring treatment on specific trauma-related appraisals in participants with PTSD in Arabic-speaking countries. Based on previous research, we expected to find a significant reduction in all specific trauma appraisals (i.e. shame, self-blame, anger, fear, alienation, and betrayal) from pre-treatment to post-treatment in both treatment conditions. We did not expect the two treatments to differ regarding the magnitude of change in specific trauma appraisals. We further investigated the association between changes in PTSD symptom severity and changes in specific trauma appraisals in the two conditions and expected to find significant positive associations in both treatments. Moreover, in both treatments, we expected to find significantly greater changes in all trauma appraisals for participants who showed a reliable improvement in PTSD symptom severity compared to those who did not.

2. Method

The study was conducted at the Center ÜBERLEBEN, Berlin, Germany (psychosocial centre for the

treatment of war and torture victims). The Ethics Committee of the Freie Universität Berlin approved the study. The study was pre-registered at the German Clinical Trials Register (Trial number: DRKS00010245). A detailed description of the original report is provided in Stein et al. (2023).

2.1. Selection of participants

The present study included Arabic-speaking participants from different North African and Middle Eastern countries with a diagnosis of PTSD according to the DSM-5 criteria. Additional inclusion criteria were: 1) age ≥ 18 years; 2) a personal email address and access to a computer and internet; 3) ability to speak, read, and write in standard Arabic; 4) provision of informed consent by checking a box online. Applicants were excluded if they met any of the following criteria: 1) simultaneous psychotherapeutic treatment elsewhere or treatment planned within the next four weeks; 2) unstable dose of psychopharmacological treatment (i.e. beginning treatment, changes within the last four weeks or planned changes within the next four weeks); 3) ongoing contact with perpetrator; 4) severe depressive symptoms (i.e. BDI ≥ 45); 5) manic or hypomanic symptoms; 6) psychotic tendencies (i.e. at least one delusion or one hallucination symptom); 7) risk of suicide (i.e. participant indicating serious suicide attempts within the last three years or a current intent); 8) drug or alcohol abuse/dependency with current use; 9) usage of the intervention within the last six months. Inclusion and exclusion criteria were either checked in the screening via self-report or in a clinical interview. For the current study, participants with missing data at baseline for study-relevant measures were excluded.

2.2. Procedure

Between February 2021 and December 2022, potential participants were recruited through several sources, e.g. the programme website (<https://ilajnafsy.bzfo.de/portal/>), social networking sites, and word-of-mouth recommendation. After registering on the programme website, which included information on the treatments, data security, participation requirements, and the informed consent, participants could enter the password-protected web portal to begin an online screening of self-report questionnaires. After successfully completing the screening questionnaires, participants were interviewed by trained Arabic-speaking clinical interviewers by telephone/voice over IP. The interviewers undertook diagnoses according to the DSM-5, checked for exclusion criteria, and provided information about the treatment or relevant alternatives (for a detailed description of the interview, see Stein et al. (2023)). Subsequently, eligible participants

were assigned to PTSD or depression treatment, based on their primary diagnosis. The current study includes only participants assigned to the PTSD treatment. After assignment, participants were randomly allocated to one of three conditions: the exposure treatment, the cognitive restructuring treatment, or the waitlist control group. Participants in the waitlist control group were randomized to one of the treatment conditions in a second randomization step and received treatment after three weeks of waiting. The allocation schedule was created using the R package Blockrand (Snow, 2020), via block randomization with variable block sizes. Participants also completed questionnaires after the waiting period (waitlist group) and after completing the treatment (treatment groups and waitlist group after treatment). To increase the sample size in the current study, participants in the waitlist condition were included in the respective treatment condition after waiting and being randomized to one of the treatment conditions. For these participants, the pre-treatment values were taken from the post-waitlist questionnaire.

2.3. Treatments

Both treatments were based on a Dutch internet-based cognitive-behavioural writing treatment approach for PTSD (Interapy; Lange et al., 2003) and adapted to the characteristics of exposure and cognitive PTSD treatment approaches. Both treatments were delivered exclusively via the online platform specially developed for the project. A detailed description of the specific changes that were undertaken to develop and adapt both treatments as well as writing examples are reported in Stein et al. (2023). Both treatments included psychoeducation as well as an explanation of the respective treatment rationale. During the treatment, participants wrote six planned letters (approx. two letters/week, duration of 45 min each) over a period of approximately three weeks, with a specific focus on their worst traumatic event. Participants received instructions for the writing assignments as well as individual feedback from an assigned counsellor. Instructions and feedback consisted of manualized and structured texts that were tailored to each participant's individual needs and traumatic experiences. To promote adherence, the manual was highly standardized, and all counsellors received continuous training and supervision. The communication between participants and their individual counsellor took place asynchronously in the online portal, i.e. there were no simultaneous or live interaction. After receiving each letter, counsellors delivered individualized feedback and provided instructions for the subsequent letter(s) within two working days. There were no additional individual activities for the participants.

