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Trauma-informed yoga (online) for positive mental health: A pilot study

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ABSTRACT

Objective: This aim of the study was to explore the effectiveness of an online trauma-informed yoga programme to increase positive mental health and reduce stress in the general population.

Design: This was a mixed-methods prospective intervention study with an active trauma informed yoga group and a wait-listed control group.

Methods: Thirty participants were recruited from an organisation based in the United Kingdom. The active intervention was a once weekly pre-recorded TIY video class (approximately one-hour) for 10 weeks. The control group were wait-listed. The primary outcome was a comparison between the active and control groups post-intervention on the positive mental health scale. Secondary outcomes were the difference between groups over various related scales. ANCOVA was used in the analysis to respectively control for baseline levels of the outcomes.

Results: A non-significant increase in PMH ($b = 2.44$, $p = 0.16$), mindfulness ($b = 6.35$, $p = 0.07$) and resilience ($b = 4.08$, $p = 0.15$) and a significant increase in selfcompassion ($b = 2.53$, $p = 0.04$) were demonstrated, while perceived stress increased non-significantly ($b = 1.51$, $p = 0.56$) and empowerment was reduced non-significantly ($b = -0.25$, $p = 0.29$) for the active group compared with controls.

Conclusions: Consistent trends over multiple outcomes demonstrated positive effects of TIY on PMH, mindfulness, resilience, and a significant improvement in self-compassion. Limitations of a small study include an increased risk of failing to reject the null hypothesis when it is false. A larger trial is warranted to demonstrate the effects of TIY more conclusively in positive mental health.

Statements of:

What is already know about the topic

- Trauma-informed yoga (TIY) has been found to be useful as an adjunct treatment for posttraumatic stress disorder.
- TIY is a contemporary Western form of yoga.
- TIY has been found to assist emotion regulation when sessions are conducted in person.
- TIY has been found to help increase feelings of safety when sessions are conducted in person.
- TIY has been found to reduce symptoms of trauma.

What this paper adds

- Trauma-informed yoga (TIY) is a gentle treatment approach for people who have experienced trauma.
- TIY may have beneficial effects on positive mental health, self-compassion, and resilience.
- TIY may contribute to supporting a general population with life stress.
- TIY can be adapted for remote participation.

1. Background

Stress is defined as an experience resulting from a real or imaginary threat [1]. It can impact an individual's mental [2], cognitive [3], physical [4] and moral [5] health via numerous physiological reactions. Stress is associated with major causes of death: cardiovascular disease [6], cancer [7], lung disease [8,9], accidents [10], cirrhosis [11] and

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suicide [12]. Research has demonstrated causal associations with other chronic disease processes including autoimmune diseases [13–15].

Many chronic diseases require changes in behaviours for improvement to occur [16]. Reducing stress using healthy coping strategies may be necessary, but lack of health coping strategies may contribute to increased levels of stress [17]. The practice of yoga can bring relief from life stress and restore balance to life [18] and may offer an alternative way for skill acquisition in managing healthy coping strategies to reduce stress.

Yoga originated in India as a philosophical practice guiding ethical behaviour [18,19]. Yoga is facilitated through physical movement (asana), meditation (dhyana) and breath awareness (pranayama) [20]. Yoga encompasses many schools of thought and practice, with differing degrees of emphasis on asana, dhyana, and pranayama [21].

Trauma-informed yoga (TIY) is a contemporary Western form of yoga, using low-impact physical movement, mindfulness, and breath awareness to alleviate the effects of stress, anxiety, and symptoms common to trauma exposure [22]. Perhaps TIY is most suited for the subset of people who prefer a gentle but structured yoga practise; where vulnerability is reduced through careful yoga shape selection, no physical adjustments are performed, and invitational language is used to avoid reactionary stress responses [23]. It has been demonstrated as an effective adjunct treatment to improving the symptoms of post-traumatic stress disorder [24]. TIY has been correlated with improvements in emotion regulation, feelings of safety and personal growth [25]. A close link exists between individual perception of stress, emotional regulation, and positive emotions [26]. Interventions supporting positive emotional experiences such as TIY may have the potential to increase positive mental health (PMH) [27].

It has been posited that positive mental health (PMH) could be a protective factor against various mental health disorders and psychopathologies [27]. PMH is usually associated with enhanced subjective and psychological wellbeing [28]. It is a vital factor for individual resilience [29], which is necessary for protection against depression, anxiety, and stress [30,31]. Positive emotions appear to increase resilience and in turn, resilience appears to increase positive emotions [32,33]. Interventions that both encourage helpful adaptive skills and reduce maladaptive practices could build resilience, lower stress, and increase PMH [34].

Therefore, the aim of this study was to explore the effectiveness of a trauma-informed yoga (TIY) programme to increase positive mental health (PMH) and reduce stress in the general population.

2. Materials and methods

2.1. Research Design

The study was designed as a mixed-methods prospective intervention study with two parallel groups: an active TIY group and a control group, which was a wait-listed group.

2.2. Study protocol

Study participants were emailed a link to an online survey, hosted in Qualtrics (qualtrics.com), pre-and-post the 10-week TIY programme. As this study coincided with the COVID-19 pandemic, study participants in the active group were also required to access a website that had been created to enable weekly pre-recorded videos of the TIY classes to be uploaded to the website (rather than physically attending a yoga class).

2.3. Participants

Participants were recruited from an accountancy firm in the United Kingdom. Adults with self-perceived work and personal life stress were invited to participate in the study. Due to the limitations of the pandemic, an additional criterion for participation was access to the

internet and a quiet space in the home, suitable for yoga practice. Email invitations were sent by the Human Relations department of the firm to all employees inviting participation in the study. Employees were able to share the invitation for participation with their family, friends and associates. The study had the ethics approval from an institutional Human Research Ethics Committee (Approval Number 2020/050).

2.4. Group allocation and blinding

Participants were alternately allocated to a group according to order of enrolment to the study. As this was an open-label study, there was no imperative to conceal the allocation schedule through randomisation. Sample size was determined to provide sufficient data to demonstrate data trends.

2.5. Interventions

Participants in the active TIY intervention group took part in a once weekly, one-hour in length, pre-recorded TIY video class for the duration of 10 weeks. The pre-recorded TIY video classes had the same structure every week, including presentation of basic TIY shapes to be practiced. Basic TIY shapes included seated, kneeling, and standing forms that offered an opportunity to stretch, move or notice the placement of one's body. Modifications to the basic TIY shapes were offered and encouraged by the researcher during the TIY class to accommodate individual needs. The researcher reminded participants at the beginning of each TIY session to work at their individual capacity, emphasising pain should not be felt. Participants in the wait-listed group did not participate in an intervention for the duration of the 10-week study.

2.6. Outcomes

The primary outcome was a comparison between the active TIY intervention group and the wait-listed control group post-intervention on the *Positive Mental Health Scale*. Secondary outcomes were the between group differences in changes over time of the active TIY intervention group and the control group post-intervention for mindfulness, perceived stress, resilience, self-compassion, and empowerment.

2.7. Measures

The *Positive Mental Health Scale* (PMH-Scale) [34] is a 9-item, unidimensional questionnaire that measures positive self-appraisals associated with subjective and psychological aspects of wellbeing. Answers to questions like, "I am confident" are rated on a scale from 0 (do not agree) to 3 (agree). A higher score suggests greater positive mental health. The PMH-scale has shown good convergent and discriminate validity in student, patient, and general population samples with good internal consistency ($\alpha = 0.82 - 0.93$) [34].

