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Association between trait mindfulness and symptoms of post-traumatic stress: A meta-analysis

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ABSTRACT

Mindfulness is characterized by skills such as heightened awareness and acceptance of internal experiences, which may be helpful for people who have experienced trauma. The consistency and strength of the relationship between trait mindfulness and PTSD symptomology, however, is unknown. Studies were included in this review if they were published in an English language peer-reviewed journal, reported on a correlational relationship between validated measures of mindfulness and PTSD, and all participants were over the age of 18. A random effects meta-analysis showed that there was a robust, pooled relationship between total mindfulness and PTSD ($r_+ = -0.39$, 95% CI [-0.47 to -0.30]), based on 35 datasets with 13,370 participants, with low risk of publication bias. Sixteen articles reported on facets of mindfulness and PTSD symptomology [5,206 to 5,600 participants]: the strongest associations were with Act with Awareness ($r_+ = -0.37$) and Non-judge ($r_+ = -0.37$), followed by Describe ($r_+ = -0.22$) and Non-react ($r_+ = -0.21$). Observe was not significantly associated with PTSD symptoms. Results from this analysis suggest that people who are more mindful also report fewer symptoms of PTSD; the strength of the relationship varies across mindfulness facets. There was high heterogeneity across studies.

1. Introduction

Trauma exposure contributes a substantial cost to individuals, communities and society (Magruder et al., 2017). The World Mental Health Survey reported that the burden of Post-traumatic Stress Disorder (PTSD) was around 77.7 person-years per 100 respondents, with inadequate treatment availability (Kessler et al., 2017). Prevention of trauma-related sequels, such as PTSD, have been recommended for improvements in public health (Magruder et al., 2017). One of the fastest growing areas of mental health research within the last decade includes the psychological benefits of mindfulness (Van Gordon et al., 2015). As well as results highlighting the benefits of mindfulness-based interventions (Hopwood and Schutte, 2017; Liu et al., 2022), there is also a growing interest in understanding how one's natural disposition to act mindfully, often referred to as 'trait mindfulness' (Brown and Ryan, 2004), is associated with adverse mental health outcomes. Trait mindfulness refers to how people use mindfulness principles within their

every-day lives, without specific interventions or training, and has been associated with greater overall psychological health (Enkema et al., 2020; Tomlinson et al., 2018).

The magnitude of the relationship between trait mindfulness and mental health symptoms varies across facets of mindfulness (Baer et al., 2006). For example, the facets Non-judge and Act with Awareness show the strongest negative relationship with negative affectivity, with slightly weaker correlations reported for Describe and Non-react (Carpenter et al., 2019). Similar findings have also been reported in relation to 'desirable' and 'undesirable' general wellbeing (Mattes, 2019). However, to date, a focused analysis of the consistency and strength of the relationship between trait mindfulness and PTSD symptomology, without testing active interventions, has not been reported. A greater understanding of the relationship between trait mindfulness and PTSD symptomology has implications for fostering skills in mindful acceptance and awareness in people who are more at risk of developing symptoms.

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This aim of this systematic review and meta-analysis was to produce a quantitative summary of the existing literature and to estimate the consistency and strength of the relationship of trait mindfulness, and mindfulness facets, with PTSD symptomology. We also investigated the heterogeneity of this relationship using moderator analyses of sample population, mindfulness facets, and measures of both mindfulness and PTSD. This review is an important step in determining the extent to which skills that characterize mindfulness may be protective against symptoms associated with post-traumatic stress.

2. Methods

2.1. Search strategy and eligibility criteria

A study protocol was registered with PROSPERO (CRD42020184234) prior to data collection. The search terms – (“PTSD” OR “posttraumatic stress” OR “post traumatic stress” OR “post-traumatic stress”) AND “mindful*” – were used to search titles and abstracts in PubMed, Medline, Scopus, and PsycINFO online databases (Supplementary Materials 1). The searches were conducted in August 2020 and updated in March 2021. Screening was completed using bibliographic software, following King et al. (2011) recommendations, and was conducted by a primary coder; 10% of articles were verified by an external coder at each stage and disagreements resolved thorough discussion. All papers included in the analysis were cross-referenced for additional, eligible studies.

Studies were eligible for inclusion if they were 1) published in an English language peer-reviewed scientific journal, 2) included participants aged 18+ years, 3) included validated measures of mindfulness and PTSD, 4) included a bivariate cross-sectional association (correlation coefficient) between mindfulness and PTSD. Longitudinal studies were only included if they reported on cross-sectional data, to ensure that data was comparable at baseline. All intervention studies were excluded.

2.2. Data extraction and quality assessment

Data for study design, sample characteristics, and research methods (such as measure used, with alpha coefficients when provided) were extracted from each study. The correlation coefficients between mindfulness – and/or mindfulness facets – and PTSD symptomology were also extracted, along with their statistical significance.