2.3.1. Exposure treatment

The exposure treatment included a phase of self-confrontation in which participants wrote four letters about the traumatic event and their related thoughts, fears, and physiological reactions. Participants were instructed to describe in detail their sensory perceptions of the most traumatic situation they had experienced. In the phase of social sharing, participants wrote two letters to themselves or to a significant other in the form of a symbolic supportive farewell letter.

2.3.2. Cognitive restructuring treatment

The cognitive restructuring treatment consisted of a phase of cognitive restructuring which contained four letters reflecting on feelings of guilt, dysfunctional automatic cognitions, and unrealistic assumptions. Participants were instructed to reflect on dysfunctional cognitions and adjust unrealistic assumptions by writing a letter addressed to a hypothetical friend who experienced the same traumatic event. The written instructions for the letter included reflective questions (e.g. What evidence and counterevidence is there that your friend is responsible for what happened?), aiming to encourage participants to identify and modify dysfunctional automatic cognitions and assumptions. The phase of social sharing was identical to that described for the exposure treatment.

2.4. Counsellors

Ten native Arabic-speaking counsellors living in Germany or Egypt with a diploma in psychology or psychology-related disciplines conducted the internet-based treatments. All counsellors received multiple training sessions with a focus on PTSD and treatment options, specifics of internet-delivered treatments, implementation of the treatment, and potential difficult situations that might arise during the treatments. Regular monthly supervision by experienced cognitive-behavioural supervisors was provided.

2.5. Assessment

All measures were self-reported and presented online on the password-protected platform. As no validated Arabic versions of the measures were available at the time of planning the study, the measures were translated into Arabic using the forward-backward translation method.

Sociodemographic characteristics and exposure to traumatic events (using items from the Harvard Trauma Questionnaire (HTQ; Mollica et al., 1992), the Posttraumatic Diagnostic Scale (PDS; Foa et al., 1997) and the Life Events Checklist for DSM-5 (LEC-5; Weathers, Blake, et al., 2013)) were assessed in the screening.

A diagnosis of PTSD and/or comorbid depressive disorders was established using the Structured Clinical Interview for DSM-5 Disorders (SCID-5-CV; First et al., 2016) conducted by trained clinical interviewers by telephone/voice over IP prior to randomization to one of the treatment conditions.

The specific appraisals of the traumatic event were measured using the Trauma Appraisal Questionnaire (TAQ; DePrince et al., 2010), which was implemented as part of the screening and at the end of treatment/waiting time. Respondents rated their agreement with 54 statements, which describe reactions to traumatic events on a five-point scale (from 'strongly disagree' to 'strongly agree') referring to the past month. The TAQ consists of six subscales: betrayal (e.g. 'The person who was supposed to be closest to me hurt me the most.'), self-blame (e.g. 'The event happened because I wasn't careful enough'), fear (e.g. 'I don't feel safe even when others say I am safe.'), anger (e.g. 'I want to physically hurt the people or thing that made the event happen.'), alienation (e.g. 'I mostly stay to myself.'), and shame (e.g. 'I've lost my sense of manhood or womanhood.'). The TAQ has shown strong reliability and validity in different samples (e.g. DePrince et al., 2010). In this study, Cronbach's alpha was $\alpha = .93$ for the total score and the mean inter-item correlation was $r = .20$ at baseline. For the subscales, Cronbach's alpha was $\alpha = .82$ for betrayal, $\alpha = .86$ for self-blame, $\alpha = .86$ for fear, $\alpha = .81$ for anger, $\alpha = .80$ for alienation and $\alpha = .84$ for shame at baseline. The mean inter-item correlation was $r = .40$ for betrayal, $r = .37$ for self-blame, $r = .36$ for fear, $r = .33$ for anger, $r = .29$ for alienation, $r = .43$ for shame.

Symptoms of posttraumatic stress in the past month were assessed using the self-report PTSD Checklist for DSM-5 (PCL-5; Weathers, Litz, et al., 2013). The PCL-5 consists of 20 items covering the PTSD symptoms outlined in the DSM-5, with symptom severity rated on a five-point scale ranging from 0 ('not at all') to 4 ('extremely'). A total sum score was calculated to indicate symptom severity. The scores on the PCL-5 at pre- and post-treatment were used to determine reliable change after treatment. The PCL-5 appears to be a valid and reliable screening measure for Arabic-speaking populations who have experienced trauma (Ibrahim et al., 2018). In this study, Cronbach's alpha for the PCL-5 was $\alpha = .87$ at baseline. The mean inter-item correlation was $r = .26$.