Trait mindfulness was measured using the *Freiburg Mindfulness Inventory* (FMI-14) [35]. The FMI-14 uses a 14-item Likert self-rating scale to measure trait mindfulness. The response scale ranges between 1 (almost never) to 4 (almost always). Higher scores correlate with higher levels of mindfulness. The FMI-14 shows good internal consistency ($\alpha = 0.86$) [35].

Perceived stress was measured using The *Perceived Stress Scale* (PSS-10) [36]. The measure consists of 10 Likert-type questions and response categories range from 1 (never) to 5 (very often). Total scoring is done by reverse scoring items 4, 5, 7 and 8, then summing the 10 items [37,38]. Higher scores correlate with higher perceived stress. Reliability is consistent ($\alpha = 0.84$) [37].

Resilience and capacity to change were measured using The *Connor-Davidson Resilience Scale* (CD-RISC-10) [38]. It is a 10-item Likert-style measure and response categories range from 0 (not true at all) to 4 (true nearly all of the time). A higher score correlates with greater resilience. The CD-RISC-10 is reported to be a reliable measure ($\alpha =$

0.89) [39].

Self-compassion was measured using The *Self-Compassion Scale-Short Form* (SCS-SF) [40]. The SCS-SF is a 12-item questionnaire measuring components of self-compassion: self-kindness vs self-judgement, common humanity vs isolation and mindfulness vs over-identification. A 5-point scale ranging from 1 (almost never) to 5 (almost always) is used. A total score is found by taking the mean of the 12 items, after reverse scoring items that are negatively worded. A higher score suggests greater self-compassion. Adequate internal consistency is reported ($\alpha = 0.85$) [41].

The *Psychological Empowerment Measure* (PEM) includes four subscales [42]. The subscales are meaning, competence, self-determination, and impact. The 12 question Likert scale and response categories range from 1 (strongly disagree) to 7 (strongly agree). A higher score indicates greater personal empowerment. The PEM shows good internal consistency ($\alpha = 0.78$) [42].

2.8. Theory/calculation

A mixed methods design was used to pilot an evaluation of TIY on the various outcomes. This paper reports the results of the quantitative component of the evaluation.

Analyses included adjusted and unadjusted estimates of the difference between groups at post-intervention. Adjusted estimates were modelled using analysis of covariance (ANCOVA) that included baseline values of the outcome as a covariate to control for group differences at baseline [43]. Unadjusted estimates were calculated as the differences between groups at post-intervention with no adjustment for baseline values of the outcome. The change scores were calculated from baseline to post-intervention (see Table 2). A random intercept model was used to explore the data for trends over time, including group by time interactions. Individuals were modelled as random effects and time (pre, post) and group (control, active) were included as covariates as follows:

$$y_{ij} = \alpha + \beta_1 time_{ij} + \beta_2 group_{ij} + \beta_3 time_{ij} * \beta_4 group_{ij} + s_j + e_{ij}$$

As these analyses were conducted on pilot data, hypothesis testing

Table 1

Baseline demographic characteristics for wait-listed control group and active trauma-informed yoga (TIY) group.

	Control group (n = 15) Mean (Standard deviation)	Active (TIY) group (n = 15) Mean (Standard deviation)
Age	47.0 (9.4)	48.2 (8.8)
	Number (%)	Number (%)
Gender		
Male	5 (33.3)	3 (20.0)
Female	10 (66.7)	12 (80.0)
Job		
Statistician/Analyst	1 (06.7)	
Teacher	1 (06.7)	1 (07.7)
Creative Artist	1 (06.7)	
Sportsmen/Athletes	3 (20.0)	
Administration	4 (26.7)	6 (46.2)
Accountancy	1 (06.7)	6 (46.2)
Sales/Service	3 (20.0)	1 (07.7)
Residence		
UK	9 (60.0)	11 (84.6)
USA		2 (15.4)
Australia	6 (40.0)	
Relationship		
Single	2 (13.3)	5 (38.5)
Defacto/married	12 (80.0)	8 (61.5)
Prefer not to answer	1 (06.7)	
Religion		
Catholic	1 (06.7)	3 (23.1)
Christian	2 (13.3)	3 (23.1)
No ID religion	1 (06.7)	1 (0.77)
Agnostic	1 (06.7)	1 (0.77)
Prefer not to answer	10 (66.7)	4 (30.8)
Other		1 (0.77)

Table 2

Active and control group means at pre- and post-intervention and the change from baseline for each measure by group.

Group	Measure	Pre		Post		Direction of Change ^a
		Mean	SD	Mean	SD	
Active	PMH-Scale	26.3	4.3	29.7	4.3	↑3.4
	FMI-14	33.9	10.9	38.8	9.5	↑4.9
	PSS-10	24.1	5.9	22.8	4.3	↓1.3
	CDS-RISC-10	38.0	6.4	41.7	7.0	↑3.7
	SCS-SF	16.1	4.0	17.8	3.6	↑1.7
	PEM	2.6	1.1	2.5	1.1	↓0.1
Control	PMH-Scale	30.5	3.7	30.1	3.8	↓0.4
	FMI-14	36.7	9.5	36.5	6.9	↓0.2
	PSS-10	19.9	4.3	19.3	4.7	↓0.6
	CDS-RISC-10	38.9	7.0	38.1	5.2	↓0.8
	SCS-SF	16.3	3.6	16.0	2.4	↓0.3
	PEM	2.3	0.8	2.5	0.8	↑0.2

Note: PMH-Scale measures PMH; FMI-14 measures mindfulness; PSS-10 measures perceived stress, CDS-RISC-10 measures resilience, SCS-SF measures self-compassion and PEM measures empowerment.

^a Change calculated from baseline to post-intervention. Up arrow indicates increase; down arrow decreases from baseline.

and interpretation did not focus on p-values; rather, the data trends. Consistent, strong data trends over multiple outcomes were considered supportive of the merit of moving into a larger, more conclusive placebo-controlled clinical trial. Data were analysed using IBM SPSS Statistics (version 26) [44] or STATA (version 16) [45].

3. Results

3.1. Participant characteristics

Thirty participants (22 females; 8 males) were randomly allocated into a wait-listed control and an active group. The flow of participants through the study is shown in Fig. 1. The mean age for participants in the wait-listed control group was 47 years ($M = 47.0$; $SD = 9.4$) and for the active group was 48.2 years ($M = 48.2$; $SD = 8.8$). There was a lower proportion of males compared to females within both groups: the wait-listed control group consisted of 33.3% males and 66.7 % females; the active group consisted of 20 % males and 80 % females. Participants in the wait-listed control group resided in the United Kingdom (60 %) or Australia (40 %) and in the active group resided in the United Kingdom (84.6 %) or United States of America (15.4 %). All participants were employed. Table 1 shows baseline demographic data for both groups.

3.2. Withdrawals

During the 10-week intervention period, 12 participants (4 males and 8 females) withdrew from the study for various personal and work reasons. Three males and six females from the active group withdrew from the study without reason.

3.3. Descriptive Statistics

There were minor differences between groups at baseline, with PMH showing the largest difference, where the active group ($M = 26.3$, $SD = 4.3$) was lower than the control group ($M = 30.5$, $SD = 3.7$) (Table 2). Stress (PSS-10) was also higher in the active group compared with controls at baseline.