The Critical Appraisal Tool for Cross-Sectional Studies (AXIS) (Downes et al., 2016) was used to assess the methodological quality and risk of bias for all papers included in the analysis. An overall AXIS score was generated by marking one point for ‘yes’, with a maximum score of 20; this technique has been used in previous analyses (Rodríguez-Morales et al., 2020). All ‘don’t know’ scores were discussed with the reviewing team and ‘no’ received zero points. An external reviewer quality assessed 10% of papers and disagreements were discussed in detail to achieve a consensus score.

2.3. Statistical analysis

Meta-analyses were conducted using the ‘metafor’ package (Viechtbauer, 2010) in R (R Core Team, 2017) [data and analysis scripts are openly available: <https://osf.io/au28p/>]. A random-effects model was pre-determined as most appropriate, to account for differences in study characteristics and measures, using a restricted maximum-likelihood (REML) estimator (Veroniki et al., 2016). Raw correlation coefficients were converted to Fisher’s z to improve distribution, and the aggregate effect and confidence intervals were then converted back into a correlation coefficient for reporting (Borenstein et al., 2009). Heterogeneity was examined using the Inconsistency index (I^2); with $I^2 < 25\%$ indicating low heterogeneity; $I^2 < 50\%$ moderate; and $I^2 > 75\%$ indicative of substantial heterogeneity (Higgins et al., 2003).

An overall meta-analysis examined the aggregated association between mindfulness and PTSD symptomology. Moderator analyses explored the effects of sample characteristics (e.g., study population), and methodological differences (e.g., quality assessment (AXIS total) and the instruments used to measure mindfulness and PTSD). Moderator analyses were conducted on categories that included five or more studies (Jackson and Turner, 2017). Additional meta-analyses measured the aggregated association between each mindfulness facet and PTSD. Mindfulness facets were measured using the Five Facet Mindfulness Questionnaire (FFMQ) (Baer et al., 2006) and Kentucky Inventory of Mindfulness Score (KIMS) (Baer et al., 2004); both questionnaires measure overlapping facets – Observe, Describe, Act with awareness, and Non-judge – and the FFMQ measures an additional facet, Non-react.

Publication bias was tested through inspection of funnel plots of the standard error and sampling variance. Egger’s test and Trim and Fill analysis tested whether the plot was symmetrical (Duval and Tweedie, 2000). Graphical Display of Study Heterogeneity (GOSH) (Olkin et al., 2012) ran one million randomly selected models of the meta-analysis; the pooled effect sizes and heterogeneity were plotted on a G-plot and histogram to explore data clusters (Harrer et al., 2019). Finally, given available reliability estimates for mindfulness and PTSD symptom measures, we examined the ‘dis-attenuated’ or true correlation, which assumes the greatest magnitude of the association between mindfulness and PTSD symptomology under no measurement error (Supplementary Materials 2).

3. Results

3.1. Overview of studies

As outlined in the PRISMA Diagram (Fig. 1), 1,114 titles and abstracts were screened for suitability, and 113 articles assessed for full text review. Studies that reported a correlation co-efficient between mindfulness (total score and/or facets of mindfulness) and PTSD total score were included in the analysis. When multiple papers reported on the same dataset, the study with the largest number of participants was used. Two papers reported on correlation coefficients for two different population samples in their study, e.g. separate data for military personnel and college students (Bravo et al., 2018) and for neurocritical patients and their carers (Meyers et al., 2020), and thus data was extracted as separate datasets for these analyses. This resulted in a total of 40 studies, with 42 datasets, as outlined in Table 1.

3.2. Quality assessment

Studies were predominately completed in the USA ($n = 31$; 74%), and publication dates ranged from 2009 to 2021, with over 75% of studies published after 2015. Sample sizes ranged from 25 to 1,912, with an overall sample size of 15,345. The average age of participants was 35.7 years, there was a near-equal split between male and female gender (51.5% male), with around 61% of participants described as white Caucasian.

Two studies measured PTSD using the Clinician-Administered PTSD scale for DSM-IV (CAPS; Blake et al., 1995), which is the gold standard instrument for making a diagnosis of PTSD. Most other studies used self-report screening questionnaires for symptoms of PTSD, as outlined in DSM-IV and DSM-5, that cannot be used to imply a diagnosis, or ‘disorder’; these are highlighted under ‘measures of PTS-S’ (Post-Traumatic Stress Symptomology) in Table 1. Four studies also used measures that assess symptoms often associated with trauma, but are not exclusively related to PTSD symptoms. In this review, these measures are referred to as ‘trauma-associated symptoms’ (TAS).

