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Candidate Mechanisms of Action of Mindfulness-Based Trauma Recovery for Refugees (MBTR-R): Self-Compassion and Self-Criticism

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Objective: Mindfulness- and compassion-based interventions may represent a promising intervention approach to the global mental health crisis of forced displacement. Specifically, Mindfulness-Based Trauma Recovery for Refugees (MBTR-R)—a mindfulness- and compassion-based, trauma-sensitive, and sociocul-turally adapted intervention for refugees and asylum-seekers—has recently demonstrated randomized control evidence of therapeutic efficacy and safety. Yet, little is known about potential mechanisms underlying these therapeutic effects for trauma recovery and for refugees and asylum-seekers. ***Method:*** Thus, we examined adaptive and maladaptive forms of self-referentiality, namely self-compassion and self-criticism, as mechanisms of action for trauma recovery in a randomized wait-list control trial of MBTR-R among a community sample of 158 traumatized and chronically stressed asylum-seekers (46% female) in an urban postdisplacement setting (Middle East). Self-compassion and self-criticism were measured vis-à-vis an experimental Self-Referential Encoding Task (SRET) designed to quantify cognitive processes underlying self-compassion and self-criticism using diffusion modeling, a computational modeling approach to quantify cognitive processes underlying decision-making from behavioral reaction time data. ***Results:*** Findings indicate that self-compassion and self-criticism were associated with trauma- and stress-related psychopathology at preintervention. Relative to wait-list controls, MBTR-R led to significant elevation in self-compassion, and reduction in self-criticism, from pre to postintervention. Finally, pre to postintervention change in self-criticism significantly mediated therapeutic effects of MBTR-R on depression and posttraumatic stress disorder (PTSD) outcomes, while pre to postintervention change in self-compassion only mediated therapeutic effects on PTSD outcomes. ***Conclusions:*** Findings speak to the importance of (mal)adaptive self-referentiality as a target mechanism in MBIs and trauma recovery broadly, and among refugees and asylum-seekers specifically.

What is the public health significance of this article?
In a randomized wait-list control trial, we found that self-compassion and self-criticism were associated with stress- and trauma-related mental health symptoms, were therapeutically engaged by the intervention and mediated intervention effects of Mindfulness-Based Trauma Recovery for Refugees (MBTR-R), among traumatized East African asylum-seekers residing in the Middle East (Israel). Findings demonstrate the importance of self-compassion and self-criticism as malleable factors in trauma recovery, and as candidate mechanisms of action of mindfulness and compassion training, among diverse forcibly displaced people. More broadly, the study and findings highlight the need and importance of clinical science as instrumental in efforts to address the global public mental health crisis of forced displacement.

Keywords: asylum-seekers, mindfulness, self-compassion, self-criticism, self-referential encoding task

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Today, we are in the midst of a global crisis of forced displacement (Patel et al., 2018; Silove et al., 2017). Worldwide, an ever increasing number of refugees and asylum-seekers have been forcibly displaced by conflict, persecution, and natural disaster (United Nations High Commissioner for Refugees, 2020). The trauma and stress experienced before, during, and following forced migration leads to high rates of stress- and trauma-related mental health problems, including posttraumatic stress, depression, and anxiety (Bogic et al., 2015; Burri & Maercker, 2014; Priebe et al., 2016; Silove et al., 2017). The scale and scope of the generational and intergenerational costs of this human rights and mental health crisis are immeasurable (Patel & Farmer, 2020). Accordingly, global calls for the development and delivery of novel mental health interventions that are effective, safe, yet are brief, cost-effective, and scalable, have led to the emergence of an intervention science of refugee mental health (Haagen et al., 2017; Schick et al., 2018; Siriwardhana et al., 2014; Tol et al., 2018; World Health Organization, 2013).

One emerging approach to refugee mental health applies mindfulness-based interventions (MBI) or elements of mindfulness practices and principles to promote trauma recovery and buffer the stress of forced displacement (Aizik-Reebs et al., 2021; Tol et al., 2020). Indeed, there is a robust cross-sectional association between mindfulness and lower levels of psychopathology posttrauma (Boyd et al., 2018; Dahm et al., 2015; Thompson & Waltz, 2010) as well as promising evidence for the efficacy and safety of MBIs for trauma recovery, including 20 randomized controlled trials of MBIs among military veterans (Boyd et al., 2018; Goldberg et al., 2020). There are also promising initial findings regarding the feasibility, safety, and efficacy of one MBI, as well as interventions incorporating elements of mindfulness practices, for example, Self-Help Plus (SH+), culturally adapted cognitive-behavioral therapy (CBT), for refugee and asylum-seekers' well-being as well as depression and posttraumatic stress symptoms (Aizik-Reebs et al., 2021; Shaw et al., 2019; Tol et al., 2020).

To date, one MBI has been specifically developed to promote mental health among diverse forcibly displaced populations—Mindfulness-Based Trauma Recovery for Refugees (MBTR-R; Aizik-Reebs et al., 2021). MBTR-R is a 9-session mindfulness-based group intervention that is trauma-sensitive and socioculturally adapted for diverse populations of refugees and asylum-seekers. MBTR-R format and structure parallel common MBIs, including Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy and includes systematic training in formal and informal mindfulness practices (e.g., body scan, sitting meditation, mindful movement, 3-min breathing space). It also entails formal and informal loving-kindness and self-compassion practices, psychoeducation on trauma-related mental health problems common among refugees, key trauma-sensitive (e.g., safe place practice), and sociocultural adaptations (e.g., separate groups for men and women, socioculturally specific metaphors). Initial randomized control findings documented that, relative to wait-list control, MBTR-R led to significant improvements in rates and symptom severity of stress- and trauma-related mental health outcomes including posttraumatic stress disorder (PTSD), depression, anxiety, multimorbidity as well as elevations in subjective well-being among a sample of Eritrean refugees and asylum-seekers residing in Israel (Aizik-Reebs et al., 2021). Moreover, MBTR-R appears to be safe, for even the most vulnerable asylum-seekers—the intervention was not associated with elevated participant-level rates of clinically significant deterioration (reliable-change-index; RCI-based classification) in any of the monitored mental health outcomes.

Despite the promising evidence for the feasibility, safety, and efficacy of MBIs for trauma recovery (Aizik-Reebs et al., 2021; Boyd et al., 2018; Goldberg et al., 2020; Hopwood & Schutte, 2017; Winders et al., 2020), there is little empirical study of the mechanisms of action underlying the effects of mindfulness in trauma recovery in general, and among diverse forcibly displaced people in particular. Such mechanistic knowledge is important for several reasons. First, it is important to establish the scientific plausibility of MBIs broadly and in trauma recovery specifically (Dimidjian & Segal, 2015; Van Dam et al., 2017). Second, to understand whether targeted processes are indeed accounting for therapeutic effects as opposed to common factors embedded in the delivery of MBIs (Davidson & Kaszniak, 2015; Rosenkranz et al., 2019). Third, to enrich understanding of protective and curative processes implicated in trauma recovery (Ehlers & Clark, 2000). Fourth, to guide the development and delivery of interventions that may be useful to promote adaptive coping, recovery, and well-being among forcibly displaced populations (Nickerson, 2018; Yuval et al., 2016). Finally, to understand whether MBI mechanisms of action, more commonly studied among Western Educated Industrialized Rich Democratic (WEIRD) populations, generalize to diverse socio, cultural, and linguistic populations such as refugees (Henrich et al., 2010; Reebs et al., 2017; Yuval et al., 2020).