2.6. Statistical analyses

All statistical analyses were performed using R statistical software, version 4.2.2 (R Core Team, 2021) and Mplus statistical modelling software, version 8 (Muthén & Muthén, 1998–2017). To check for differences between the two treatment groups at pre-treatment, we applied Welch two-sample tests

and Chi-square tests with Yates' continuity correction (or Fisher exact test if assumptions were not met). Changes in trauma appraisal between pre- and post-treatment in both conditions were modelled with multi-group change models (e.g. Klopach & Wickrama, 2020; McArdle, 2009) using the robust maximum likelihood estimator. The rate of change between pre- and post-treatment is modelled in the form of the change score, which represents the average decrease or increase in trauma appraisal between pre- and post-treatment separately for both treatment conditions. Effects between the two treatment conditions are represented by the differences between the specific average change scores of each treatment condition. The p value was adjusted for six treatment outcomes using Bonferroni correction, leading to a value of $< .008$ being considered as statistically significant (with an error rate kept at .05). Associations of changes in PTSD symptom severity with changes in specific trauma appraisals between pre- and post-treatment were evaluated using Pearson product-moment correlation. For the correlation coefficient r , values between .1 and .3 represent a small effect, values between .3 and .5 a medium effect, and values between .5 and 1 a large effect. The reliable change index for PTSD symptom severity was calculated to determine whether participants with reliable PTSD improvement (reliable improvers) differed from non-reliable improvers regarding changes in specific trauma appraisals (using $r = .82$ for the PCL-5, (Blevins et al., 2015) and the pre-treatment standard deviation of the sample ($SD = 13.21$)). A decrease of 16 points or more on the PCL-5 between pre- and post-treatment ($\alpha = .05$) was defined as a reliable improvement in PTSD symptom severity and participants with difference scores lower than 16 were defined as non-reliable improvers. Participants with reliable deterioration (increase of 16 points or more on the PCL-5) were excluded due to the small number of participants in this group ($n = 6$ in total sample). The classification of participants regarding changes in PTSD symptom severity was undertaken following multiple imputation of the post-treatment PCL-5 scores for each multiple imputed data set separately. Reliable improvers and non-reliable improvers were compared regarding the average change in trauma appraisal between pre-treatment and post-treatment using Welch two-sample tests for both treatment conditions separately.

At post-treatment, rates of missing values were 46.1% ($n = 77$) for the TAQ and 43.1% ($n = 72$) for the PCL-5 in the cognitive restructuring treatment, and 52.7% ($n = 88$) and 50.3% ($n = 84$), respectively, in the exposure treatment. To deal with missing data, we performed multiple imputation (100 imputed data sets, 500 iterations) using the R package MICE (van Buuren & Groothuis-Oudshoorn, 2011),

separately for the two treatment conditions. The imputation model included all outcome measures. Predictive mean matching on the level of sum scores for the TAQ subscales and for the PCL-5 total score was applied. All results were pooled across imputed data sets.

3. Results

3.1. Participant flow

The flow of participants through the trial is provided in detail in Stein et al. (2023). In total, 365 participants (cognitive restructuring treatment: $n = 118$; exposure treatment: $n = 122$; waitlist: $n = 125$) were included in the original study. From the participants in the waitlist control group, 63 were randomized to the cognitive restructuring treatment and 62 to the exposure treatment. In the present study, $n = 31$ participants (cognitive restructuring treatment: $n = 3$; exposure treatment: $n = 4$; waitlist: $n = 24$) were excluded due to missing pre-treatment values on the TAQ and the PCL-5. Thus, the final sample consisted of 334 Arabic-speaking participants (cognitive restructuring treatment: $n = 167$; exposure treatment: $n = 167$). Of these, 81.7% began one of the treatments ($n = 273$; cognitive restructuring treatment: $n = 141$; exposure treatment: $n = 132$) and 49.4% completed all six letters ($n = 165$; cognitive restructuring treatment: $n = 94$; exposure treatment: $n = 71$).

3.2. Participant characteristics

Participants were mainly from Egypt ($n = 88$, 26.3%), Saudi Arabia ($n = 64$, 19.2%), and Syria ($n = 41$, 12.3%). The majority were of female ($n = 250$, 74.9%), single ($n = 210$, 62.9%), from a metropolitan city or town ($n = 300$, 89.8%), and had a high educational level (high school or university/college diploma; $n = 306$, 91.6%). The average age was 25.54 years ($SD = 6.79$, range = 18–53). The participants reported one to 22 different traumatic events, with an average of 5.26 ($SD = 3.68$). The frequency of specific traumatic events is listed in Table 1. Comorbid depressive disorders (assessed using the SCID-5-CV) were common ($n = 246$, 73.7%). The mean PCL-5 score at baseline was 47.02 ($SD = 13.21$). In the total sample, the average pre-treatment values were 21.94 ($SD = 6.96$, range = 7–35) for shame, 28.33 ($SD = 9.32$, range = 10–50) for self-blame, 37.42 ($SD = 8.87$, range = 11–55) for fear, 28.37 ($SD = 7.6$, range = 11–45) for anger, 40.42 ($SD = 6.22$, range = 16–50) for alienation, and 25.63 ($SD = 6.68$, range = 7–35) for betrayal. At pre-treatment, there were no significant differences between the two treatment groups in any variable (all $ps \geq .05$). Information on baseline characteristics for participants in both treatment conditions is provided in Tables 2 and 3.

Table 1. List of traumatic events for all participants ($N = 334$).