The most frequently used mindfulness measure was the FFMQ, which was used in 18 studies; five studies reported a total mindfulness score only, five reported on mindfulness facets only, and eight studies reported total and facet level scores. Three studies used the KIMS, which

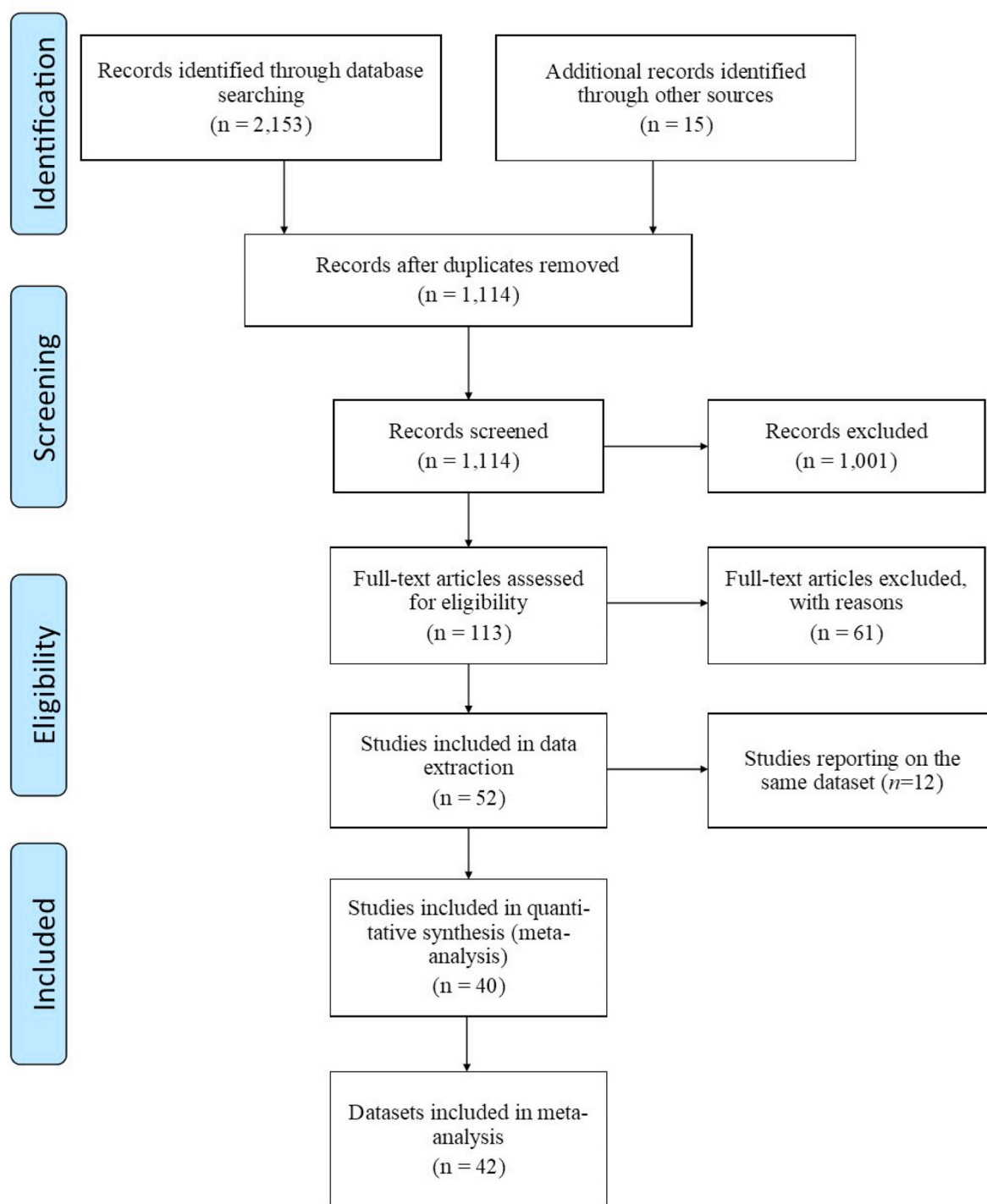


Fig. 1. PRISMA diagram of systematic search.

reports on four facets of mindfulness; however one study (Schoorl et al., 2015) also included the Non-judge facet from the FFMQ. All studies that used the KIMS reported on mindfulness facets, and one also reported a total mindfulness score.

Total AXIS scores ranged from 7 to 19, with 60% of papers scoring between 14 and 16 out of 20 ($n = 25$). Most studies (93%, $n = 37$), used measures with good psychometric properties, and all measures were self-report. The mean internal reliability for mindfulness total score was $\alpha = 0.87$, for total PTSD score was $\alpha = 0.93$, and mindfulness facets ranged from $\alpha = 0.79$ to $\alpha = 0.87$. A full summary can be found in Supplementary Materials 3.

3.3. Bivariate association between mindfulness and PTSD

There was a significant negative association, $r = -0.39$, between mindfulness and PTSD symptomology (95% CI $[-0.47$ to $-0.30]$, $Z = -8.02$, $I^2 = 96.8\%$), based on 35 datasets taken from 33 articles with 13,370 participants, as outlined in Table 2 and Fig. 2.

3.4. Publication bias and reliability attenuation

A trim and fill analysis identified no missing studies. GOSH analysis showed that the pooled effect size was robust ($K = 1,000,000$ models,

Table 1
Overview of studies included in the meta-analysis.