To begin to build an empirical understanding of the mechanisms of action of mindfulness training in trauma recovery among forcibly displaced people, we focus here on one such candidate mechanism of action of MBTR-R—(mal)adaptive self-referentiality, and specifically self-compassion and self-criticism (Garland et al., 2015; Gilbert & Procter, 2006; Gu et al., 2015). Self-referentiality refers broadly to mental processes related to the notion of "self", such as self-referential thoughts and beliefs, associations with one's self, and phenomenological experience of self (Bhar & Kyrios, 2016; Desbordes, 2019; Mennin & Fresco, 2013; Northoff et al., 2006; Tagini & Raffone, 2010; Wheeler et al., 2017). *Self-criticism* has been conceptualized as a common maladaptive form of self-referentiality and reduced self-criticism is theorized to be a change mechanism and outcome of mindfulness and compassion training (Desbordes, 2019; Gilbert & Procter, 2006; Shahar et al., 2015). Self-criticism has been conceptualized as a self-evaluative process, associated with negative self-schemas, excessive self-judgment (Gilbert et al., 2006; Shahar et al., 2015), and is accompanied by harsh negative affect (Greenberg et al., 1990, 1998; Whelton & Greenberg, 2005). Likewise, self-criticism is theorized to stimulate perception of threat, defensive reactions, and behaviors, which lead to negative emotions such as hopelessness, shame, and despair, and thereby contributes to the development and maintenance of stress- and trauma-related mental health problems (Gilbert et al., 2004; Greenberg, 2004; Whelton & Greenberg, 2005).

In contrast, *self-compassion* is conceptualized as an adaptive form of self-referentiality and elevated self-compassion is theorized to be a change mechanism and outcome of mindfulness and compassion training (Desbordes, 2019; Sevel et al., 2020). Self-compassion has been conceptualized as a multifaceted construct that includes self-kindness, understanding the universality of suffering, recognition, and tolerance of suffering, and the motivation to act to alleviate suffering (Neff, 2003b; Strauss et al., 2016). Self-compassion is

theorized to promote the development of positive emotion and self-appraisals, acceptance, and reduced emotional reactivity (Garland et al., 2015; Trompetter et al., 2017). Likewise, self-compassion is thought to facilitate self-soothing, warmth, and reassurance following traumatic experiences and stressors, rather than maladaptive self-criticism, shame, or self-blame (Au et al., 2017; Gilbert & Procter, 2006).

Theory and research have implicated self-criticism and self-compassion in trauma recovery, and as change mechanisms and outcomes of mindfulness- and compassion-based interventions. First, self-criticism has been linked to the development and maintenance of stress- and trauma-related mental health problems (Harman & Lee, 2010; Löw et al., 2020; Werner et al., 2019). For example, following traumatic stressors, negative self-critical appraisals (e.g., "I am worthless," "I am weak, because I am not coping") may contribute to the development and maintenance of chronic stress (Ehlers & Clark, 2000; Harman & Lee, 2010). Indeed, self-criticism has been associated with heightened vulnerability and maladaptive coping strategies in the face of stress as well as poor recovery and persistence of symptoms posttrauma (Cox et al., 2004; Gilbert et al., 2004; Gruen et al., 1997; Hewitt & Flett, 2002; Kannan & Levitt, 2013; Whelton & Greenberg, 2005). Furthermore, initial study has documented that mindfulness- and compassion-based interventions reduce maladaptive self-referentiality and self-criticism (Gilbert & Procter, 2006; Krieger et al., 2019; Ondrejková et al., 2020). However, there is no study to date testing the role of self-criticism as a change mechanism in mindfulness- and compassion-based interventions for trauma recovery (Cox et al., 2004; Shahar et al., 2015). Likewise, the role of self-criticism in trauma recovery among refugees and asylum-seekers has yet to be studied.

Second, self-compassion has been found to help buffer the harmful effects of trauma history and current stressors on stress reactivity as well as stress- and trauma-related mental health problems in WEIRD populations (Barlow et al., 2017; Dahm et al., 2015; Gilbert & Procter, 2006; Scoglio et al., 2018; Wilson et al., 2019). Furthermore, there is emerging evidence that mindfulness- and compassion-based training may help cultivate self-compassion (Ferrari et al., 2019) and thereby contribute to trauma recovery (Winders et al., 2020). With respect to refugees and asylum-seekers, there are initial qualitative and uncontrolled studies indicating that cultivating self-compassion, through cognitive-behavior therapy incorporating elements of mindfulness and self-compassion, may promote trauma recovery among traumatized refugees (Hinton, Ojserkis, et al., 2013; Hinton, Pich, et al., 2013; Kananian et al., 2017).

It is important to note that study of self-compassion and self-criticism in trauma recovery and as a change mechanism in mindfulness- and compassion-based interventions, has been limited to, and arguably limited by, sole reliance on self-report measurement methods (Muris & Otgaar, 2020). We propose that laboratory-based self-referential encoding methods, and computational modeling designed to quantify cognitive self-referential processes, may provide a promising approach to measurement of (mal)adaptive self-referentiality (Dainer-Best et al., 2018; Derry & Kuiper, 1981; Disner et al., 2017). Specifically, the Self-Referential Encoding Task (SRET; Derry & Kuiper, 1981) is a computer-based, two forced-choice, decision-making task, that enables well-established computational diffusion modeling of the processes underlying decision-making related to (mal)adaptive self-referential cognition (e.g., rate of information accumulation, decision-threshold; Dainer-Best et al., 2018; Disner et al., 2017).

Briefly, diffusion models assume that decisions (e.g., to endorse/reject the sentence "I am disgusted with myself") are driven by a cognitive process of information accumulation (e.g., in-favor of endorsing) until a decision-threshold is reached and a behavioral response executed (Ratcliff & Childers, 2015). This assumption is applied to tasks as the SRET in which participants are *forced* to respond to one of two options—reject or endorse a stimuli, and where the speed of response (reaction time) is recorded. Critically, using behavioral reaction time data, diffusion modeling enables estimating different cognitive factors affecting the direction and speed of the accumulation process to different stimuli (e.g., self-compassion vs. self-criticism) toward a decision, such as the rate of information accumulation decision-threshold—both between and within participants (Ratcliff & Childers, 2015; see additional details in Method Measures section below). Although the SRET has not yet been applied or adapted to measure self-compassion or self-criticism, it is robust and very well-suited for this purpose (Auerbach et al., 2015; Connolly et al., 2016; Dainer-Best et al., 2018; LeMoult et al., 2017), particularly the rate of information accumulation parameter (Dainer-Best et al., 2018).

Accordingly, through a randomized wait-list control trial, the present study tested whether self-compassion and self-criticism are indeed associated with stress- and trauma-related mental health problems, and whether changes in these processes function as mediating mechanisms of action of MBTR-R for trauma recovery, among traumatized Eritrean asylum-seekers residing in an urban postmigration setting in the Middle East (Israel). Self-compassion and self-criticism were measured vis-à-vis a computational diffusion model applied to a novel adaptation of the SRET. The study tested three key aims. First, we aimed to test whether self-compassion and self-criticism were, as theorized, associated with stress- and trauma-related symptom severity including PTSD and depression among traumatized Eritrean asylum-seekers at baseline (preintervention; Aim 1). We hypothesized that low self-compassion and high self-criticism would function as barriers to trauma recovery among traumatized asylum-seekers (Hinton, Ojserkis, et al., 2013).