3.4. Primary outcome

When baseline values were included in the model, PMH increased non-significantly ($b = 2.4$ $p = 0.16$, 95 % CI [-1.1, 6.0]) post-intervention compared to the waitlisted control group (Table 3). When baseline values were not included in the model (unadjusted estimates)

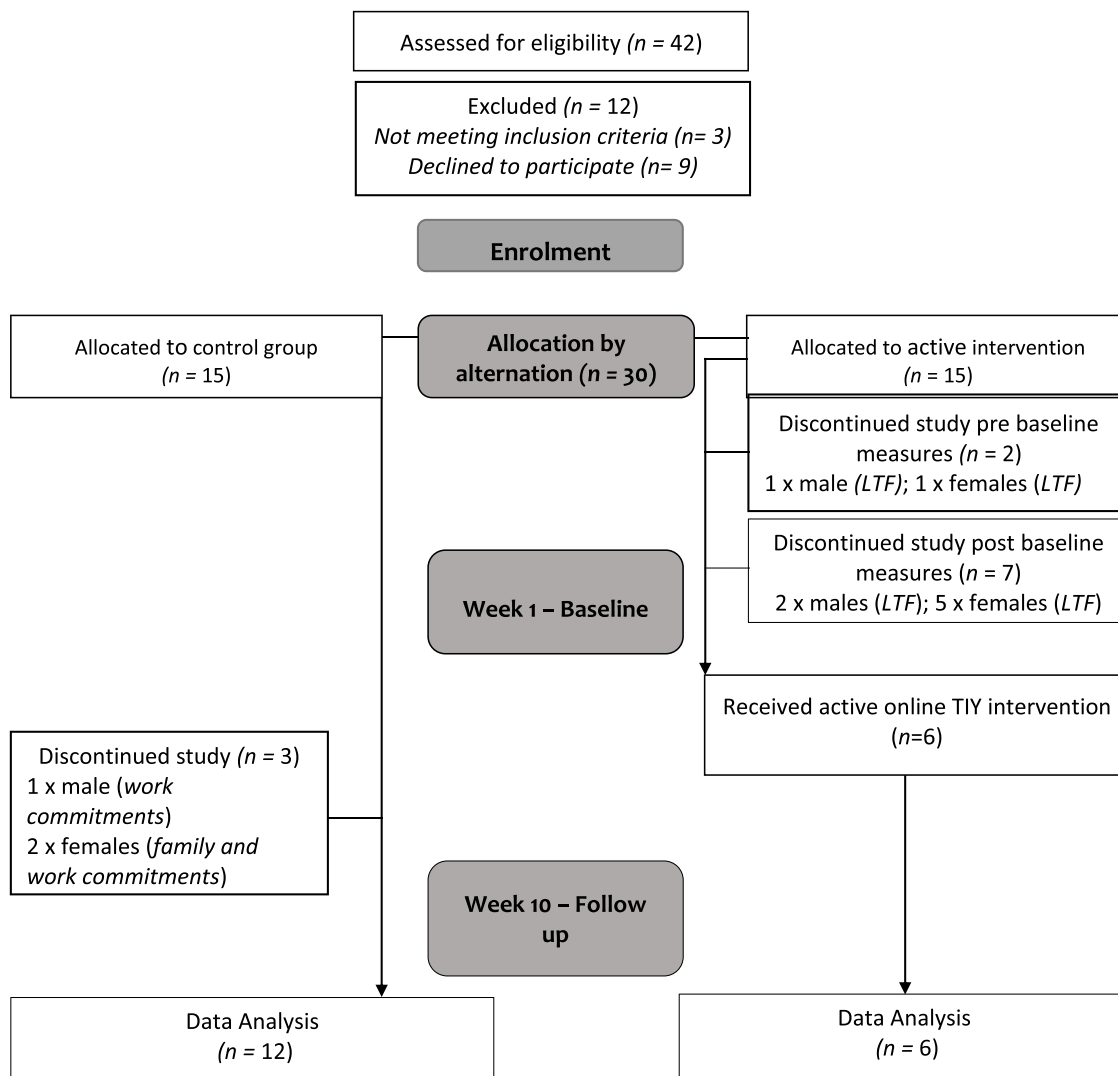


Fig. 1. Diagram showing flow of participants through the study. Notes: Lost to Follow-up (LTF).

Table 3

Parameter estimates for positive mental health, empowerment, mindfulness, perceived stress, resilience, and self-compassion.

Outcome	B	Std. Error	t	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
PMH	2.44	1.67	1.46	0.16	-1.11	5.99
Res	4.08	2.71	1.51	0.15	-1.7	9.85
Mindfulness	6.35	3.26	1.95	0.07	-0.60	13.30
SC	2.53	1.12	2.26	0.04	0.15	4.92
PStress	1.51	2.54	0.59	0.56	-3.91	6.92
Emp	-0.26	0.23	-1.11	0.29	-0.75	0.24

Note. Abbreviations are: PMH – positive mental health, Emp – empowerment, PStress – perceived stress, Res – resilience and SC – self-compassion; B – unstandardized beta

there was no trend toward a difference between groups ($b = -0.4$, $p = 0.8$, 95 % CI [-4.6, 3.8]). There was a significant group by time interaction ($b = 3.96$, $p = 0.01$) (Fig. 2). The slope (pre-post) for controls was non-significant ($b = -0.26$, $p = 0.78$), while the slope for the active group was positive and significant in comparison with controls ($b = 3.7$ [95 %CI 1.26, 6.14]).

3.5. Secondary outcomes

When baseline values were included in the model the active group increased non-significantly ($b = 4.08$, $p = 0.15$, 95 % CI [-1.0, 5.0]) in resilience at post-intervention. The unadjusted estimates showed a decrease for resilience in the active group ($b = -0.87$, $p = 0.7$, 95 % CI [-5.3, 3.5]). There was evidence of a nonsignificant trend for a group by time interaction ($b = 4.58$, $p = 0.11$) (Fig. 3). The pre-post slope for controls was non-significant ($b = -0.49$, $p = 0.78$), while the slope for the active group was positive (but non-significant) in comparison ($b = 4.1$ [95 %CI -0.45, 8.63]).

For mindfulness, the FMI-14 scores were non-significantly higher ($b = 6.35$, $p = 0.07$, 95 % CI [-0.6, 13.3]) at post-intervention for the active group compared with controls. The unadjusted estimates were also higher ($b = 2.3$, $p = 0.5$, 95 % CI [-6.0, 10.6]). There was a significant group by time interaction ($b = 7.93$, $p = 0.02$) (Fig. 4). The pre-post slope for controls was non-significant ($b = -0.11$, $p = 0.96$), while the slope for the active group was positive and significant in comparison ($b = 7.81$ [95 %CI 2.40, 13.22]).