Authors & year	Country	Population	N	Average age in years (SD)	White, non-hispanic, ethnicity (%)	Male (%)	Measure of Mindfulness	Measure of PTSD	Quality rating	R between mindfulness & PTSD total	Include measures facets
Measure of PTSD											
Frewen et al. (2012)	Canada	Women with PTSD (Community)	55	39.84 (8.03)	91%	0%	KIMS	CAPS	7	−0.24*	Yes
Meyer et al. (2019)	USA	Military Veterans	117	37.33 (10.15)	31%	83%	MAAS	CAPS	12	−0.54**	No
Measure of PTS-S											
Arnudova and Amaro (2020)	USA	Substance users	237	32.34 (8.99)	20%	0%	FFMQ	PSS-SR	15	N-R	Yes
Barr et al. (2019)	USA	Military Veterans	577	38.78 (8.78)	49%	80%	MAAS	PCL-5	14	−0.73***	No
Bernstein et al. (2011)	USA	Community	76	30.0 (12.5)	93%	54%	MAAS	PDS	15	−0.47**	No
Boelen and Lenferink (2018)	Netherlands	Students	314	21.8 (2.7)	N-R	12%	MAAS	PSS-SR	16	−0.39*	No
Boelen (2021)	Netherlands	Students	473	21.40 (1.89)	N-R	12%	MAAS	PSS-SR	11	−0.33***	No
Boughner et al. (2016)	USA	Community	952	35.40 (11.42)	73%	45%	FFMQ-SF	PCL-5	15	N-R	Yes
Bowen et al. (2017)	USA	Substance users	286	38.47 (10.93)	51%	71%	FFMQ	PCL-C	14	−0.44**	No
Bravo et al. (2018)	USA	Military personnel	407	32.74 (7.50)	62%	56%	FFMQ	PCL-5	14	−0.53*	Yes
Bravo et al. (2018)	USA	Students	310	24.46 (8.66)	48%	59%	FFMQ	PCL-5	14	−0.32*	Yes
Call et al. (2015)	USA	Military personnel	198	29.92 (8.70)	72%	92%	MAAS	PCL-M	13	−0.457**	No
Garland and Roberts-Lewis (2013)	USA	Substance users	125	38.7 (10.0)	37%	92%	FFMQ	PCL-C	14	−0.584***	Yes
Gonzalez et al. (2016)	USA	People living with HIV/AIDS	137	48.94 (8.89)	40%	85%	FFMQ	PDS	15	N-R	Yes
Hagen et al. (2016)	Norway	Disaster survivors	25	47.96 (10.0)	N-R	36%	FFMQ	IES-R	14	0.293	Yes
Hanley et al. (2017)	USA	Students	505	21.11 (3.30)	75%	24%	FFMQ	IES-R	11	−0.12**	No
Haspolat and Çırakoğlu (2021)	Turkey	Community	246	34.50 (N-R)	N-R	41%	FFMQ	IES-R	15	−0.47**	Yes
Huang et al. (2019)	China	Firefighters	409	21.3 (1.68)	N-R	100%	MAAS	PCL-5	14	−0.60***	No
Kachadourain et al. (2021)	USA	Military Veterans	1268	60.6 (15.2)	75%	90%	MAAS	PCL-5	16	−0.66**	No
Kalil et al. (2014)	USA	Students	157	26 (4.73)	60%	23%	FFMQ	PCL-C	9	N-R	Yes
Kauffman et al. (2020)	USA	Students	139	25.4 (8.07)	53%	24%	MMAS	PDS	19	−0.28**	No
Kuhl and Boyraz (2017)	USA	Students	536	20.7 (4.3)	72%	46%	FFMQ-SF	PCL-5	14	0.42***	No
Liu et al. (2021)	China	Breast cancer patients	230	47.8 (9.1)	N-R	N-R	MAAS	PSS	15	−0.50**	No
Martin et al. (2018)	USA	Psychiatric inpatients	152	33.86 (11.29)	44%	58%	FFMQ	PCL-5	15	N-R	Yes
Meyers et al. (2020)	USA	Caregivers of patients in a Neuro-ICU	103	53 (14)	89%	32%	CAMS-R	PCL	16	−0.53***	No
Meyers et al. (2020)	USA	Patients in a Neuro-ICU	102	52 (17)	81%	53%	CAMS-R	PCL	16	−0.39***	No
Nagy et al. (2020)	USA	Community	217	35.23 (10.84)	78%	42%	CAMS-R	PCL-5	12	−0.30***	No
Pow and Cashell (2017)	USA	Disaster relief counsellors	235	57.95 (10.26)	89%	32%	FFMQ	IES-R	13	−0.17**	No
Schoorl et al. (2015)	Netherlands	Outpatients	101	41.3 (10.7)	N-R	16%	KIMS-E	SRIP	16	N-R	Yes
Shipherd and Salters-Pedneault (2018)	USA	Military Personnel	1524	28.51 (6.71)	62%	90%	FFMQ	PCL	15	−0.50***	Yes
Smith et al. (2011)	USA	Firefighters	124	33.70 (8.13)	37%	93%	MAAS	PDS	9	−0.40**	No
Stanley et al. (2019)	USA	Firefighters	831	38.37 (8.53)	75%	95%	FFMQ	PCL-5	16	0.297**	Yes