Second, we aimed to test whether, as theorized, relative to a wait-list control, MBTR-R led to a significant elevation in self-compassion and reduction in self-criticism (Aim 2). Indeed, MBTR-R was designed to target (mal)adaptive self-referentiality, and specifically self-compassion and self-criticism, in two key ways. MBTR-R was designed to help participants reduce maladaptive self-referentiality, such as self-criticism, through teaching and training reduced automaticity, nonjudgmental awareness, curiosity, and acceptance toward one's experience when difficulties arise. Likewise, MBTR-R was designed to help participants cultivate greater levels of self-compassion through training in loving-kindness practices and learning to deploy self-compassion as a more adaptive response to a host of difficulties such as fear, sadness, shame, and anger.

Third, we aimed to test whether expected change in self-compassion and self-criticism mediated the effect of MBTR-R on stress- and trauma-related symptom severity outcomes (Aizik-Reebs et al., 2021; Aim 3). Indeed, if as theorized, self-compassion or self-criticism function as malleable causal protective or risk processes in the development or maintenance of stress- and trauma-related

mental health outcomes among refugees and asylum-seekers, then the expected therapeutic change in these processes should statistically mediate the observed mental health effects of MBTR-R (Kraemer et al., 1997; Zvolensky et al., 2006).

Method

Participants

This study was a single-site randomized control trial examining MBTR-R versus a wait-list control in a community sample of Eritrean asylum-seekers residing in an urban postmigration setting in the Middle East (Israel). The study received human subjects' research ethics approval by the University of Haifa Institutional Review Board committee. Hundred fifty-eight participants (46.2% women) were recruited via public flyers, community recruitment and via local non-governmental organizations and municipal organizations working with refugees. Over the course of 1 year, male and female Eritrean asylum-seekers were recruited in three cohorts, and randomized to either the MBTR-R or wait-list control condition. Exclusion criteria were (a) active suicidality, (b) current psychotic symptoms, (c) current mental health treatment (psychiatrist, psychotherapy, psychosocial support group). Randomization was conducted via random number generation in blocks of two conditions with a ratio of three MBTR-R participants to two wait-list control participants. This was done based on a power analysis to, first, ensure sufficient number of participants to detect medium size between-group effects; and, second, to ensure sufficient power to detect moderate effects in planned within-group analyses among the MBTR-R group (Borm et al., 2007; Moher et al., 2009).

Procedure

Following assessment for eligibility to participate in the study through a phone screening, consent and randomization to condition, participants completed the preintervention assessment including self-report questionnaires and behavioral/cognitive-experimental tasks assessing a variety of targeted processes, vulnerability factors, and mental health outcomes. Participants in the MBTR-R intervention condition also completed brief weekly self-report assessments of targeted change processes before and after each intervention session. Following the 9-week intervention or identical wait-list control period, participants completed assessments at 1-week postintervention. Participants randomized to MBTR-R also completed a follow-up assessment 5 weeks after the postintervention assessment. Behavioral/cognitive-experimental tasks, including the SRET were measured at pre and postintervention assessment. A mean number of 16 participants per group were enrolled in MBTR-R. Wait-list control participants only completed the 1-week postintervention assessment—to ensure that we did not unnecessarily withhold treatment for asylum-seekers in the wait-list control condition (Gold et al., 2017). See Figure S2 in Supplemental Materials for CONSORT diagram.

Mindfulness-Based Trauma Recovery for Refugees Intervention Condition

MBTR-R is a mindfulness-based group (10–20 participants) intervention consisting of nine 2.5-hr weekly sessions. MBTR-R format and structure parallel common MBIs (Crane et al., 2017) including Mindfulness-Based Stress Reduction and Mindfulness-Based Cognitive Therapy (Kabat-Zinn, 2017; Segal et al., 2013). First, MBTR-R includes systematic training in formal and informal mindfulness practices common to MBIs (e.g., body scan, sitting meditation, mindful movement, 3-min breathing space; Crane et al., 2017). Mindfulness-based attention regulation, attitudinal qualities, and skillful action were taught as skills to facilitate coping with daily postmigration stressors and trauma-related mental health problems (e.g., hyperarousal, avoidance). Second, formal and informal loving-kindness and self-compassion practices (Germer & Neff, 2015) are included and taught as ways of coping with chronic stress of postmigration living difficulties, as well as posttraumatic -memories, -cognitions, and -symptoms including responses to these experiences such as fear, self-judgment, guilt, shame, and hostility. Third, psychoeducation about posttraumatic stress, stress reactivity, and depression are integrated in the intervention to facilitate understanding, and to normalize and destigmatize, stress- and trauma-related mental health problems common among refugees and asylum-seekers (Dutton et al., 2013; Kelly & Garland, 2016). Critically, trauma-sensitive adaptations to mindfulness meditation practices were included to reduce risk of adverse responding to, as well as to optimize salutary benefits from MBTR-R (Treleaven, 2018). To provide optimal conditions for participants to learn mindfulness and key intervention principles and to benefit from the group format, delivery of MBTR-R was socioculturally adapted. See Table S1 in Supplemental Materials for a session-by-session overview of MBTR-R.

Wait-List Control Condition

Following the 9-week wait-list period and 1-week postintervention assessment, participants randomized to wait-list control were offered an equivalent group intervention (i.e., 22.5 total hours, group instructor and cultural mediator, psychoeducation and low-intensity cognitive-behavior therapy skill training, relaxation techniques). We chose this wait-list control intervention primarily due to ethical considerations (Gold et al., 2017). Critically, as this is the first trial of MBTR-R, we did not yet know safety or efficacy outcomes of MBTR-R, and we were committed to provide participants seeking assistance randomized to wait-list control mental health care that would not involve exposing them to any unnecessary risk (Gold et al., 2017; Mohr et al., 2009). When participants were randomized to condition, MBTR-R and the wait-list control interventions were described nearly identically—in terms of purpose, total number of hours, etc—so as to ensure similar expectancy effects and motivation between conditions.

Measurements

Self-Referential Encoding Task

We adapted the Self-Referential Encoding Task (SRET; Derry & Kuiper, 1981) to measure self-compassion and self-criticism. The SRET is a computer-based, two forced-choice, decision-making task, that enables computational diffusion modeling of the processes underlying decision-making related to (mal)adaptive self-referential cognition (Dainer-Best et al., 2018; Disner et al., 2017). Specifically, diffusion modeling uses a sequential sampling technique to deconstruct endorsement rate and reaction time into distinct

parameters of decision-making and cognitive processing based on estimations from empirical response time distributions (Voss et al., 2013). It is based on the premise that during decision-making, information accumulates continuously until (in the case of SRET) one of two response criteria are fulfilled (i.e., whether the sentence is self-descriptive or not). The decision-making and cognitive processing parameters estimated in the present diffusion model are drift rate (v), threshold separation (a), or amount of information required to arrive at a decision; and the duration of nondecisional processes (t). Drift rate reflects the average speed in which information accumulates toward making and behaviorally executing a decision (Voss et al., 2013). For SRET data, drift rate (v) is functionally important as it reflects how much a given stimulus influences the speed of the decision-making process for categorizing a stimuli as self-referential (Dainer-Best et al., 2018; Disner et al., 2017). Additionally, threshold separation (a) reflects the amount of information needed to reach a "cut-off point" for making a decision. Accordingly, threshold separation is important in accounting for variability in reaction time affected by degree to which different people are conservative in their decision process. That is, some people require for more information accumulated before they make a decision. Importantly, this "trait" is not necessarily affected by stimuli type. Finally, reaction times are also made up of nondecisional times, such as the speed of motor responses, which affect between-person variability in reaction time. This source of variability is represented by duration of nondecisional process (t).