	<i>n</i> (%)
Frequency of exposure to specific traumatic events ^a	
Sexual contact while under the age of 18 with a person at least 5 years older (e.g. contact with genitals or breasts)	218 (65.3)
Sexual assault by a family member or acquaintance (e.g. rape or attempted rape)	132 (39.5)
Being close to death	116 (34.7)
Sexual assault by stranger (e.g. rape or attempted rape)	106 (31.7)
Life-threatening illness	83 (24.9)
Violent attack by a family member or acquaintance (e.g. being physically attacked, robbed, shot at or threatened with a firearm, stabbed)	82 (24.6)
Poor health without access to medical care	81 (24.3)
Serious accident, fire, or explosion (e.g. industrial accident, agricultural accident, car accident, airplane or ship accident)	78 (23.4)
Unnatural death of a family member or friend	70 (21)
Combat deployment in war or stay in war zone	62 (18.6)
Serious injury	61 (18.3)
Violent assault by stranger (e.g. being physically assaulted, robbed, shot at or threatened with a firearm, stabbed)	60 (18)
Lack of food or water	59 (17.7)
Forced separation from family members	49 (14.7)
Torture	44 (13.2)
Murder of a stranger or strangers	38 (11.4)
Not having a roof over one's head	33 (9.9)
Natural disaster (e.g. hurricane, tornado, flood disaster, severe earthquake)	32 (9.6)
Disappearance or kidnapping	30 (9.0)
Murder of a family member or friend	29 (8.7)
Forced isolation	29 (8.7)
Brainwashing	25 (7.5)
Captivity (e.g. penal prisoner, prisoner of war, hostage)	24 (7.2)
Serious injury, damage, or death caused to someone else by participant	5 (1.5)

Note: ^aMultiple answers for traumatic event possible; n = sample size.

3.3. Changes in trauma appraisal during cognitive restructuring and exposure treatment

In the cognitive restructuring treatment, changes between pre- and post-treatment in shame, self-blame, fear, anger, alienation, and betrayal were significant (all $ps < .001$), with effect size estimates between $d = -0.55$ (betrayal) and $d = -0.89$ (self-blame). In the exposure treatment, significant changes emerged in shame, self-blame, fear, anger, and alienation (all $ps < .001$). Effect size estimates for significant changes ranged from $d = -0.52$ (self-blame) to $d = -0.74$ (fear). After Bonferroni correction, there was no evidence of differences between the two treatment conditions regarding magnitude of change. Means and standard deviations for trauma appraisal at pre-treatment and post-treatment in both treatment conditions are reported in Table 3. Estimated within-treatment changes and between-treatment differences are provided in Table 4.

3.4. Association between changes in PTSD symptom severity and changes in trauma appraisal during cognitive restructuring and exposure treatment

In the cognitive restructuring treatment, changes in posttraumatic stress symptoms were significantly associated with changes in alienation, $r = .80$, fear,

Table 2. Sociodemographic, trauma-related, and clinical characteristics of samples in each treatment condition and comparison between the two treatments.

		CR (<i>n</i> = 167)	EXPO (<i>n</i> = 167)	Test statistic	<i>p</i>
Age	<i>M</i> (<i>SD</i>)	25.4 (6.19)	25.7 (7.36)	−0.39 (322.56) ^a	.694
Female sex	<i>n</i> (%)	125 (74.9%)	125 (74.9%)	0 ^b	1
Marital status				Fisher ^c	.067
Single	<i>n</i> (%)	110 (65.9%)	100 (59.9%)		
Married/In a relationship	<i>n</i> (%)	45 (26.9%)	62 (37.1%)		
Divorced	<i>n</i> (%)	10 (6%)	5 (3%)		
Widowed	<i>n</i> (%)	2 (1.2%)	0 (0%)		
Education				.35 ^b	.554
High	<i>n</i> (%)	155 (92.8%)	151 (90.4%)		
Low	<i>n</i> (%)	12 (7.2%)	16 (9.6%)		
Type of residence				.29 ^b	.587
Urban	<i>n</i> (%)	152 (91%)	148 (88.6%)		
Rural	<i>n</i> (%)	15 (9%)	19 (11.4%)		
Flight experience	<i>n</i> (%)	23 (13.8%)	20 (12%)	.11 ^b	.744
Cumulative traumatic events (trauma exposure list)	<i>M</i> (<i>SD</i>)	5.17 (3.55)	5.34 (3.82)	−0.42 (300.3) ^a	.678
Sexual violence during most distressing trauma (LEC-5)	<i>n</i> (%)	56 (33.5%)	52 (31.1%)	.12 ^b	.726
SCID-5-CV diagnosis				1.25 ^b	.264
PTSD	<i>n</i> (%)	49 (29.3%)	39 (23.4%)		
PTSD with comorbid depressive disorder	<i>n</i> (%)	118 (70.7%)	128 (76.6%)		
Posttraumatic stress symptom severity (PCL-5)	<i>M</i> (<i>SD</i>)	46.91 (13.21)	47.14 (13.24)	−0.16 (332) ^a	.875

Note: ^aWelch test with corrected degrees of freedom in brackets; ^bChi-square test of independence with Yates' continuity correction with one degree of freedom; ^cFisher exact test; CR = cognitive restructuring treatment; EXPO = exposure treatment; PTSD = Posttraumatic Stress Disorder; LEC-5 = Life Events Checklist for DSM-5 (extended version); SCID-5-CV = Structured Clinical Interview for DSM-5 Disorders - Clinician Version; PCL-5 = PTSD Checklist for DSM-5; *M* = Mean; *SD* = Standard Deviation; *n* = sample size.