There was a significant increase ($b = 2.53$, $p = 0.04$, 95 % CI [0.15, 4.9]) in self-compassion scores at post-intervention for the active group. Unadjusted estimates were also higher but were not significant ($b = 2.0$, $p = 0.2$, 95 % CI [-1.0, 5.0]). There was a significant group by time interaction ($b = 3.31$, $p = 0.01$) (Fig. 5). The pre-post slope for controls

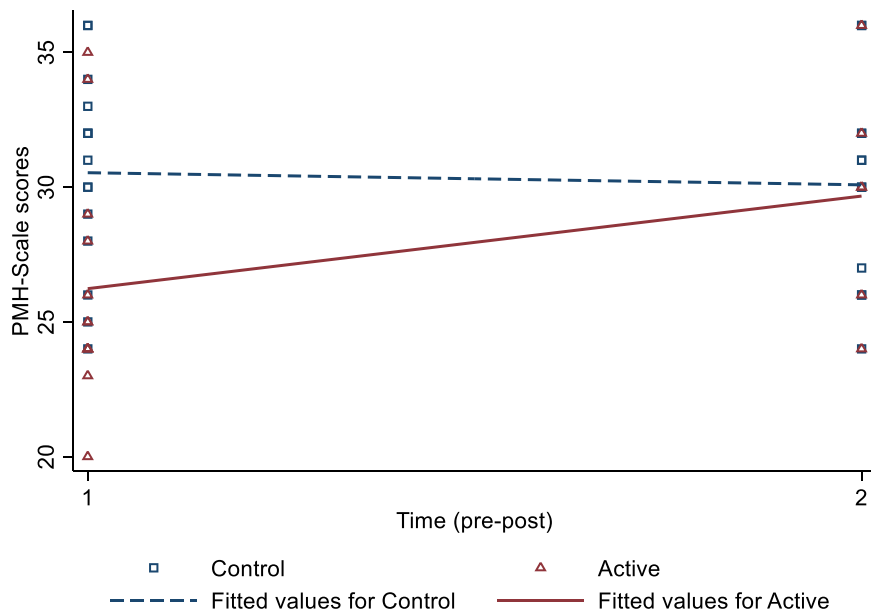


Fig. 2. : Pre and post Positive Mental Health (PMH) scores for the active and control groups. Note: PMH-Scale = Positive Mental Health Scale.

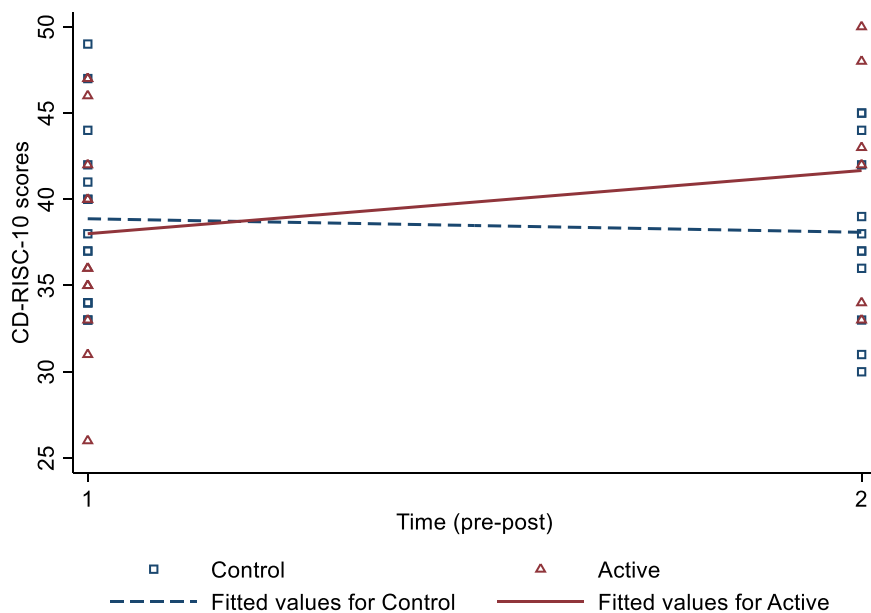


Fig. 3. Pre and post resilience scores for the active and control groups. Note: CD-RISC-10 = Connor Davidson Resilience Scale – 10.

was non-significant ($b = -0.50$, $p = 0.51$), while the slope for the active group was positive and significant in comparison ($b = 2.81$ [95%CI 0.77, 4.85]).(Figs. 6 and 7).

Perceived stress was higher at post-intervention for the active group compared with controls, after controlling for baseline values ($b = 1.51$, $p = 0.56$, 95% CI [-3.9, 6.9]), but this was not significant. The unadjusted estimates were also higher ($b = 3.5$, $p = 0.1$, 95% CI [-1.3, 8.4]). There was no group by time interaction for perceive stress scores.

Empowerment scores were lower for the active group at post-intervention ($b = -0.25$, $p = 0.29$, 95 % CI [-0.8, 0.2]) after controlling for baseline empowerment scores. There was no difference between groups in the unadjusted estimates for empowerment ($b = 0.08$, $p = 0.9$, 95 % CI [-1.0, 1.2]). There was no group by time interaction for PEM scores.

4. Discussion

The results from this pilot study demonstrate consistent data trends for the impact of TIY on PMH, mindfulness, and resilience. A significant difference between the groups was demonstrated for self-compassion. There were no such data trends observed in stress and empowerment. These preliminary findings contribute towards our understanding of TIY and its effect on PMH, mindfulness, resilience, and self-compassion.

The results of the study suggest that TIY may help build self-compassion skills. Self-compassion is the capacity for self-kindness, being non-judgemental of oneself and accepting one's own emotions, feelings, and experiences [46,43,47]. Compassion has been correlated with positive emotions, motivation, reflective wisdom, resourcefulness, and emotional intelligence [48] Self-regulation [49], stress reduction [50] and connecting with one's authentic self [51,52] have also been associated with self-compassion. Another study has also found yoga to

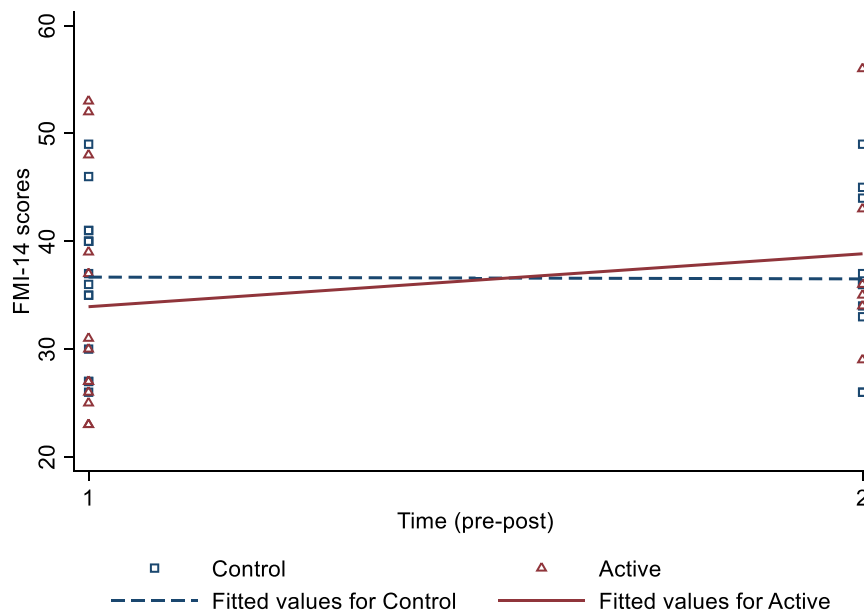


Fig. 4. : Pre and post mindfulness scores for the active and control groups. Note: FMI-14 = Freiburg Mindfulness Inventory-14.