Stimuli Selection

For the purpose of measuring self-compassion and self-criticism, we initially selected 44 sentences, based on the Self-Compassion Scale (Neff, 2003a) and Gilbert's Self-Criticizing/Attacking and Self-reassuring Scale (Gilbert et al., 2004) for an initial content-valid sample of item/stimuli content related to six dimensions of self-compassion and self-criticism. The self-compassion scale/condition score was comprised of items/stimuli from the Self-Compassion Scale's *mindfulness*, *self-kindness*, and *common humanity* subscales, as well as reverse-scored items from the Self-Criticizing/Attacking and Self-Reassuring Scale. The self-criticism scale/condition score was comprised of items/stimuli from the Self-Criticizing/Attacking and Self-Reassuring Scale *inadequate self* subscale as well as from the Self-Compassion Scale subscales *self-judgment*, *isolation*, and *over-identification*. We next revised 19 out of 44 items/stimuli, simplified language to optimize clarity of stimuli/item content and added two new stimuli/items to reflect self-criticism. Subsequently, the items/stimuli were translated to Tigrinya and then back-translated to English (Geisinger, 1994). In an iterative process of pilot testing and cognitive interviewing among six native Tigrinya-speaking participants, we excluded five items/stimuli that were either repetitive, were not distinguishable from each other in Tigrinya, or their meaning was not clear in Tigrinya (Willis & Miller, 2011). We retained a total of 39 items/stimuli—17 sentences reflecting self-compassion and 22 sentences reflecting self-criticism.

Stimuli Preparation and Delivery

Unlike traditional delivery of SRET stimuli, in which stimuli are presented visually as text read by participants, we presented self-compassion and self-critical statements via audio stimuli. Specifically, items/stimuli were recorded in Tigrinya by one female and one male native Tigrinya speaker. Audio delivery was important for two reasons. First, because of varying levels of reading ability in this population, measuring reaction time in response to text stimuli creates a significant confound or threat to the internal validity of the task. Specifically, it would not have been possible to obtain valid reaction time data. By delivering via audio stimuli, we control for perceptual processing time per stimulus, such that reaction time differences between participants are limited to subsequent cognitive processing differences that the task is designed to capture (Derry & Kuiper, 1981).

Task Procedure and Instructions

Task procedures largely followed previous SRET studies (Dainer-Best et al., 2018; LeMoult et al., 2017). Participants were seated in front of a laptop monitor with a response box and headphones. Upon initiation of the Tigrinya-speaking research assistant, the task instructions appeared on the computer screen and the research assistant went over the task instructions with participants for clarification and possible questions. In the task instructions, participants were informed that they would hear sentences and that some of these sentences may evoke emotion, while others may be more neutral. They were instructed to listen to each sentence, and to respond immediately—as quickly and accurately as possible—whether that sentence described them or did not describe them by pressing the respective keys of "yes" and "no" on the response box. Following participant response, the intertrial interval was 500 ms (LeMoult et al., 2017). Male participants listened to the stimuli recorded in a male voice and female participants listened to stimuli recorded in a female voice.

SRET Indices

Endorsement rate is the most common SRET metric—the proportion of self-compassion and self-critical sentences endorsed as self-descriptive. Likewise, reaction time to stimuli is a second common SRET metric, with faster reaction time thought to reflect (more) facilitated identification with stimulus content (Dainer-Best et al., 2018; Ratcliff & Rouder, 1998). In-line with power simulation studies on the number of stimuli in each condition required for robust parameter estimation (Lerche et al., 2017), only a three-parameter model (v, a, t) could be estimated. Respectively, threshold (a) and response time constant (t) could only be (reliably) estimated at the subject level (and not stimuli-condition level). Accordingly, (a) and (t) could not be specified separately for self-compassion and self-critical stimuli and thus could not be used as indicators for self-compassion and self-criticism. Drift rate (v)—reflecting the average slope of the information accumulation process—was used as metric of self-compassion and self-criticism. Of total $N = 94$, $n = 18$ could not be included in diffusion modeling analyses, because only endorsement rate, but not reaction time, were collected due to technical failure in initial data collection.

Questionnaires

All measures were translated and back-translated, and psychometrically evaluated and validated in earlier research—either in our or other research groups' studies of these specific African refugee

populations (Badri et al., 2012; Reebs et al., 2017; Tanay & Bernstein, 2013; Yuval & Bernstein, 2017; Yuval et al., 2016). All translated measures were pilot-tested and revised, in an iterative process, which included cognitive interviewing with translators and Eritrean asylum-seekers to ensure linguistic as well as sociocultural meaning (Miller & Fernando, 2008; Sartorius & Kuyken, 1994).

Demographic variables including gender, sex, and level of education were assessed via a self-report questionnaire. The *Harvard Trauma Questionnaire* (HTQ; Mollica et al., 1992) was used to measure traumatic stress exposure as well as PTSD symptom severity. HTQ was developed to be used and adapted across sociocultural groups and languages, and thus is a well-established instrument to measure traumatic stress and PTSD symptoms in diverse forcibly displaced populations, including East African populations specifically (Darzi, 2017; Hollifield et al., 2002; Nakeyar & Frewen, 2016; Reebs et al., 2017). HTQ mean cut-off score ≥2 is commonly used to identify categorical (diagnostic) symptom status of PTSD (Oruc et al., 2008; Silove et al., 2007; Tinghög et al., 2017). The HTQ has three subscales, measuring reexperiencing, avoidance, and arousal. In addition, a subscale of items measuring idioms of posttraumatic distress specific to East African refugees (e.g., "feeling isolated because of loss of social role") was included (Badri et al., 2012). The *Brief Patient Health Questionnaire* (PHQ-9; Spitzer et al., 1999) was used to measure depression symptom severity. PHQ mean cut-off score ≥10 is commonly used to identify categorical (diagnostic) symptom status of depression (Manea et al., 2012). The PHQ-9 is a commonly used measure of depression in diverse populations and refugee populations (Poole et al., 2019).

Data Analytic Section

First, descriptive statistics of self-compassion and self-critical stimuli endorsement as well as SRET diffusion model parameters were reported (see Tables 1 and 2). Likewise, endorsement- and diffusion- interitem and interscale zero-order correlations were computed and reported (see Table 3).

Second, among all participants, we tested whether indices of self-compassion and self-criticism were associated with stress- and trauma-related symptom severity including PTSD and depression at preintervention, as theorized. Specifically, we tested, whether endorsement rate at preintervention was predicted by PTSD and depression symptom severity and type of stimuli (self-compassion vs. self-critical sentences) using general linear effects models for endorsement rates (trial-level scores) and linear mixed models for drift (condition-level scores), using the R package lme4 (Bates et al., 2015). Models were run with fixed effects of PTSD or depression and the interaction of PTSD or depression and type of stimuli (self-compassion vs. self-critical sentences) and random intercept.