$r = .72$, anger, $r = .70$, shame, $r = .65$, self-blame, $r = .60$, and betrayal, $r = .43$ (all $ps < .001$). Participants who experienced reliable improvements in PTSD symptom severity ($n = 89.4$) showed, on average, higher pre- to post-treatment changes in shame ($t(90.45) = -6.28$, $p < .001$), self-blame ($t(79.73) = -5.30$, $p < .001$), fear ($t(85.79) = -6.79$, $p < .001$), anger ($t(91.55) = -6.83$, $p < .001$), alienation ($t(79.65) = -9.03$, $p < .001$), and betrayal ($t(63.43) = -3.54$, $p < .001$) compared to those who did not ($n = 71.3$).

In the exposure treatment, changes in posttraumatic stress symptoms were significantly associated with changes in fear, $r = .56$, alienation, $r = .52$, self-blame, $r = .49$, shame, $r = .44$, anger, $r = .41$, and

betrayal, $r = .34$ (all $ps < .001$). Participants who experienced reliable improvements in PTSD symptom severity ($n = 87.9$) showed, on average, higher pre- to post-treatment changes in shame ($t(64.7) = -3.39$, $p < .001$), self-blame ($t(80.06) = -4.45$, $p < .001$), fear ($t(64.37) = -4.81$, $p < .001$), anger ($t(64.25) = -3.22$, $p < .001$), and alienation ($t(61.57) = -4.30$, $p < .001$) compared to those who did not ($n = 72.9$). Changes in betrayal between reliable improvers and non-reliable improvers were non-significant ($t(69.35) = -2.63$, $p = .010$). Changes and associated standard errors for specific trauma appraisals for reliable improvers and non-reliable improvers are depicted in Figure 1 for the exposure treatment and in Figure 2 for the cognitive restructuring treatment.

Table 3. Means and standard deviations for trauma appraisals at pre-treatment and post-treatment.

	Treatment condition	Pre-treatment	Post-treatment ^a
		<i>M</i> (<i>SD</i>)	
Shame	CR	21.97 (7.2)	15.55 (7.39)
	EXPO	21.90 (6.73)	17.16 (7.49)
Self-blame	CR	28.84 (9.36)	20.16 (8.23)
	EXPO	27.81 (9.29)	22.49 (9.49)
Fear	CR	37.33 (8.95)	28.98 (10.54)
	EXPO	37.51 (8.82)	30.02 (11.59)
Anger	CR	28.04 (7.6)	22.25 (8.80)
	EXPO	28.7 (7.6)	23.66 (8.75)
Alienation	CR	40.4 (6.43)	33.93 (9.88)
	EXPO	40.45 (6.01)	34.38 (9.54)
Betrayal	CR	26.22 (6.71)	22.64 (7.79)
	EXPO	25.04 (6.61)	23.51 (8.18)

Note: ^aPost-treatment values are pooled across 100 imputed data sets; CR = cognitive restructuring treatment; EXPO = exposure treatment; *M* = Mean; *SD* = Standard Deviation.

4. Discussion

The present study investigated the effect of an internet-delivered exposure treatment and cognitive restructuring treatment on specific trauma appraisals in participants with PTSD from Arabic-speaking countries. As expected, trauma-related shame, self-blame, anger, fear, and alienation decreased significantly between pre-treatment and post-treatment in both treatment conditions, with medium effect sizes for the exposure treatment and medium to large effect sizes for the cognitive restructuring treatment. Regardless of whether traumatic appraisals such as shame, alienation, or anger are addressed directly, our findings suggest that both approaches are effective in reducing them. Although exposure and cognitive treatment methods might promote different processes to facilitate symptom changes, i.e. through emotional processing of the

Table 4. Estimated within-treatment changes and between-treatment differences between pre-treatment and post-treatment for cognitive restructuring and exposure treatment.