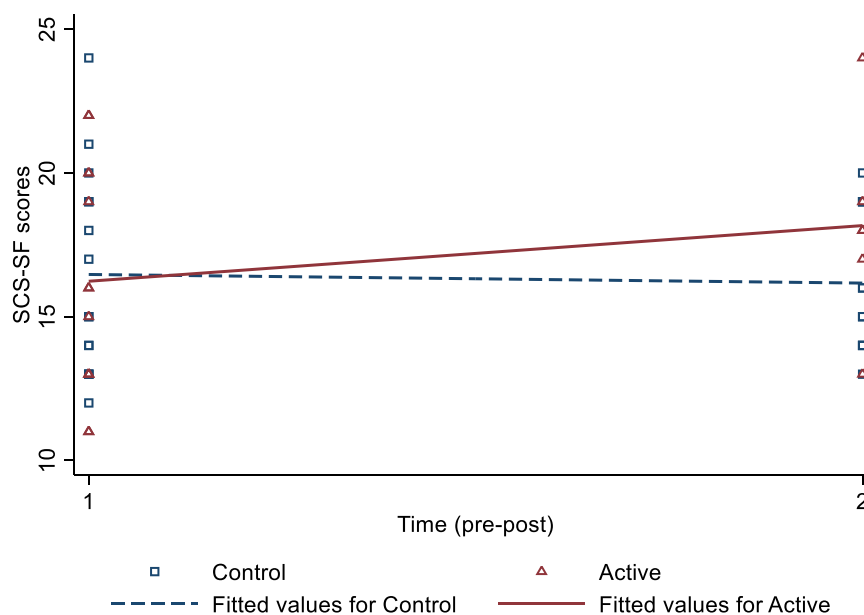


Fig. 5. : Pre and post self-compassion scores for the active and control groups. Note: SCS-SF = Self-compassion Scale – Short Form.

increase self-compassion, mindfulness, and human connection [53].

Along with self-compassion, mindfulness developed through TIY may increase resilience and improve PMH [53,54]. Mindfulness, a process adapted from Buddhist philosophy and meditation, aims to bring awareness to the present moment and build coping skills to deal with challenging mental and physical experiences [55,56]. Physically and mentally challenging experiences, such as chronic health and psychological conditions, may be associated with positive responses using mindfulness techniques [57,58]. The practice of mindfulness has been shown to reduce stress [58], improve stress responses [59], regulate emotions [60], improve wellness [61], increase self-satisfaction [62], increase practices supporting transformation of the self [63], and pro-social behaviour [64]. Therefore, TIY could be an accessible intervention to help to build PMH, resilience, self-compassion, and mindfulness.

Failure to demonstrate a data trend for empowerment in this study

could have resulted from the choice of measurement tool. The PEM focuses on empowerment in the workplace. However, empowerment may also be understood in other contexts, including the context of spiritual intelligence, ‘a state of knowing’ and wholeness [65-68]. Spiritual intelligence is reported to be a route through which quality of life may be improved [69]. Empowerment outcomes in this study may also have been influenced by cultural differences. Although participants were recruited from several different high income Western countries, cross-cultural literacy in relation to empowerment could be different between Australia, United Kingdom and United States of America [70].

This study was conducted during the COVID-19 pandemic and associated lockdowns leading to the TIY classes being pre-recorded. Pre-recording the videos may have affected psychological empowerment and perceived stress due to unforeseen lack of personal space and privacy. Lack of routine may have also contributed to nine withdrawals from the active intervention. A face-to-face class or a Zoom class,

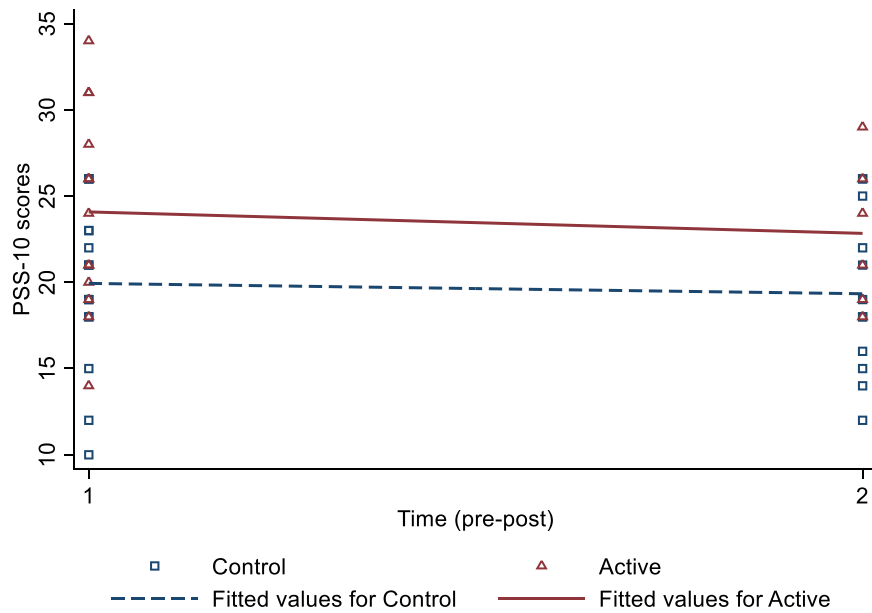


Fig. 6. : Pre and post perceived stress scores for the active and control groups. Note: PSS-10 = Perceived Stress Scale-10.

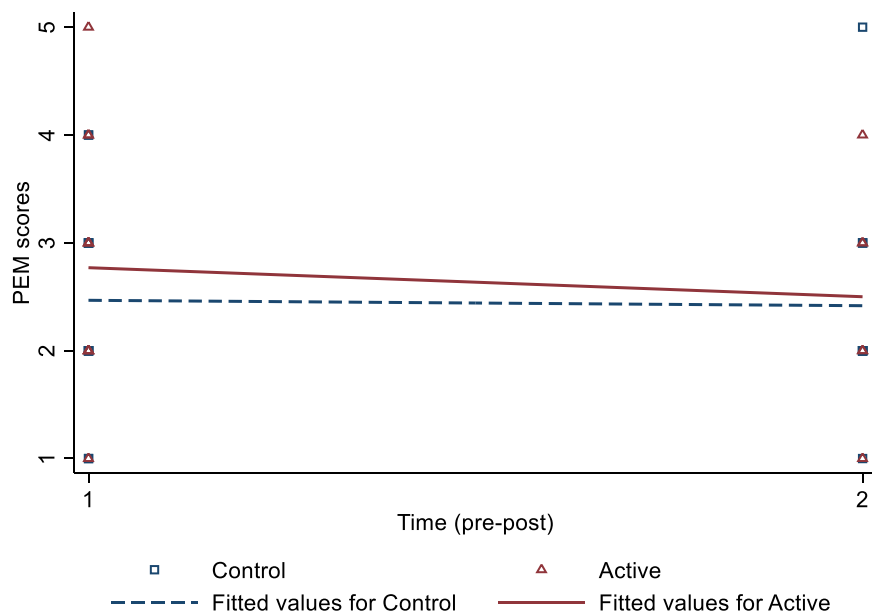


Fig. 7. : Pre and post empowerment scores for the active and control groups. Note: PEM = Psychological Empowerment Measure.

practised in 'real time' may have been more engaging for some participants. Future studies exploring the dynamics that support engagement with a TIY intervention could be useful, including comparisons with real time interventions.