(continued on next page)

Table 1 (continued)

Authors & year	Country	Population	N	Average age in years (SD)	White, non-hispanic, ethnicity (%)	Male (%)	Measure of Mindfulness	Measure of PTSD	Quality rating	R between mindfulness & PTSD total	Include measures facets
Sun et al. (2021)	China	Students	1912	20.28 (2.10)	N-R	30%	MAAS	IES	16	−0.29***	No
Viana et al. (2017)	USA	Outpatients	182	37.8 (10.6)	0%	11%	MAAS	PDS	12	−0.38**	No
Voith et al. (2020)	USA	Men charged with domestic violence	67	35.42 (11.61)	6%	100%	MSER-R	PCL-5	14	−0.708	No
Vujanovic et al. (2009)	USA	Community	239	23 (9.6)	92%	46%	KIMS	PDS	14	N-R	Yes
Wen et al. (2021)	China	Aid workers	298	20.8 (N-R)	N-R	64%	MAAS	IES-R	11	−0.53**	No
Wise et al. (2020)	USA	Long-haul truck drivers	140	37 (10.6)	90%	30%	MAAS	PCL-C	13	−0.66*	No
Measure of trauma-associated symptoms											
Glück et al. (2016)	Austria	Elderly adults	97	73.6 (6.9)	N-R	32%	FFMQ	ETI	19	−0.34***	No
Hicks and Dayton (2019)	USA	Expectant parents	102	27.7 (4.3)	28%	50%	FFMQ	PSC-40	11	−0.36**	Yes
Park et al. (2021)	USA	Community	1015	38.9 (13.50)	82%	45%	CAMS-R	PDI	17	0.24***	No
Shorey et al. (2014)	USA	People who misuse substances	125	37.36 (12.47)	92%	67%	MAAS	PDSQ	12	−0.25**	No

N-R = not reported in study publication. % values reported to 0.d.p. FFMQ = Five Facet Mindfulness Questionnaire. MAAS = The Mindfulness Attention Awareness Scale. KIMS = Kentucky Inventory of Mindfulness Score. CAMS-R = The Cognitive and Affective Mindfulness Scale – Revised. MSES-R = The Mindfulness-Based Self Efficacy Scale - Revised. CAPS = Clinician Administered PTSD scale for DSM-IV. PCL-5 = PTSD Checklist for DSM-5. PCL-C = PTSD Checklist for DSM-IV. PCL-M = PTSD Checklist for DSM-IV Military version. PDS = Post-traumatic Diagnostic Scale. IES-R = Impact of Events Scale. PSS-SR = PTSD Symptom Scale – Self report. SRIP = Self-rating Inventory for Post-traumatic Stress. PDI = Posttraumatic Distress Inventory. PDSQ = Psychiatry Diagnostic Screening Questionnaire. TSC-33 = Trauma Symptoms Checklist. ETI = Essen Trauma Inventory. Bibliographic in appendix 2.8. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 2

Results of the meta-analysis for relationship between total mindfulness, and mindfulness facets, and symptoms of PTSD.

Mindfulness measure	r_+	Number of datasets (k)	Number of participants (n)	95% CI	Z	I^2	τ^2 (SD)
Total mindfulness	−0.39	35	13,370	−0.47 to −0.30	−8.03***	96.8%	0.084 (0.022)
Observe	0.06	16	5,600	−0.00 to 0.12	1.46	72.6%	0.008 (0.005)
Describe	−0.22	16	5,600	−0.31 to −0.12	−4.40***	91.6%	0.034 (0.015)
Act with Awareness	−0.37	16	5,600	−0.49 to −0.23	−5.10***	96.4%	0.085 (0.034)
Non-judge	−0.37	16	5,600	−0.48 to −0.25	−5.75***	95.5%	0.067 (0.027)
Non-react	−0.21	14	5,206	−0.32 to −0.09	−3.49***	94.0%	0.0462 (0.021)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

average pooled $r = -0.39$, average $I^2 = 95.7\%$; see Supplementary Materials 4). When dis-attenuating correlations for reported internal reliability of mindfulness and PTSD subscales, the pooled effect was $r = -0.43$ (95% CI [−0.52 to −0.33], $Z = -7.76$, $I^2 = 97.2\%$).

3.5. Bivariate association between mindfulness facets and PTSD

Random effects meta-analyses were also used to examine the relationship between different facets of mindfulness and PTSD symptomology, as outlined in Table 2. Data were extracted from 16 datasets, taken from 15 studies, with a total of 5,600 participants for the facets Observe, Describe, Act with Awareness and Non-judge. Data for the relationship between Non-react and PTSD were extracted from 14 datasets, taken from 13 studies, with 5,206 participants. The relationship between Observe and PTSD symptomology was non-significant ($r = 0.06$, $p = 0.0503$), but Act with Awareness ($r = -0.37$, $p < 0.001$), Non-judge ($r = -0.37$, $p < 0.001$), Describe ($r = -0.22$, $p < 0.001$), and Non-react ($r = -0.21$, $p = 0.0005$) all showed significant inverse pooled relationships with PTSD symptomology. The heterogeneity across studies remained high, ranging from $I^2 = 72.6\%$ –96.4%.