Outcome	Treatment condition	<i>M</i> (<i>SE</i>)	<i>p</i>	<i>d</i>	[95% <i>CI</i>]	Treatment comparison	ΔM (<i>SE</i>)	<i>p</i>	<i>d</i>	[95% <i>CI</i>]
Shame	CR	-6.42 (0.75)	<.001	-0.81	[-1.02, -0.60]	CR vs. EXPO	1.67 (1.04)	.109	0.23	[-0.05, 0.51]
	EXPO	-4.75 (0.71)	<.001	-0.72	[-0.95, -0.49]					
Self-blame	CR	-8.68 (0.90)	<.001	-0.89	[-1.09, -0.70]	CR vs. EXPO	3.36 (1.36)	.013	0.34	[0.07, 0.60]
	EXPO	-5.33 (1.02)	<.001	-0.52	[-0.72, -0.31]					
Fear	CR	-8.35 (1.12)	<.001	-0.71	[-0.91, -0.52]	CR vs. EXPO	0.86 (1.59)	.589	0.08	[-0.21, 0.36]
	EXPO	-7.49 (1.13)	<.001	-0.74	[-0.98, -0.51]					
Anger	CR	-5.79 (0.80)	<.001	-0.72	[-0.93, -0.51]	CR vs. EXPO	0.75 (1.13)	.506	0.10	[-0.19, 0.39]
	EXPO	-5.04 (0.78)	<.001	-0.70	[-0.93, -0.47]					
Alienation	CR	-6.47 (0.99)	<.001	-0.64	[-0.83, -0.46]	CR vs. EXPO	0.40 (1.41)	.778	0.04	[-0.24, 0.33]
	EXPO	-6.07 (0.98)	<.001	-0.66	[-0.86, -0.46]					
Betrayal	CR	-3.58 (0.67)	<.001	-0.55	[-0.75, -0.35]	CR vs. EXPO	2.05 (1.06)	.054	0.32	[-0.01, 0.64]
	EXPO	-1.54 (0.77)	.045	-0.24	[-0.47, -0.01]					

Note: All estimates are pooled across 100 imputed data sets; CR = cognitive restructuring treatment; EXPO = exposure treatment; *M* = Treatment-specific mean changes between pre-treatment and post-treatment; ΔM = Difference between treatment-specific means of change scores; *SE* = Standard Error; *CI* = Confidence Interval; *d* = Effect size; Significant *p* values are printed in **bold**.

trauma memory in exposure treatment and through changing the meaning of the event in cognitive treatment (e.g. Ehlers & Clark, 2000; Foa & Kozak, 1986), both methods involve activating aspects of the traumatic event and corrective learning, by either experiencing that an activation of the trauma does not lead to the feared outcome (i.e. disconfirming specific cognitions) or by modifying maladaptive cognitions through a change in perspective.

Our results are in line with previous studies demonstrating that exposure is also effective in reducing maladaptive non-fear appraisals. For example, after prolonged exposure, state anger (Cahill et al., 2003), self-blame and other dysfunctional appraisals of the self and the world (Foa & Rauch, 2004), as well as trauma-related shame, guilt and internalized anger (Langkaas et al., 2017) have been found to be significantly reduced. Additionally, reductions in

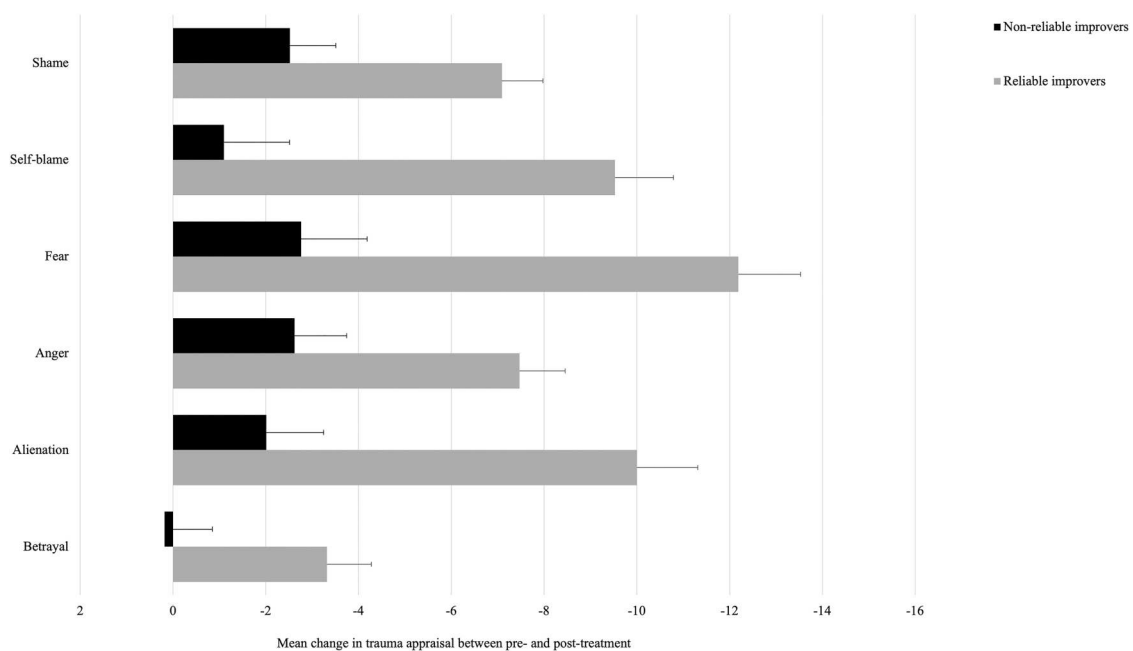


Figure 1. Mean changes and standard errors in trauma appraisal between pre-treatment and post-treatment for reliable improvers and non-reliable improvers in the exposure treatment.