Third, we tested whether, relative to wait-list control, MBTR-R led to significant elevation in self-compassion and reduction in self-criticism at postintervention using general linear effects models for endorsement rates and linear mixed models for drift. Models were run with fixed effects of group (MBTR-R vs. wait-list control), assessment session (pre vs. postintervention assessment), type of stimuli (self-compassion vs. self-critical sentences), and their interaction terms and a random effect of time. We also included pairwise contrasts between groups and assessment sessions to test the individual effect of each predictor in the interaction. We report Wald z-statistics for trial-level parameters in linear effects models of endorsement and t-statistics for condition-level parameters in linear mixed models of diffusion drift rate.

Fourth, we tested whether expected changes in self-compassion and self-criticism, from pre to postintervention, mediated previously observed effects of MBTR-R on stress- and trauma-related symptom severity (Aizik-Reebs et al., 2021). To do so, we ran mediation models with linear mixed models to test whether the effect of assessment session on endorsement of self-compassion and self-criticism stimuli in the MBTR-R group would mediate the effect of assessment session on PTSD and depression outcomes using an accelerated, boot-strapped, cross-product test of mediation using the "mediation" package in R (Tingley et al., 2014). We used restricted maximum likelihood (REML) to account for missing observations. Because drift and endorsement rate were very strongly correlated in these data, and sufficient power is critical to robust mediation analyses, we tested mediation only with endorsement rate ($N = 94$) rather than drift ($N = 76$). See Figure S1 in Supplemental Materials for illustration of the mediation models.

All analyses testing changes from pre to postintervention were conducted among MBTR-R treatment completers [participants who attended more than half (>4) of the MBTR-R sessions]. This definition of completion is aligned with mindfulness-based-cognitive-therapy; MBCT trials (Kuyken et al., 2016; Spinhoven et al., 2017) as well as reasonable expectations due to real-world constraints on regular attendance of refugees and asylum-seekers due to postmigration environmental instability and stressors (Asgary & Segar, 2011; Spiegel et al., 2010). Indeed, intent-to-treat analyses were reported in the parent efficacy and safety paper (Aizik-Reebs et al., 2021). Rigorous, internally valid study of target engagement and mechanisms of action requires sufficient dosing (Kazdin, 2007, 2009; Spokas et al., 2008). Accordingly, analyses were run among treatment completers who received an adequate dose of the intervention to test intervention mechanism of action (Kazdin, 2007).

Results

Data Screening and Descriptive Data

Participants were 20–48 years old, $M(SD) = 31.8(5.21)$ years, and demonstrated high levels of posttraumatic stress, $M(SD)_{HTQ} = 2.22(.73)$, 60% diagnostically elevated symptoms of PTSD, and depression symptoms, $M(SD)_{PHQ} = 8.22(6.58)$, 35% diagnostically elevated symptom levels of depression [see Aizik-Reebs et al. (2021) for more details].

See Table 1 for self-compassion and self-critical stimuli, stimuli endorsement rates, and stimuli-condition correlations. Following data collection, we omitted two stimuli ("I deserve my self-criticism," "I deserve love and acceptance")—each demonstrated a very limited association with self-compassion or self-criticism scale/condition score as well as a very limited interstimulus correlation with stimuli from the same condition (Bollen & Lennox, 1991). Consistent with theory and the design of the SRET entailing independent albeit related self-compassion and self-criticism conditions/subscales, self-compassion and self-criticism stimuli, and condition scores were significantly correlated ($r = -.46$), and as expected by design, self-compassion stimuli loaded more strongly on the self-compassion condition ($r = .59$) than on the self-criticism condition ($r = -.28$); likewise self-criticism stimuli loaded

Table 1

Mean Endorsement of Self-Compassion and Self-Critical Stimuli/Items and Correlation With Self-Compassion and Self-Criticism Conditions/Subscales (n = 158)

Task stimuli/items	Self-compassion condition/items	Self-criticism condition/items	Subscale	Mean
Self-compassion condition/scale				
Mindfulness subscale				
When I feel distressed, I try to take a balanced view of events	.508**	−.264**	646**	.80
When I have a hard time, I try to keep my negative emotions in balance	.665**	−.357**	714**	.81
When I'm feeling down, I try to approach my feelings with curiosity and openness	.687**	−.228**	710**	.76
When I fail at something important to me, I try to keep things in perspective	.360**	−.141	594**	.71
Reversed stimuli from self-criticism scale				
I find it easy to forgive myself	.531**	−.358**	733**	.78
I am hopeful about my future	.639**	−.468**	733**	.75
I am gentle toward and supportive of myself	.560**	−.295**	746**	.82
Self-kindness subscale				
When I feel distressed, I try to be loving toward myself	.733**	−.335**	727**	.73
When I feel distressed, I am kind to myself	.627**	−.185**	658**	.57
I am tolerant of my flaws and inadequacies	.533**	−.228**	578**	.83
I try to be understanding and patient toward those aspects of myself that I don't like	.646**	−.264**	664**	.75
When I go through a hard time, I give myself the care that I need	.802**	−.516**	626**	.61
Common humanity subscale				
When things are going badly for me, I see the difficulties as part of life that everyone goes through	.572**	−.283**	.741**	.74
I try to see my failings as part of being human	.512**	−.117	.591**	.84
When I feel distressed, I try to remind myself that most people feel inadequate sometimes	.499**	−.077	.615**	.81
When I feel down, I remind myself that there are lots of other people in the world feeling like I am	.573**	−.287**	.725**	.78
Self-criticism condition/scale				
Inadequate self				
I am often disappointed in myself	−.280**	.694**	.737**	.65
I remember and dwell on my faults	−.407**	.721**	.775**	.41
I am disgusted with myself	−.355**	.695**	.730**	.32
I find it difficult to control my anger and frustration at myself	−.356**	.641**	.712**	.47
Self-Judgment				
I am disapproving and judgmental of my flaws and inadequacies	−.349**	.621**	.733**	.38
I am often critical and judgmental of myself	−.105	.592**	.691**	.56
When times are difficult, I tend to be tough on myself	−.273**	.584**	.703**	.37
I am intolerant and impatient toward the aspects of myself that I don't like	−.342**	.704**	.733**	.38
Isolation				
When I fail at something that is important to me, I tend to feel lonely	−.206*	.594**	.682**	.62
When I'm feeling down, I tend to feel like most other people are probably happier than I am	−.304**	.673**	.771**	.64
When I'm struggling, I tend to feel like other people must be having an easier time	−.202*	.582**	.703**	.57
When I feel distressed, I think that I am the only person who feels inadequate	−.336**	.661**	.753**	.53
When I think about my faults, I feel alone and cut off from the rest of the world	−.411**	.761**	.752**	.43
Over-identification				
When I feel distressed, I tend to blow events out of proportion	−.333**	.509**	.702**	.47
When I have a hard time, I get carried away by my negative emotions	−.085	.492**	.641**	.59
When I am feeling down, I tend to obsess and fixate on everything that is wrong	−.397**	.610**	.713**	.43

* $p < .05$. ** $p < .001$.

more strongly on the self-criticism condition ($r = .63$) than on the self-compassion condition ($r = -.30$).