One of the limitations of this study was the small sample size, which was compounded by the withdrawals through the study resulting in small uneven group sizes. When interpreting the p-values for the non-significant outcomes, it must be considered that there is an increased risk of a type 2 error, a failure to reject the null hypothesis when it is false in the population. Therefore, caution must be applied to the interpretation of the results. In this study the data analysis was conducted using several methods to explore for data trends. These included reporting the unadjusted estimates the estimates adjusted for baseline values of the outcome and those adjusting for an interaction effect over time. Overall, there were consistent data trends for a treatment affect across PMH, resilience, self-compassion, and mindfulness. Data trends

were not observed for perceived stress and empowerment. Future study in this area should consider using the former measures and analysing the data using linear models to include all the data, increasing the power of the analyses, and reducing the risk of a type 2 error.

A further limitation was the use of alternation instead of randomisation to allocate participants to groups. This was designed as a simple pilot open label study, as part of a wider mixed-methods programme evaluation. As such there was no concealment of group allocation nor possibility of blinding.

The purpose of the study was to evaluate the feasibility of conducting a larger trial. It was noted that there were many withdrawals during the study, many participants were lost to follow-up. This seemed to be disproportionately from the active group. However, the active group also had higher stress scores at baseline. It is difficult to determine whether the intervention was related to the reason for withdrawal.

In future studies, a randomised control study would be more rigorous

than an open-label study. Future research, utilising a randomised control trial design is required to provide a more comprehensive comparison of treatment effects by the inclusion of an experimental group (receiving the intervention) and a control group (receiving an alternative treatment). Further in an RCT design bias is minimised, the likelihood of confounding factors is reduced and statistically reliability is improved [71].

In future studies a Subjective Units of Distress Scale (SUDS) could be used to measure the impact of each TIY session for participants. Tracking participant attendance at online sessions was a limitation. Additionally, other models of empowerment measures should be explored in future studies. For instance, future studies could examine how empowerment translates within different cultures and potentially bringing additional knowledge to this area of research.

5. Conclusions

This prospective intervention study has demonstrated the potential for a 10-week TIY programme for improving self-compassion in general populations who are experiencing work and personal life stress. There were also consistent trends over multiple outcomes for a positive effect of TIY on PMH, mindfulness and resilience. A larger trial is now required to conclusively demonstrate these consistent data trends.

6. Ethical Statement for Advances in Integrative Medicine

Hereby, I TRACEY MULVIHILL consciously assure that for the manuscript TRAUMA-INFORMED YOGA (ONLINE) FOR POSITIVE MENTAL HEALTH: A PILOT STUDY the following is fulfilled:

- 1) This material is the authors' own original work, which has not been previously published elsewhere.
- 2) The paper is not currently being considered for publication elsewhere.
- 3) The paper reflects the authors' own research and analysis in a truthful and complete manner.
- 4) The paper properly credits the meaningful contributions of co-authors and co-researchers.
- 5) The results are appropriately placed in the context of prior and existing research.
- 6) All sources used are properly disclosed (correct citation). Literally copying of text must be indicated as such by using quotation marks and giving proper reference.
- 7) All authors have been personally and actively involved in substantial work leading to the paper, and will take public responsibility for its content.

The violation of the Ethical Statement rules may result in severe consequences.

To verify originality, your article may be checked by the originality detection software iThenticate. See also <http://www.elsevier.com/editors/plagdetect>.

I agree with the above statements and declare that this submission follows the policies of Solid State Ionics as outlined in the Guide for Authors and in the Ethical Statement.

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CRediT authorship contribution statement

Tracey Mulvihill: conceptualisation, formal analysis, investigation, writing - original draft and visualisation, **Sandra Grace:** conceptualisation, formal analysis, supervision, writing -reviewing and

editing, supervision, **Joanne Bradbury:** conceptualisation, formal analysis, supervision, writing - reviewing and editing, supervision, **Frances Doran:** conceptualisation, formal analysis, supervision, writing - reviewing and editing, supervision.

Authors note

The authors have no conflicts of interest.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

- [1] B.L. Seaward, *Managing Stress Principles and Strategies for Health and Wellbeing*, Jones & Bartlett, Burlington, MA, 2017.
- [2] M.K. Anniko, K. Boersma, M. Tillfors, Sources of stress and worry in the development of stress-related mental health problems: A longitudinal investigation from early-to-mid-adolescence, *Anxiety Stress Coping* 32 (2019) 155–167, <https://doi.org/10.1080/10615806.2018.1549657>.
- [3] G.S. Shields, Stress and cognition: a users guide to designing and interpreting studies, *Psychoneuroendocrinology* 112 (2020) 1–13, <https://doi.org/10.1016/j.psyneuen.2019.104475>.
- [4] S. Lee, K.A.S. Kandauda, T.K. Lee, C. Walker-O'Neal, Long-term physical health consequences of financial and marital stress in middle-aged couples, *J. Marriage Fam.* 83 (2021) 1212–1226, <https://doi.org/10.1111/jomf.12736>.
- [5] B.J. Griffin, N. Purcell, K. Burkman, B.T. Litz, C.J. Bryan, M. Schmitz, et al., Moral injury: an integrative review, *J. Trauma Stress* 32 (2019) 350–362, <https://doi.org/10.1002/jts>.
- [6] D. Tawseef, A. Radfar, S. Abohashem, R.K. Pitman, A. Tawakol, M.T. Osbourne, Psychosocial stress and cardiovascular disease, *Curr. Treat. Options Cardiovasc. Med.* 21 (2019) 23, <https://doi.org/10.1007/s11936-019-0724-5>.
- [7] B. Miravec, M. Tibensky, L. Horvathova, Stress and cancer. Part I: mechanisms mediating the effect of stressors on cancer, *J. Neuroimmunol.* 346 (2020) 1–9, <https://doi.org/10.1016/j.jneuroim.2020.577311>.
- [8] A. Al-Hussainy, R. Mohammed, Consequences of maternal psychological stress during pregnancy for the risk of asthma in the offspring, *Scand. J. Immunol.* 93 (2021) 1–13, <https://doi.org/10.1111/sji.12919>.
- [9] M. Barnhouse, B.L. Jones, The impact of environmental chronic and toxic stress on asthma, *Clin. Rev. Allergy Immunol.* 57 (2019) 427–438, <https://doi.org/10.1007/s12016-019-08736-x>.
- [10] T. Laukkala, R. Bor, B. Budowle, N. Pooshan, S. Antti, S. Markku, V. Alpo, Pilot post-traumatic stress disorder and fatal aviation accidents: a descriptive study, *Aviat. Psychol. Appl. Hum. Factors* (2018) 93–99, <https://doi.org/10.1027/2192-0923/a000144>.
- [11] S. Zhang, C. Ma, X. Wang, Q. Wang, W. Song, C. Li, C. Zhai, Y. Qi, S. Fan, F. Cheng, Impact of chronic psychological stress on non-alcoholic fatty liver disease, *Int. J. Clin. Exp.* 12 (2019) 7991–7998.
- [12] E.B. Duprey, E.D. Handley, J.T. Manly, D. Cicchetti, S.L. Toth, Child maltreatment, recent stressful life events, and suicide ideation: a test of the stress sensitivity hypothesis, *Child Abus. Negl.* 113 (2021) 1–10, <https://doi.org/10.1016/j.chiabu.2020.104926>.
- [13] S.C. Segerstrom, G.E. Miller, Psychological stress and the human immune system: a meta-analytic study of 30 years of inquiry, *Psychol. Bull.* 130 (2004) 601–630.
- [14] M. Faresjö, The link between psychological stress and autoimmune response in children, *Crit. Rev. Immunol.* 35 (2015) 117–134, <https://doi.org/10.1615/critrevimmunol.2015013255>.
- [15] K.J. Polinski, E.A. Bemis, M. Feser, J. Seifert, K.M. Demoruelle, C.C. Striebich, et al., Perceived stress and inflammatory arthritis: a prospective investigation in the studies of the aetiologies of rheumatoid arthritis cohort, *Arthritis Care Res.* 72 (2020) 1766–1771, <https://doi.org/10.1002/acr.24085>.
- [16] M.P. Guerreiro, J. Strawbridge, A.M. Cavaco, I.B. Félix, M.M. Marques, C. Cadogan, Development of a European competency framework for health and other professionals to support behaviour change in persons self-managing chronic disease, *BMC Med.* 21 (2021) 287, <https://doi.org/10.1186/s12909-021-02720-w>.
- [17] K.V. Guruprakash, S.G. Mehta, B. Atul, J. Prakash, K.J. Divinakumar, S.A. Khan, P. Patra, A study of relationship between perceived stress, coping pattern, burnout & general psychopathology among the postgraduate medical students, *Ind. Psychiatry J.* 27 (2018) 141–146.
- [18] H. Cramer, R. Lauche, J. Langhorst, G. Dobos, Yoga for depression: a systematic review and meta-analysis, *Depress. Anxiety* 30 (2013) 1068–1083, <https://doi.org/10.1002/da.22166>.