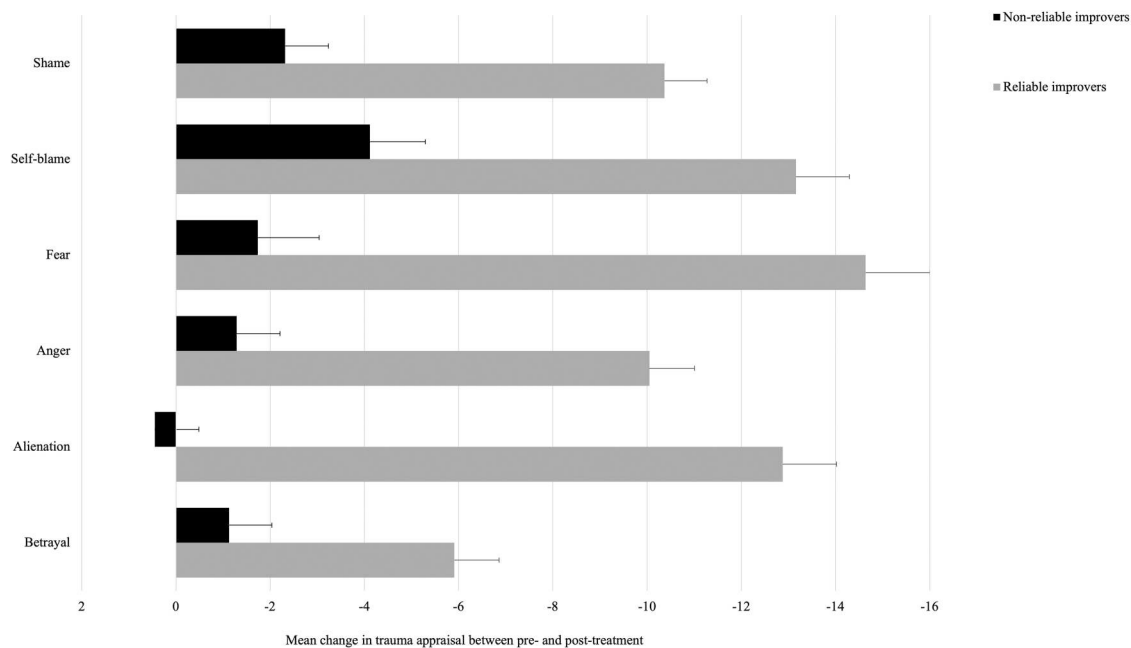


Figure 2. Mean changes and standard errors in trauma appraisal between pre-treatment and post-treatment for reliable improvers and non-reliable improvers in the cognitive restructuring treatment.

maladaptive posttraumatic cognitions have been suggested to be a mechanism of change during prolonged exposure treatment (e.g. Kumpula et al., 2017; Zalta, 2015). For instance, a Norwegian study suggested that time-specific changes in trauma-related shame and guilt predicted changes in PTSD symptoms during imagery exposure treatment (Øktedalen et al., 2015). One possible explanation for this reduction in non-fear appraisals may lie in the validating, encouraging, and accepting interaction with the counsellor, which might help to correct and reduce appraisals of shame and alienation. Moreover, by confronting themselves with their worst traumatic event, individuals might gain self-competence in terms of dealing with and feeling in control of the trauma and all associated painful thoughts and feelings (Kumpula et al., 2017). In line with this, Foa and Rauch (2004) showed that a reduction in the perception of incompetence was strongly related to changes in PTSD symptoms. Even though the cognitive restructuring intervention in the present study only targeted a limited number of specific cognitive distortions inherently associated with appraisals of self-blame, alienation, and shame, there was a significant change in all trauma appraisals. This corresponds to previous studies demonstrating that cognitive treatments effectively reduce different maladaptive appraisals, including anger, guilt, and shame (e.g. Resick et al., 2008). Moreover, research suggests that changes in maladaptive posttraumatic appraisal are an active therapeutic component in cognitive treatments (Zalta, 2015). For instance, changes in negative appraisals of the self and self-blame were found to precede a reduction in PTSD symptom severity during cognitive processing

therapy (Schumm et al., 2015). Thus, by re-evaluating the meaning of the traumatic event and/or its consequences, PTSD symptoms can be reduced.

We were unable to detect any significant differences between the exposure and cognitive restructuring treatment regarding specific appraisals, which is in line with the majority of research in this area (Foa & Rauch, 2004; Serfioti et al., 2022). Interestingly, in our sample, effect size estimates for self-blame and shame were larger in the cognitive restructuring treatment than in the exposure treatment, whereas effect size estimates of within-treatment change were similar for fear, anger, and alienation.

Contrary to expectation, betrayal was not significantly reduced in the exposure treatment, and changes in betrayal in the cognitive restructuring treatment were small compared to the other appraisals. One reason for this might be that our sample included a large proportion of sexual assault survivors. An appraisal of betrayal might be a realistic evaluation of the event in the aftermath of sexual violence by a significant other (i.e. 'I feel betrayed', 'The person who was supposed to be closest to me hurt me the most'). Furthermore, some authors suggest that survivors of interpersonal violence by a close person may remain unaware of the betrayal in order to help them cope with what has happened (i.e. through dissociation) (Freyd et al., 2007), or – if interpersonal violence from close people happened multiple times and at an early age – survivors might have developed dysfunctional concepts of relationships that involve expectations of harm and unsafety rather than labelling violence as betrayal (DePrince et al., 2009). In dealing with the traumatic experience, individuals

might become more aware of betrayal as an appropriate evaluation of the traumatic event. Future research should therefore analyze the temporal course of betrayal throughout therapy in various groups of participants with different traumatic experiences and with different baseline levels of betrayal.