Overall, participants endorsed more self-compassion, M (SD) = 76.52% (23.36), than self-critical, M (SD) = 50.87% (29.54), stimuli at preintervention, $t(149) = -6.93$, $p < .000$,. See Table 2 for behavioral data for SRET metrics at preintervention, including metrics from the drift diffusion model. There was a strong positive correlation ($r = .93$) between endorsement rate of self-compassion

Table 2
Behavioral Data for Metrics From the SRET at Preintervention, Including Metrics From the Drift Diffusion Model

	Preintervention						Postintervention					
	MBTR-R		Control		Total		MBTR-R		Control		Total	
SRET metrics	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*	*M* (*SD*)	*N*
Self-compassion endorsement	.77 (.24)	94	.76 (.23)	56	.76 (.23)	150	.83 (.21)	50	.74 (.28)	46	.79 (.25)	96
Self-criticism endorsement	.47 (.30)	94	.57 (.28)	56	.51 (.30)	150	.39 (.33)	50	.60 (.28)	46	.49 (.33)	96
RT to self-compassion stimuli/items (ms)	1.40 (.63)	76	1.41 (.65)	46	1.40 (.63)	122	.89 (.56)	50	1.25 (.66)	44	1.06 (.63)	94
RT to self-criticism stimuli/items (ms)	1.51 (.66)	76	1.53 (.60)	46	1.51 (.63)	122	1.09 (.51)	50	1.28 (.52)	44	1.18 (.52)	94
Drift rate (*v*) to self-compassion stimuli/items	.76 (.63)	76	.64 (.60)	46	.71 (.62)	122	1.06 (.79)	50	.72 (.85)	44	.90 (.83)	94
Drift rate (*v*) to self-criticism stimuli/items	−.11 (.75)	76	.16 (.66)	46	−.01 (.73)	122	−.35 (.92)	50	.10 (.75)	44	−.14 (.87)	94
Nondecisional processing time (*t*)	.09 (.12)	76	.07 (.09)	46	.08 (.11)	122	.07 (.01)	50	.07 (.01)	44	.07 (.01)	94
Threshold separation (*a*)	2.69 (.31)	76	2.66 (.30)	46	2.68 (.31)	122	2.35 (.37)	50	2.49 (.37)	44	2.42 (.37)	94

Note. SRET = self-referential encoding task; MBTR-R = mindfulness-based trauma recovery for refugees; RT = reaction time.

stimuli and drift rate to self-compassion stimuli as well as between endorsement rate of self-critical stimuli and drift rate to self-critical stimuli ($r = .97$; see Table 3). Thus, in these data, drift was largely accounted for by stimuli endorsement with limited incremental value of reaction time for decision-making (see also Dainer-Best et al., 2018).

Aim I: To Test Whether Self-Compassion and Self-Criticism Were Associated With Stress- and Trauma-Related Symptom Severity, Including PTSD and Depression

See Table 3 for cross-sectional (preintervention) correlations of SRET metrics with PTSD and depression. PTSD was positively associated with endorsement of self-critical stimuli ($\beta = 1.50$, $SE = .15$, $z = 10.04$, $p < .001$) and diffusion drift to self-critical stimuli, $\beta = .59$, $t(106) = 7.83$, $p = <.001$; as well as negatively associated with endorsement of self-compassion stimuli, ($\beta = -1.00$, $SE = .17$, $z = -5.86$, $p < .001$) and diffusion drift to self-compassion stimuli, $\beta = -.42$, $t(106) = -5.21$, $p = <.001$. Likewise, depression was positively associated with endorsement of self-critical ($\beta = .17$, $SE = .02$, $z = 10.06$, $p < .00$) and diffusion drift to self-critical stimuli, $\beta = .07$, $t(106) = 8.62$, $p < .00$; as well as negatively associated with endorsement of self-compassion stimuli ($\beta = -.14$, $SE = .02$, $z = -7.84$, $p < .00$) and drift to self-compassion stimuli, $\beta = -.06$, $t(106) = -6.67$, $p < .001$.

Aim II: To Test Whether, Relative to a Wait-List Control, MBTR-R Led to a Significant Elevation in Self-Compassion and Reduction in Self-Criticism

Relative to wait-list controls, participants randomized to MBTR-R demonstrated significantly reduced rates of endorsement of self-critical stimuli ($\beta = .26$, $SE = .04$, $z = 5.86$, $p < .001$) and significantly elevated rates of endorsement of self-compassion stimuli ($\beta = -.10$, $SE = .03$, $z = -3.01$, $p = .004$) at post relative to preintervention. Likewise, relative to wait-list controls, participants randomized to MBTR-R demonstrated significantly reduced drift rates to self-critical stimuli ($\beta = .45$, $SE = .15$, $t = 2.94$, $p = .01$), but not significantly elevated drift rates to self-compassion stimuli ($\beta = -.34$, $SE = .16$, $t = -2.11$, $p = .11$) at post relative to preintervention. Based on the association between endorsement and drift, and the effect size for each respective analysis with drift and endorsement rate, we understand that the difference in the effect of MBTR-R on endorsement rate relative to drift with respect to self-compassion may be a statistical power function of the smaller sample size in the analyses used for drift. Furthermore, to assess the utility of the computational modeling of reaction time data, we ran the same set of analyses with respect to raw reaction time. In contrast to effects observed for change in drift, there were no effects for raw reaction time to self-compassion or self-critical stimuli from pre to postintervention. Finally, among participants randomized to MBTR-R, change in endorsement from pre to postintervention of self-compassion stimuli was moderately and negatively correlated with change in endorsement of self-critical stimuli ($r = -.414$, $n = 50$, $p < .01$), but change in drift from pre to postintervention to self-compassion stimuli was not significantly correlated with change in drift to self-critical stimuli ($r = -.177$, $n = 42$, $p = .26$).

Aim III: To Test Whether Expected Change in Self-Compassion and Self-Criticism Mediate the Effect of MBTR-R on Stress- and Trauma-Related Symptom Severity Outcomes

Change in self-critical endorsement from pre to postintervention mediated the effect of MBTR-R, relative to wait-list control, on change in PTSD, Average Causal Mediation effect, ACME = −.19, Bias-corrected and accelerated bootstrapped (BCa) 95% CI [−.32 to −.06], proportion mediated = .60, BCa 95% CI [.24 to 1.20], and depression, Mediation effect: ACME = −1.89, BCa 95% CI [−3.04 to −.57], proportion mediated = .62, BCa 95% CI [.27–1.15], symptom outcomes. Likewise, change in self-compassion endorsement from pre to postintervention mediated the effect of MBTR-R, relative to wait-list control, on PTSD, Mediation effect: ACME = −.20, BCa 95% CI [−.34 to −.08], proportion mediated = .63, BCa 95% CI [.21–1.59], but not depression, Mediation effect: ACME = −.48, BCa 95% CI [−1.51 to .40], proportion mediated = .16, Bca 95% CI [−.24 to .50], symptom outcomes. See Figure S1 in Supplemental Materials for illustration of the mediation models.