3.6. Moderation effects for mindfulness and PTSD symptomology

Table 3 outlines the results of all moderation analyses. Study quality, as measured using the AXIS, did not moderate the relationship between mindfulness and PTSD symptomology. However, the effect was significantly moderated by study population (Supplementary Materials 5), with the relationship between mindfulness and PTSD symptomology strongest for professionals (made up of military personnel, firefighters, aid workers, and long-haul truck drivers) and weakest for students. There was a significant effect of endorsing a traumatic event; studies that did not require participants to endorse a trauma, as classified using the DSM-IV (American Psychiatric Association, 1994) or DSM-5 (American Psychiatric Association, 2013), showed a slightly stronger correlation between mindfulness and PTSD symptomology compared to studies that did. The relationship between mindfulness and PTSD was significantly moderated by the measure used to assess mindfulness; a stronger relationship was reported in studies that employed the MAAS (Brown and Ryan, 2003), compared to studies that used the FFMQ. The strength of the relationship did not vary with the instrument used to assess PTSD symptomology.

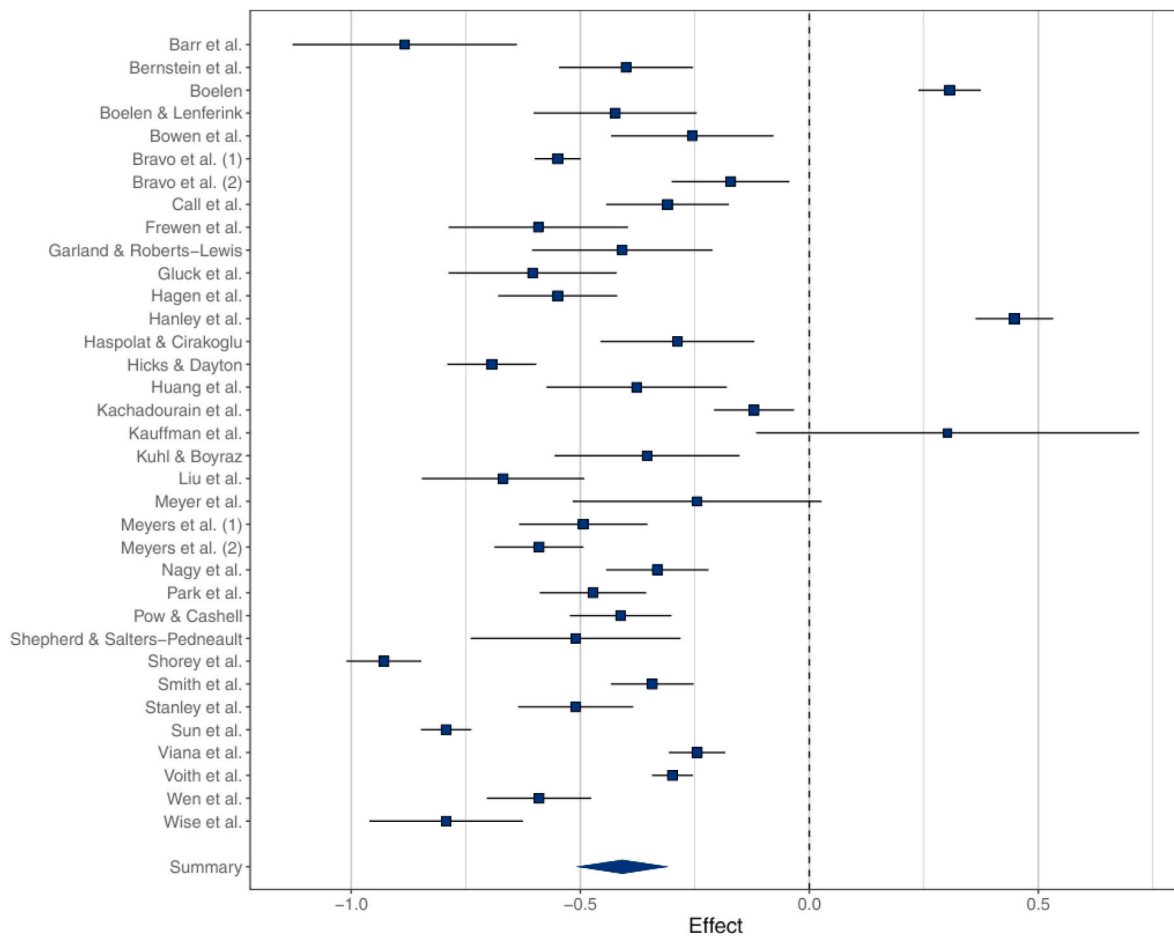


Fig. 2. Forest plot of associations between total mindfulness and PTSD Symptomology. Values are Fisher's Z correlation coefficients.