As expected, changes in posttraumatic stress symptom severity were positively associated with changes in trauma appraisals in the cognitive restructuring treatment, with large effect sizes (except for betrayal). In the exposure treatment, changes in posttraumatic stress symptom severity showed significant positive associations with changes in trauma appraisals, but effect sizes were only large for fear and alienation. In both treatment conditions, significant differences emerged between reliable improvers and non-reliable improvers regarding shame, self-blame, alienation, anger, and fear. These results are in line with previous research demonstrating a link between PTSD symptoms and specific trauma appraisals (Gomez de La Cuesta et al., 2019). Furthermore, studies have also found that changes in specific trauma appraisals are associated with or even predict changes in PTSD (e.g. Cowlishaw et al., 2022; Foa & Rauch, 2004; Ginzburg et al., 2009; Görg et al., 2017) in different trauma samples receiving trauma-focused treatment.

4.1. Limitations and outlook

The present study is the first to examine the effect of an exposure and a cognitive restructuring treatment, delivered via the internet, on specific trauma appraisals in Arabic-speaking participants with PTSD in a randomized clinical trial. However, some limitations should be mentioned. The generalizability of the findings might be limited due to the self-selection of participants who were mainly young, highly educated, and female, the fact that a large proportion were living in urban areas, the application of exclusion criteria, and the assessment via self-report. Nevertheless, the characteristics of the present sample are typical for people receiving internet-based treatment. Furthermore, we used a measure to assess trauma appraisal that has not been validated in the Arabic language, and additionally, different authors operationalize maladaptive appraisals differently. However, it is noteworthy that the psychometric properties of the measures in this sample were good, indicating that the trauma appraisal questionnaire may be a good measure of trauma-related appraisal in Arabic-speaking populations. Nevertheless, both of these aspects might have an impact on research findings and render it challenging to compare research on the effect of treatments on trauma appraisals. Thus, further research is necessary in order to gather more data on specific trauma appraisals, including cognitive, affective, and behavioural aspects of specific

appraisals, in participants from Arabic-speaking countries. Another limitation is that our study had high rates of missing data, surpassing the average dropout rates reported in meta-analyses of PTSD treatments (e.g. Lewis, Roberts, Gibson, et al., 2020; Varker et al., 2021). It should be noted that the range of dropout rates in these meta-analyses was wide. We assumed that the high dropout rate in our study could be related to the special circumstances during COVID-19 pandemic, as our data were collected during this time. The majority of our sample comprised young, unmarried adults in Arabic-speaking countries, who tend to reside with their family, which may have resulted in limited privacy at home during lockdowns. Importantly, in our randomized clinical trial, no significant associations were found between treatment condition and the proportion of participants who discontinued treatment compared to those who completed treatment (Stein et al., 2023). To comprehensively address the issue of missing data, we applied multiple imputation with a high number of iterations and imputations. However, replication of the findings with less missing data is crucial in order to draw final conclusions. Qualitative interviews with those who drop out of treatment would also be important to gain a better understanding of the motives for treatment discontinuation. Finally, we only assessed trauma appraisals at pre- and post-treatment. To gain a clearer understanding of the temporal relationship between changes in trauma appraisal and changes in PTSD symptoms, investigations incorporating multiple assessments at several time points during treatments as well as at follow-up are needed.

One of the most important issues for future research is to identify whether specific types of PTSD or distinct patterns of trauma appraisal can derive greater benefits from one treatment approach over the other (e.g. people with no guilt appraisals may not require intensive cognitive treatment, or those with high re-experiencing may require exposure). Additionally, it may be important to explore factors that facilitate changes in treatment outcomes. Investigations of predictors of treatment response might reveal nuanced patterns that are not readily apparent in direct comparisons between treatments.

5. Conclusion

This study demonstrated that brief cognitive restructuring and exposure treatment delivered via the internet can be effective not only in treating core PTSD symptoms but also in changing trauma-related appraisals of fear, self-blame, alienation, shame, and anger, even though these appraisals are not directly targeted in the interventions. Furthermore, a strong link between changes in PTSD symptoms and changes in

trauma appraisals was found during both interventions. Overall, internet-delivered trauma-focused interventions with an exposure or a cognitive focus seem to be beneficial for Arabic-speaking people with PTSD and can be used to treat maladaptive trauma appraisals that are often associated with a high degree of suffering and impairment.

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Data availability statement

The detailed information of the dataset does not fully protect the anonymity of the respondents. For this reason, the entire dataset cannot be made publicly available. However, excerpts of the data on a higher aggregation level can be provided upon justified request to the corresponding author.

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