- [19] S. Phillips, Yoga, Karma, and Rebirth: A Brief History and Philosophy, Columbia University Press, New York, NY, 2009.
- [20] T. Oosterbroek, B. Dirk, The experience of Trauma Centre-Trauma Sensitive Yoga training on professional practice of mental health professional and yoga instructors, *Complement. Ther. Clin. Pract.* 43 (2021) 1–6, <https://doi.org/10.1016/j.ctcp.2021.101365>.
- [21] B.A. van der Kolk, L. Stone, J.I. West, A. Rhodes, D. Emerson, M. Suvak, J. Spinazzola, Yoga as an adjunctive treatment for PTSD, *J. Clin. Psychiatry* 75 (2014) e559–e565, <https://doi.org/10.4088/JCP.13m08561>.
- [22] J. West, B. Liang, J. Spinazzola, Trauma sensitive yoga as a complementary treatment for posttraumatic stress disorder: a qualitative descriptive analysis, *Int. J. Stress Manag.* 24 (2017) 173–195, <https://doi.org/10.1037/str0000040>.
- [23] D. Emerson, E. Hopper, *Overcoming Trauma through Yoga: Reclaiming Your Body*, North Atlantic Books, Berkeley, California, 2011.
- [24] L. Justice, C. Brems, K. Ehlers, Considerations for trauma-informed yoga, *Int. J. Yoga Ther.* 28 (1) (2018) 39–50, <https://doi.org/10.17761/2018-00017R2>.
- [25] U. Kelly, T. Haywood, E. Segal, M. Higgans, Trauma-sensitive yoga for post-traumatic stress disorder in women veterans who experience military sexual trauma: interim results from a randomized control study, *J. Altern. Complement. Med.* 27 (2021) S45–S59, <https://doi.org/10.1089/acm.2020.0417>.
- [26] H.R. Trompetter, E. de Kleine, E.T. Bohlmeijer, Why does positive mental health buffer against psychopathology? An exploratory study on self-compassion as a resilience mechanism and adaptive emotion regulation strategy, *Cogn. Behav. Ther.* 41 (2017) 459–468, <https://doi.org/10.1007/s10608-016-9774-0>.
- [27] C.L.M. Keyes, D. Shmotkin, C.D. Ryff, Optimizing well-being: the empirical encounter of two traditions, *J. Pers. Soc. Psychol.* 82 (2002) 1007–1022, <https://doi.org/10.1037/0022-3514.82.6.1007>.
- [28] T. Teismann, T. Forkmann, J. Brailovskaia, P. Siegmann, H. Glaesmer, J. Margraf, Positive mental health moderates the association between depression and suicide ideation: a longitudinal study, *Int. J. Clin. Health Psychol.* 18 (2018) 1–7, <https://doi.org/10.1016/j.ijchp.2017.08.001>.
- [29] K.J. Aroian, A.E. Norris, Resilience, stress, and depression among Russian immigrants to Israel, *West. J. Nurs. Res.* 22 (2000) 54–67, <https://doi.org/10.1177/01939450022044269>.
- [30] A.P. Wingo, G. Wrenn, T. Pelletier, A.R. Gutman, B. Bradley, K.J. Ressler, Moderating effects of resilience on depression in individuals with a history of childhood abuse or trauma exposure, *J. Affect. Disord.* 126 (2010) 411–414, <https://doi.org/10.1016/j.jad.2010.04.009>.
- [31] B.L. Fredrikson, T. Joiner, Positive emotions trigger upward spirals toward emotional wellbeing, *Psychol. Sci.* 13 (2002) 172–175, <https://doi.org/10.1111/1467-9280.00431>.
- [32] A.B. Burns, J.S. Brown, N. Sachs-Erikson, E. Ashby Plant, J. Thomas Curtus, B. L. Fredrikson, T.E. Joiner, Upward spirals of positive emotion and coping: Replication, extension, and initial exploration of neurochemical substrates, *Pers. Individ. Diff.* 44 (2008) 360–370, <https://doi.org/10.1016/j.paid.2007.08.015>.
- [33] C.T. Gloria, M.A. Steinhardt, Relationships among positive emotions, coping, resilience and mental health, *Stress Health* 32 (2014) 145–156, <https://doi.org/10.1002/smi.2589>.
- [34] J. Lukat, J. Margraf, R. Lutz, W.M. van der Veld, E.S. Becker, Psychometric properties of the positive mental health scale (PMH-scale), *BMC Psychol.* 4 (2016) 1–14, <https://doi.org/10.1186/s40359-016-0111-x>.
- [35] H. Walach, N. Buchheld, V. Buttenmüller, N. Kleinknecht, S. Schmidt, Measuring mindfulness – the Freiburg Mindfulness Inventory (FMI), *Pers. Individ. Differ.* 40 (2006) 1543–1555, <https://doi.org/10.1016/j.paid.2005.11.025>.
- [36] S. Cohen, T. Kamarck, R. Mermelstein, A global measure of perceived stress, *J. Health Soc. Behav.* 24 (1983) 386–396.
- [37] J.M. Taylor, Psychometric analysis of the ten-item perceived stress scale, *Psychol. Assess.* 27 (2015) 90–101, <https://doi.org/10.1037/a0038100>.
- [38] K.M. Connor, J.R.T. Davidson, Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC), *Depress Anxiety* 18 (2003) 76–82, <https://doi.org/10.1002/da.10113>.
- [39] B. Notario-Pacheco, V.M. Vizcaino, M.C. Perez-Yus, M.D. Serrano-Parra, Validity and reliability of the Spanish version of the 10-item CD-RISC in patients with fibromyalgia, *Health Qual. Life Outcomes* 12 (2014) 14, <https://doi.org/10.1186/1477-7525-12-14>.
- [40] F. Raes, E. Pommier, K. Neff, D. Van Gucht, Construction and factorial validation of a short form of the self-compassion scale, *Clin. Psychol. Psychother.* 18 (2011) 250–255, <https://doi.org/10.1002/cpp.702>.
- [41] A.C. Kelly, J.C. Carter, D.C. Zuroff, S. Borairi, Self-compassion and fear of self-compassion interact to predict response to eating disorders treatment: a preliminary investigation, *Psychother. Res.* 23 (2013) 252–264, <https://doi.org/10.1080/10503307.2012.717310>.
- [42] G.M. Spreitzer, 'Individual empowerment in the workplace: dimensions, measurement, validation', *Acad. Manag. Ann.* 38 (1995) 1442–1465.
- [43] L. Stevens, C. Woodruff, *The Neuroscience of Empathy, Compassion, and Self-compassion*, Academic Press, London, UK, 2018.