Discussion

Trauma and stress experienced before, during, and following forced displacement, contribute to immeasurable suffering and high rates of stress- and trauma-related mental health problems among refugees (Bogic et al., 2015; Burri & Maercker, 2014; Priebe et al.,

Table 3
Correlations of SRET Metrics With Depression and PTSD at Preintervention (n = 158)

SRET metrics	Depression (PHQ)	PTSD (HTQ)	Self-compassion endorsement	Self-criticism endorsement	RT to self-compassion stimuli (ms)	RT to self-criticism stimuli (ms)	Drift rate (v) to self-compassion stimuli	Drift rate (v) to self-criticism stimuli	Nondecisional processing time (t)	Threshold Separation (a)
Self-compassion endorsement	−.530**	−.393**								
Self-criticism endorsement	.648**	.630**	−.461**							
RT to self-compassion stimuli/items (ms)	.348**	.280**	−.488**	.260**						
RT to self-criticism stimuli/items (ms)	.043	−.003	−.072	−.062	.643**					
Drift rate (v) to self-compassion stimuli/items	−.521**	−.437**	.925**	−.454**	−.615**	−.202*				
Drift rate (v) to self-criticism stimuli/items	.609**	.602**	−.373**	.970**	.229*	−.055	−.401**			
Nondecisional processing time (t)	.158	.146	−.194*	.161	.360**	.278**	−.220*	.164		
Threshold separation (a)	−.029	−.065	.028	−.142	.674**	.724**	−.074	−.148	.141	

Note. SRET = self-referential encoding task; PTSD = posttraumatic stress disorder; RT = reaction time; PHQ = Patient Health Questionnaire; HTQ = Harvard Trauma Questionnaire.
* $p < .05$. ** $p < .001$.

2016; Silove et al., 2017). MBI may represent one promising intervention approach to respond to this global human rights and mental health crisis (Aizik-Reebs et al., 2021; Patel & Farmer, 2020). MBTR-R is an MBI that is trauma-sensitive and socioculturally adapted for diverse populations of refugees and asylum-seekers (Aizik-Reebs et al., 2021). While initial evidence for the safety and efficacy of MBIs for trauma recovery (Boyd et al., 2018; Goldberg et al., 2020; Winders et al., 2020), and for MBTR-R among refugees and asylum-seekers (Aizik-Reebs et al., 2021) is encouraging, little is known about the mechanisms of action underlying these effects. We therefore conducted a randomized wait-list control trial focused on testing whether self-compassion and self-criticism function as mechanisms of change in a MBTR-R trial, conducted among $N = 158$ (46.2% women) traumatized Eritrean asylum-seekers residing in an urban postmigration setting in the Middle East (Israel). Self-compassion and self-criticism were measured via a novel self-referential encoding (SRET) laboratory behavioral task and computational diffusion models. As hypothesized, we found that self-compassion and self-criticism were associated with symptom levels of depression and posttraumatic stress at preintervention, were both therapeutically effected by mindfulness- and compassion-related training in MBTR-R, and, in part, mediated therapeutic effects of MBTR-R on trauma recovery outcomes.

First, we found that, at baseline, self-compassion was related to lower levels of PTSD and depression; likewise, self-criticism was related to higher levels of PTSD and depression (Barlow et al., 2017; Cleare et al., 2019; Dahm et al., 2015). These findings are consistent with previous findings regarding the protective properties of self-compassion, as well as risk associated with self-criticism, for posttraumatic stress and depression in WEIRD populations (Barlow et al., 2017; Hiraoka et al., 2015; Werner et al., 2019; Winders et al., 2020). Notably, relative to self-compassion, there is limited study to date of the associations between self-criticism and stress- and trauma-related symptoms posttrauma (Cox et al., 2004; Harman & Lee, 2010). Yet, the observed strong association between self-criticism and depression as well as PTSD indicates the potential functional importance of (mal)adaptive self-referentiality in trauma recovery and importance of additional study to develop our understanding of this association (Cox et al., 2004; Kannan & Levitt, 2013).

We theorize that the role of self-referentiality in trauma recovery broadly, and among forcibly displaced people specifically, may be related to the types and contexts of traumatic stress experiences and trauma recovery (Germer & Neff, 2015). Indeed, the trauma and stress of forced displacement is often complex, entailing interpersonal loss, shame, guilt (Ter Heide et al., 2016). Like so many other traumatized asylum-seekers, participants were exposed to multiple, severely traumatizing events, including torture, kidnapping, death of family member(s) or friend(s), as well a variety of chronic postmigration stressors including financial, food, housing, and vocational insecurity, as well as xenophobia and fear of deportation (Aizik-Reebs et al., 2021; Bogic et al., 2015). Such experiences may potentiate maladaptive self-attribution processes and action appraisals (e.g., shame, self-blame, survivors' guilt) that drive self-criticism and interfere with trauma recovery (Ehlers & Clark, 2000; Murphy et al., 2017; Stotz et al., 2015; Wilson et al., 2006). Consequently, we also speculate that self-compassion following such complex trauma may be protective—for example, by protecting against the negative consequences of pervasive feelings

of unworthiness, insufficiency, shame, and self-criticism in the face of complex trauma (Au et al., 2017; Gilbert & Procter, 2006).

Second, observed elevations in self-compassion and reduction in self-criticism in response to MBTR-R support long-standing theory that MBIs promote self-compassion and reduce self-criticism (Garland et al., 2015; Gilbert, 2019; Gilbert & Irons, 2005; Gilbert & Procter, 2006; Shahar et al., 2015; Wilson et al., 2019); as well as initial empirical evidence for the effects of MBIs on self-compassion among trauma survivors in WEIRD populations (Winders et al., 2020). Notably, to date, there is limited empirical study of self-criticism as a change mechanism in MBIs or among trauma survivors (Germer & Neff, 2015), let alone among diverse forcibly displaced people. Findings may thereby contribute to a growing body of research on how mindfulness- and compassion-based interventions impact (mal)adaptive self-referentiality posttrauma broadly and among refugees specifically.

Third, as theorized, reduced levels of self-criticism following MBTR-R mediated therapeutic effects of MBTR-R on PTSD and depression outcomes; likewise, elevation in self-compassion mediated the effects of MBTR-R on PTSD, but not on depression. Findings are consistent with initial evidence for the role of self-compassion in MBIs (Keng et al., 2012; Sevel et al., 2020; Svendsen et al., 2017) as well as in compassion training (Hoffart et al., 2015). Yet, observed findings are the first randomized control evidence of the mediating role of self-compassion in mindfulness-based training for trauma recovery outcomes (Winders et al., 2020). Likewise, the observed mediating role of self-criticism in mindfulness-based training for trauma recovery is highly novel (Löw et al., 2020; Werner et al., 2019). Indeed, extant study of self-criticism in trauma recovery has been limited to cross-sectional correlational study as well as to a limited set of traumatic experiences (e.g., childhood maltreatment, sexual abuse; Harman & Lee, 2010; Lassri et al., 2018; Pinto-Gouveia et al., 2013). Furthermore, findings indicate that reductions in self-criticism, but not elevations in self-compassion, mediated the effects of MBTR-R on depression. These findings are inconsistent with some earlier studies documenting that self-compassion may mediate the effects of mindfulness training on depression (Frostadottir & Dorjee, 2019; Kuyken et al., 2010). Yet, these previous studies utilized a self-compassion index that entails not only items reflecting self-compassion but also items reflecting self-criticism (Neff, 2003a, 2003b). Notably, some past work has documented that these self-criticism items have been noted to largely account for most of the variance in associations between this index of self-compassion and depression [Self Compassion Scale total score; Muris (2016)]. Thus, MBTR-R (and perhaps other MBIs) might therapeutically effect depression through reductions in maladaptive self-referentiality such as self-criticism as opposed to through the cultivation of self-compassion (cf. explicit self-compassion practice). It is important that ongoing research ensures that measurement and experimental designs dissociate, as much as possible, indices of self-compassion from self-criticism (Muris & Petrocchi, 2017). We also note here that doing so vis-à-vis the SRET indices of self-criticism and self-compassion helped us to observe that reductions in self-criticism and elevations in self-compassion each mediated the therapeutic effects of MBTR-R on PTSD. Finally, as these are novel findings ongoing research is important to explore the replicability of reported findings broadly and among diverse forcibly displaced people more specifically.