Table 3

Moderation effects for the relationship between total mindfulness and PTSD Symptomology.

Moderator	r_+	Standard Error	k	n	95% CI	I^2	Z	p
AXIS score of study quality	−0.00	0.02	35	13,370	−0.04 to 0.04	96.9%		0.570
Population			32	13,043		95.7%		<0.001
Clinical	−0.43	0.09	8	1,255	−0.57 to −0.27		−4.96***	
Community	−0.35	0.11	6	1,706	−0.52 to −0.15		−3.32***	
Professional	−0.51	0.08	11	5,893	−0.61 to −0.38		−7.16***	
Students	−0.19	0.10	7	4,189	−0.36 to 0.00		−1.96*	
Mindfulness measure			29	11,811		96.6%		<0.001
FFMQ	−0.24	0.80	13	5,229	−0.38 to −0.90		−3.10**	
MAAS	−0.48	0.81	16	6,582	−0.58 to −0.37		−7.36***	
PTSD Measure			27	10,967		97.5%		0.377
IES-R	−0.25	0.14	6	3,221	−0.49 to 0.02		−1.84	
PCL	−0.45	0.09	16	7,100	−0.57 to −0.30		−5.70	
PDS	−0.38	0.17	5	646	−0.63 to −0.62		−2.44	
Endorsed trauma experience			35	13,370			96.7%	<0.001
No	−0.43	0.06	23	9,648	−0.52 to −0.33		−7.42***	
Yes	−0.30	0.09	12	3,722	−0.45 to −0.14		−3.56***	

k represents the number of datasets and n represents number of participants. $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

4. Discussion

4.1. Overview of findings

This systematic review and meta-analysis is the first of the authors knowledge to provide a detailed synthesis of findings from published, cross-sectional studies that report on the bivariate association of trait mindfulness with PTSD symptomology. Overall, there was a significant, negative relationship between mindfulness and PTSD symptomology,

which showed low risk of bias, did not vary with methodological quality, and remained significant after accounting for measurement reliability. High heterogeneity could, in part, be explained by differences in study population, professional status, and choice of instrument for assessment of mindfulness.

The pooled effect size for total trait mindfulness and PTSD symptomology was -0.39 , with mindfulness and PTSD sharing $\sim 15.2\%$ variance ($R^2 = 0.152$). An effect size of this magnitude has been described as a large effect that has both theoretical and clinical implications (Funder

and Ozer, 2019). These findings are consistent with the wider literature that outlines positive associations between trait mindfulness and good mental health (Enkema et al., 2020; Tomlinson et al., 2018). Whilst these findings represent tentative evidence in support of mindfulness based interventions in managing PTSD symptomology (Hopwood and Schutte, 2017; Lang, 2017), they may also highlight how it is also possible that trait mindfulness could act as a moderator between traumatic experiences and PTSD symptomology. Nonetheless, substantial heterogeneity across studies means that these findings should be interpreted with a degree of caution, and further research into both trait mindfulness and mindfulness interventions is required.

The relationship between mindfulness and PTSD symptomology was moderated by sample type. Studies that required participants to endorse a traumatic experience, based on PTSD diagnostic criteria (American Psychiatric Association, 1994, 2013), had a smaller pooled correlation than those that did not require participants to endorse a traumatic experience. Further exploration into the differences between trauma endorsement and PTSD symptomology, and how this may be related to trait mindfulness, is recommended.

Studies that focused on professionals who are more likely to experience trauma as part of their role had the largest overall pooled effect size, and studies that focused on students had the smallest overall pooled effect size. Whilst this is consistent with earlier reviews of mindfulness and mental health (Carpenter et al., 2019), it is difficult to directly compare these findings owing to differences within population groups. Mattes (2019) defined ‘professionals’ as those who work within a health context, and no other review has explored military, firefighters or aid workers in their moderation analyses (Carpenter et al., 2019; Mattes, 2019). Although Carpenter et al. (2019) and Mattes (2019) included clinical samples in their moderation analyses, their definition of ‘clinical’ is unclear. In this research, clinical samples included participants from any clinical setting, inclusive of inpatient substance-use services, physical health treatment (such as breast cancer and intensive care units), in-patient psychiatric units, and caregivers of patients in intensive care. Future research should therefore seek to establish meaningful clinical, non-clinical and professional groups to further examine these apparent differences in the relationship of trait mindfulness with PTSD symptomology.

The FFMQ and MAAS have been identified as the most frequently used measures of mindfulness (Enkema et al., 2020; Tomlinson et al., 2018). Results showed that the strongest pooled effect size was observed for the MAAS ($r = -0.48$) compared to the FFMQ ($r = -0.24$). It is unsurprising that different measures of mindfulness yield different results, given the conceptual differences across these measures. More research into how mindfulness is understood, measured, and operationalized is an important step toward having a consistent set of outcomes for use in psychiatry and psychological science research and practice. The effect size was not moderated by the instrument used to assess PTSD symptoms, which supports the conceptual understanding and measurement of this condition across a variety of commonly used measures.