- [44] IBM Corp. Released, IBM SPSS statistics for Windows, Version 26.0, IBM Corp., Armonk, NY, 2019.
- [45] StataCorp, Stata Statistical Software: Release 16, StataCorp LLC, College Station, TX, 2019.
- [46] K. Neff, The development and validation of a scale to measure self-compassion, *Self Identity* 2 (2003) 223–250, <https://doi.org/10.1080/15298860309027>.
- [47] K.D. Neff, K.L. Kirkpatrick, S.S. Rude, Self-compassion and adaptive psychological functioning, *J. Res. Pers.* 41 (2007) 139–154, <https://doi.org/10.1016/j.jrp.2006.03.004>.
- [48] S. Porges, *The Polyvagal Theory*, W. W. Norton & Co, New York, NY, 2011.
- [49] P. Gilbert, *The Compassionate Mind*, Constable & Robinson, London, 2009.
- [50] L.M. Yarnell, K.D. Neff, Self-compassion, interpersonal conflict resolutions, and wellbeing, *Self Identity* 12 (2013) 146–159, <https://doi.org/10.1080/15298868.2011.649545>.
- [51] J.W. Zhang, S. Chen, T.K.T. Shakur, B. Bilgin, W.J. Chai, T. Ramis, H. Shaban-Azad, P. Razavi, T. Nutankumar, A. Manukyan, A compassionate self is a true self? Self-compassion promotes subjective authenticity, *Pers. Soc. Psychol. Bull.* 45 (2019) 1323–1337.
- [52] D. Rousseau, C. Cook-Cottone, Trauma-informed yoga training in Kenya: a qualitative pilot study on feasibility and acceptability, *Complement. Ther. Med.* 40 (2018) 53–60, <https://doi.org/10.1016/j.ctim.2018.07.010>.
- [53] A. Chiesa, P. Malinowski, Mindfulness based approaches: are they all the same? *J. Clin. Psychol.* 67 (2011) 404–424, <https://doi.org/10.1002/jclp.20776>.
- [54] J. Kabat Zinn, *Full Catastrophe Living: Using the Wisdom of Your Body and Mind to Face Stress, Pain, and Illness*, Bantam Books, London, UK, 1990.
- [55] Z.V. Segal, J.M.G. Williams, J.D. Teasdale, *Mindfulness-Based Cognitive Therapy for Depression*, Guildford Press, New York, NY, 2013.
- [56] S.G. Hofmann, A.T. Sawyer, A.A. Witt, D. Oh, The effect of mindfulness-based therapy on anxiety and depression: a meta-analytic review, *J. Consul. Clin. Psychol.* 78 (2010) 169–183, <https://doi.org/10.1037/a0018555>.
- [57] C.E. Parsons, C. Crane, L.J. Parsons, L.O. Fjorback, W. Kuyken, Home practise in mindfulness-based cognitive therapy and mindfulness-based stress reduction: a systematic review and meta-analysis of participants' mindfulness practice and its association with outcomes, *Behav. Res. Ther.* 95 (2017) 29–41, <https://doi.org/10.1016/j.brat.2017.05.004>.
- [58] E. Vivian, H. Oduor, P. Girisha, P. Mantry, Mindfulness at Methodist – a prospective pilot study of mindfulness and stress resiliency interventions in patients at a tertiary care medical center, *Int. J. Public Health* 18 (2021) 4034, <https://doi.org/10.3390/ijerph18084034>.
- [59] E. Hargus, C. Crane, T. Barnhofer, J.M.G. Williams, Effects of mindfulness on meta-awareness and specificity of describing prodromal symptoms in suicidal depression, *Emotion* 10 (2010) 34–42, <https://doi.org/10.1037/a0016825>.
- [60] N.A. Farb, A.K. Anderson, H. Mayaberg, J. Bean, D. McKeon, Z.V. Segal, Minding one's emotions: mindfulness training alters the neural expression of sadness, *Emotion* 10 (2010) 25–33, <https://doi.org/10.1037/a0017151>.
- [61] D. Aherne, K. Farrant, L. Hickey, E. Hickey, L. McGrath, D. McGrath, Mindfulness based stress reduction for medical students: optimising student satisfaction and engagement, *BMC Med. Educ.* 16 (2016) 209, <https://doi.org/10.1186/s12909-016-0728-8>.
- [62] Y. Amram, D.C. Dryer, *The Integrated Spiritual Intelligence Scale (ISIS). Development and Preliminary Validation*, American Psychological Association, Boston, 2008.
- [63] D. Sisk, Spiritual intelligence: the tenth intelligence that integrates all other intelligences, *Gift. Educ. Int.* 16 (2002) 208–213.
- [64] D. Zohar, I. Marshall, *Spiritual Intelligence: The Ultimate Intelligence*, Bloomsbury Publishing, London, UK, 2001.
- [65] R.A. Emmons, Is spirituality an intelligence? Motivation, cognition, and the psychology of ultimate concern, *Int. J. Psychol. Relig.* 10 (2000) 3–26.
- [66] S. Ambhore, P. Joshi, Effect of yogic practices performed on deviants' aggression, anxiety, and impulsiveness in prison: A study, *J. Psychiatr. Res.* 4 (2009) 137–149, <https://doi.org/10.13140/RG.2.2.27313.02404>.
- [67] F.K. Anklesaria, M.S. King, The transcendental meditation program in the Senegalese penitentiary system, *J. Offender Rehabil.* 36 (2003) 303–318, https://doi.org/10.1300/J076v36n01_14.
- [68] J. Shakespeare-Finch, A. Copping, A grounded theory approach to understanding cultural differences in posttraumatic growth, *J. Loss Trauma* 11 (2006) 355–371, <https://doi.org/10.1080/15325020600671949>.
- [69] E. Hariton, Randomized control trials – the gold-standard for effectiveness research, *BJOG* 125 (2018) 176, <https://doi.org/10.1111/1471-0528.15199>.
- [70] K. Neff, Self-compassion: an alternative conceptualization of a healthy attitude toward oneself, *Self Identity* 2 (2003) 85–102, <https://doi.org/10.1080/152988603090302>.
- [71] D.A. Crews, M. Stolz-Newton, N.S. Grant, The use of yoga to build self-Compassion as a healing method for survivors of sexual violence, *J. Relig. Spiritual. Soc. Work.: Soc. Thought* (2016), <https://doi.org/10.1080/15426432.2015.1067583>.