Study findings may also have a number of implications. First, mediation findings may indicate that therapeutic effects of MBTR-R on mental health outcomes posttrauma are, at least in part, accounted for by successful engagement of mechanisms targeted by the intervention (Kazdin, 2007). Such findings potentially indicate that at least some of the salutary effects of MBTR-R (and maybe also other MBIs) are specifically related to training induced changes in self-compassion and self-criticism, and are not only explained by common factors in group interventions (e.g., social support, group setting; Rosenkranz et al., 2019). Yet, future randomized active control study of MBTR-R is important to more rigorously test whether these theorized mechanisms of action are indeed trained through the intervention. Second, these are novel empirical findings with regard to the role of self-referentiality in MBIs among traumatized refugees and asylum-seekers, and may speak to the sociocultural generalizability of self-compassion and self-criticism cultivated in contemplative training for trauma recovery. Notably, although levels of self-compassion were particularly elevated in this sample of traumatized Eritrean refugees at preintervention, the observed role of self-compassion and self-criticism in trauma recovery paralleled observations among WEIRD populations (Germer & Neff, 2015; Harman & Lee, 2010).

Third, findings may have implications for intervention research of trauma recovery among refugees and asylum-seekers, beyond MBIs. Indeed, over the past decade, a growing number of interventions for diverse forcibly displaced people have been developed and evaluated, including trauma-focused exposure-based therapies, such as Narrative Exposure Therapy (NET; Elbert et al., 2015; Robjant & Fazel, 2010); individual psychotherapy, CBT (Bolton et al., 2014; Buhmann et al., 2016; Carlsson et al., 2018), psychosocial interventions (Meyer, 2013; Silove et al., 2017) as well as low-intensity cognitive-behavior therapy such as Problem Management Plus (PM+) and e-health Self Help Plus (SH+; Purgato et al., 2019; Tol et al., 2020). While these interventions show promising evidence of efficacy and effectiveness (Slobodin & de Jong, 2015; Turrini et al., 2019), we know little about mechanisms of change of these interventions (Bryant, 2021; Nickerson, 2018; Nickerson et al., 2017). It may be important to examine whether self-compassion and self-criticism are also causal mechanisms in these intervention approaches. Indeed, it may be useful to test whether (mal)adaptive self-referentiality functions as a universal causal mechanism in trauma recovery among refugees and asylum-seekers across interventions; or whether, and perhaps more likely, such therapeutic change mechanisms may be specific to mindfulness- and compassion-based interventions (Baer, 2010; Keng et al., 2012; Wilson et al., 2019).

Fourth, findings are relevant to ongoing discourse on interrelations between self-compassion and self-criticism, their shared/unique role in (mal)adaptive self-referentiality (Brenner et al., 2017; Hermanto et al., 2016; Zuroff et al., 2021), and, in turn, how they may be optimally conceptualized and measured (Gu et al., 2020; Muris & Petrocchi, 2017; Neff, 2016; Strauss et al., 2016). In the past, the psychometric robustness of the widely used Self-Compassion Scale (Neff, 2003a) has been questioned (Muris, 2016; Muris & Otgaar, 2020; Williams et al., 2014). One point of critique was that "reverse-scored" items of the Self Compassion Scale referring to noncompassionate self-responding, often account for a large proportion of variance in psychopathology, but may be better indicators of self-criticism than degree of self-compassion

(Brenner et al., 2017; Muris & Otgaar, 2020; Muris & Petrocchi, 2017). Overall, findings of the present study indicate that self-compassion and self-criticism are moderately related, yet distinct constructs. Indeed, levels of self-compassion and self-criticism differed significantly and were only modestly correlated to begin with; likewise, self-criticism was more strongly related to PTSD and depression than was self-compassion. Furthermore, in response to MBTR-R, degree of change in self-compassion and in self-criticism was very modestly correlated. Such findings may have a variety of implications. This set of findings is consistent with theory arguing that though self-compassion and self-criticism may both be forms of self-referentiality, they do not appear to be mere bi-dimensional expressions of one another (Muris & Otgaar, 2020; Zuroff et al., 2021). Indeed, scholars have theorized that whereas self-criticism is more typically a stable, habitual, and internalized or automatic form of self-referentiality (Blatt & Zuroff, 1992; Hermanto et al., 2016), self-compassion may be a more intentional or effortful process dependent on self-awareness, mentalizing, and reflection (Gilbert, 2019; Gu et al., 2020). Consequently, maladaptive forms of self-referentiality, such as self-criticism, may to some extent be present in parallel to, and independent of, adaptive forms of self-referentiality such as self-compassion (Gilbert & Irons, 2004; Zuroff et al., 2021). As a result, responding with compassion and equanimity to self-criticism, rather than with shame and feelings of inferiority, may help to buffer the toxicity of self-criticism for mental health problems (Hermanto et al., 2016; Whelton & Greenberg, 2005).

Finally, observed findings are strengthened by the novel laboratory-based behavioral task methodology to measure and quantify these self-referential cognitive processes. To date, study of self-compassion and self-criticism has relied on self-report measurement methods (Muris & Otgaar, 2020). The SRET permits quantification of not only endorsement rates, but also the decision-making and cognitive processes underlying self-compassion and self-criticism vis-à-vis diffusion modeling of reaction time data. Findings support theory and previous research indicating that diffusion and related computational modeling yield significantly more meaningful signal of self-referential cognitive processes than raw reaction time scores (Voss et al., 2013). Notably, and as in some past studies, diffusion drift rate was largely accounted for by endorsement rate in the present study (Dainer-Best et al., 2018; Disner et al., 2017).

The present study is also limited in a number of ways. First, findings are limited to the observed sample of Eritrean refugees and we do not know yet with certainty whether observed findings generalize to other refugee populations, contexts or survivors of other forms of trauma. Second, while the findings support the role of self-compassion and self-criticism as mechanisms of mindfulness interventions in trauma recovery, their relative importance and significance in relation to other mechanisms has yet to be tested. Third, levels of self-compassion were elevated at baseline. While there was still enough variability within the sample to observe change, a different pattern of findings may have been observed with a larger sample with more variability in self-compassion. Fourth and relatedly, as study of self-compassion and self-criticism as mechanisms in trauma recovery is still novel, it is important to replicate findings with alternative conceptualization or operationalization of self-referentiality to test whether that may lead to different outcomes. Fifth, mediation was tested with respect to key mental health outcomes at postintervention—as there were no follow-up data for the wait-list control group and because the laboratory-based assessments of targeted mechanisms of action (i.e., self-compassion, self-criticism) were not again measured at follow-up. Thus, because we could not measure the putative mechanisms of action and outcomes repeatedly over three timepoints, we could not definitively establish temporal precedence needed to most optimally and rigorously test mediation (Kazdin, 2007, 2009). Sixth, a wait-list control design was selected due to ethical (as previously noted; Gold et al., 2017) and methodological considerations (see Aizik-Reebs et al., 2021 for details). Finally, we did not assess compassion for others. It may be important for future study to examine whether, as theorized, the therapeutic properties of mindfulness and compassion training are dependent on the capacity for compassion for others as well as for oneself (Condon & Makransky, 2020; Graser & Stangier, 2018; Strauss et al., 2016).

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