The relationship between mindfulness and PTSD symptomology also varied between distinct facets of mindfulness, consistent with other reviews of psychological wellbeing and distress (Carpenter et al., 2019; Mattes, 2019). The pooled effect size for the relationship of the Observe facet of mindfulness with PTSD symptoms was non-significant. Mattes (2019) reported a similar result for other non-desirable mental health outcomes, with Observe positively correlated with dissociation, absent-mindedness, and thought suppression, which are all symptoms of PTSD (Baer et al., 2006). Moreover, studies included in this systematic review reported significant positive associations (Garland and Roberts-Lewis, 2013; Shipherd and Salters-Pedneault, 2018), significant negative associations (Kalil et al., 2014), and non-significant associations (Arnaudova and Amaro, 2020; Haspolat and Çirakoğlu, 2021) between Observe and PTSD symptomology. Further exploration of the relationship between Observing inner experiences, and PTSD

symptomology, including specific symptom clusters such as hypervigilance and avoidance, is therefore recommended to better understand the disparity across studies included in this review.

All other facets of mindfulness showed significant and negative pooled effect sizes with PTSD symptomology. Consistent with Carpenter et al. (2019) and Mattes (2019) reviews of mindfulness and active psychological symptoms, the strongest of these associations was found for the Act with Awareness and Non-judge facets. These findings highlight differential associations of mindfulness facets with symptoms of PTSD, which could inform and help to tailor interventions in this area.

4.2. Limitations

There are several limitations of this review. First, many of the studies included in the quantitative synthesis did not report information about participants’ experience of meditative practice. Distinct differences between participants who regularly practiced meditation, and those who did not, have been reported (Baer et al., 2006), and it is important that future studies examining relationships of trait mindfulness collect and report these data. Moreover, participants who have previously completed mindfulness-based interventions for PTSD or other mental health difficulties may report greater use of mindfulness (Hopwood and Schutte, 2017), but these differences were not accounted for in this review.

Second, our review only included studies of participants over the age of 18 years. As 31% of adolescents experience a trauma before the age of 18 (Lewis et al., 2019), it is important that the relationship between mindfulness and PTSD symptomology is also investigated in adolescent samples. Third, all studies in this analysis were cross-sectional, and no inferences can be made about cause and effect. A systematic review of longitudinal data has suggested that higher levels of trait mindfulness confer a protective effect against future PTSD symptomology (Enkema et al., 2020), however a meta-analysis has not been reported.

Many of the studies included in this review relied on a unidimensional operationalization of mindfulness, yet there is a broad consensus that mindfulness is a multidimensional construct (Bishop et al., 2004). Concerns have also been raised about the use of the term ‘mindfulness’ to explain vastly different constructs, such as trait mindfulness and mindfulness therapy (Tomlinson et al., 2018), and it is important to also consider associations of ‘state mindfulness’ with symptoms of PTSD (see Kiken et al., 2015). Heterogeneity across studies in this review could, in part, be explained by the use of ‘mindfulness’ as an umbrella term, with measures being used that differ in terms of their operationalization and construct validity. Notably, the FFMQ, one of the most commonly used measures of mindfulness in studies included in this review, has a latent structure that has proven difficult to replicate using a variety of methods (Lecuona et al., 2020). Park et al. (2013) highlighted important conceptual differences in the current measure of mindfulness, such as the FFMQ and the MAAS. Thus, it is important that a well-established operational definition of mindfulness is agreed upon that will pave the way for a consistent, multi-dimensional measurement approach. Further variation between studies could also be explained by differences across measures, settings, populations, and professions.

4.3. Clinical implications

The results of this systematic review and meta-analysis suggest that greater mindfulness is significantly associated with fewer symptoms of PTSD. This supports the notion that skills such as heightened awareness and acceptance of internal experiences, that can be practiced during mindfulness-based interventions (Lang, 2017), may be beneficial for those who have suffered a traumatic event. The results of moderator analyses on mindfulness facets supports the multifaceted nature of the mindfulness construct and points toward skills that may be most useful in managing the effects of a traumatic event. The magnitude of the association between mindfulness and PTSD symptomology was greatest

for Act with Awareness and Non-judge, and these skills should be incorporated into interventions for people who are struggling with the distress associated with traumatic experiences. Our findings suggest that skills in Observing thoughts and feelings, despite often being a core component of mindfulness training, may be of the least benefit.

Opportunities to teach mindfulness techniques to people who have an increased risk of trauma, or who do not have access to treatment, should be considered as a potential clinical intervention. Mindfulness practice can be taught outside of traditional mental health services, which could support recommendations for more adequate support across high-, middle-and low-income countries (Kessler et al., 2017).

5. Conclusion

There is a negative association between mindfulness and symptoms of PTSD, which is robust across population samples, and against small study and publication bias. These findings suggest that mindfulness skills may confer a protective effect in managing distress associated with a traumatic event.

Conflict of interest

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jpsychires.2022.05.027>.

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