



# One-Session Mindfulness of the Breath Meditation Practice: a Randomized Controlled Study of the Effects on State Hope and State Gratitude in the General Population

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## Abstract

**Objectives** Brief, single-session mindfulness practices have been shown to reduce distress and increase mindfulness, emotion regulation, and optimism. However, their effects on state hope and gratitude have yet to be examined. Therefore, the effects of a mindfulness of the breath induction on state hope and state gratitude are explored in this online study.

**Methods** A sample of 474 adults (69% female) from the general population were randomized to either a 10-minute mindfulness practice or a 10-minute audiobook control. Participants were asked to complete pre and post state measures of hope and gratitude, as well as state and trait mindfulness.

**Results** Results showed significant positive effects of mindfulness practice for the outcomes state hope ( $d=0.68$ ;  $p < .001$ ) and state gratitude ( $d=1.12$ ;  $p < .001$ ) compared to controls. A significant statistical mediating effect of state mindfulness in the relationship between mindfulness practice and outcomes was also found.

**Conclusions** Overall, findings have implications for mindfulness inductions and how these can be helpful in improving individuals' state hope, gratitude, and mindfulness. In particular, this study has demonstrated that a 10-minute, remotely delivered, mindfulness induction can have medium to large positive effects on state hope and gratitude for individuals from the general population. These effects are especially noteworthy given the brevity and online delivery of the practice. Further future research directions are discussed.

**Trial registration** ClinicalTrials.gov Identifier: NCT04099758.

**Keywords** Mindfulness induction · State hope · State gratitude · State mindfulness · Trait mindfulness

Mindfulness-based programs (MBPs) and practices have been associated with beneficial outcomes regarding psychological distress (Khouri et al., 2013) and increased state and trait mindfulness (Kiken et al., 2015; Strohmaier et al., 2021), which consequently have been found to relate to positive outcomes, such as increased well-being and work engagement (Malinowski & Lim, 2015). Increasingly, research has also explored the effects of MBPs on positive psychological outcomes. For instance, a recent meta-analysis on MBPs at work has found these to be effective not only for reduced psychological distress but also for increased

compassion, empathy, and positive well-being (Lomas et al., 2018).

Additionally, participating in an 8-week, online-delivered MBP significantly predicted increased levels of optimism and affect in direct-care employees (Heckenberg et al., 2019), and mindfulness practice has been found to relate to greater hope and gratitude. For instance, Bluth and Eisenlohr-Moul (2017) have shown that participating in an MBP has been associated with increased gratitude, which in turn has been found to predict beneficial outcomes, such as job satisfaction (Waters, 2012), and improvements in stress, depression, and happiness (Emmons & McCullough, 2003; O'Leary & Dockray, 2015). Furthermore, a study examining the effects of mindfulness meditation delivered face-to-face, over 12 weeks, in university students, not only found significantly lower anxiety and negative affect but also increased hope compared to controls (Sears & Kraus, 2009). Similarly, participating in a 6-week mindfulness class predicted

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significantly greater hope, mediated by lowered levels of stress (Munoz et al., 2018). Greater hope has previously been found to relate to factors such as increased self-compassion and life satisfaction (Bailey et al., 2007; Yang et al., 2016).

From a theoretical perspective, increasing positive psychological resources has been suggested as a key mechanism of action of mindfulness practice. For example, according to Fredrickson's (2004) Broaden-and-Build theory, increasing positive psychological resources broadens one's awareness, encourages positive thoughts and actions, and builds personal resources, and mindfulness practice is thought to aid this process of broadening awareness (Garland et al., 2015). Previous research has supported this theory, including by showing that greater dispositional mindfulness relates to positive affect, which in turn is associated with increased personal resources of hope and optimism (Malinowski & Lim, 2015). Additionally, according to hope theory, positive emotions result from an individual's perceived progress towards desired goals (Snyder, 2002), and mindfulness practice has been found to increase awareness of, and to support progress towards, these goals (Rand & Cheavens, 2009). Furthermore, a grateful disposition and/or state has been theorized to be present when positive emotional valence and a tendency towards mindfully appreciating positive emotions and experiences, and those who have contributed to them, exist, thus increasing and sustaining subjective well-being over time (Emmons & Mishra, 2012; McCullough et al., 2002). Consistent with this, participating in mindfulness-based cognitive therapy (MBCT) has been shown to predict a greater appreciation of daily life events (Geschwind et al., 2011). Thus, there is both theoretical and empirical support for the beneficial impact of mindfulness and MBPs on positive psychological variables, such as hope and gratitude.

Although many of the abovementioned studies have focused on the effects of MBPs delivered over multiple sessions and weeks, using such programs as mindfulness-based stress reduction (MBSR) and MBCT (Kabat-Zinn, 1990; Segal et al., 2013), more recently there has been an increase in research with single-session mindfulness practices. These have been utilized due to providing the possibility of tightly controlling length, dose, and type of practice, resulting in researchers being able to draw more specific causal inferences (Tang et al., 2015). Additionally, single-session mindfulness practices are usually more accessible for the general population, therefore providing less of a burden for individuals while still offering benefits. These are often referred to as "mindfulness inductions" (e.g., Leyland et al., 2019, p. 108).

Some research utilizing mindfulness inductions has focused on their effects on cognitive performance and working memory. For instance, participants showed increased EEG alpha power while completing a Stroop task after mindfulness practice (Bing-Canar et al., 2016). Other studies have focused on the effects of mindfulness inductions on mood.

For example, participants in a mindfulness practice condition showed significant beneficial changes in mood states compared to book-listening controls (Johnson et al., 2015). Additionally, a recent review of the effect of mindfulness inductions found evidence that they resulted in more effective regulation of negative emotions compared to controls (Leyland et al., 2019). It is worth noting that the observed improvements in emotional regulation seem likely to be connected to the improvements in executive functioning, rather than the two being independent effects of mindfulness inductions (cf. Marceau et al., 2018).

There have also been several studies assessing the effects of brief, single-session mindfulness practices on positive psychological states. For instance, Mahmood et al. (2016) have shown that computer-mediated mindfulness practice results in increased state mindfulness compared to controls, while Kiken and Shook (2011) have demonstrated that mindfulness inductions increase subjective optimism. More broadly, in their review, Heppner and Shirk (2018) summarize evidence that mindfulness inductions increase mindful states, which in turn are associated with better emotion regulation and more positive social and health behaviors. Particularly, single-session mindfulness practices were theorized to allow individuals to be more accepting of everyday experiences and reduce negativity bias by increasing state mindfulness (Brown et al., 2007). Additionally, in a large-scale mindfulness induction study with college students, those who practiced mindfulness showed higher state mindfulness of the body, though post-study state mindfulness was only related to trait mindfulness for those who were experienced meditators (Bravo et al., 2018).

Perhaps unsurprisingly given their brevity, the effects of mindfulness inductions tend to be found on measures of the participants' psychological state immediately after the induction, rather than on measures of more enduring change in related psychological traits (e.g., Mahmood et al., 2016). Nevertheless, improvements in such state variables, even without the longer lasting trait changes, can still be valuable, since positive states of mind have been found to improve well-being and positive behaviors, and mindfulness inductions have the potential to be repeated multiple times (e.g., Kluemper et al., 2009).

However, although a start has been made at examining the effectiveness of mindfulness inductions on positive psychological outcomes, the effect of a brief mindfulness practice on state hope and gratitude has yet to be examined. Given the abovementioned evidence that longer MBPs can increase hope and appreciation for life, and in light of the aforementioned theory, it might be expected that brief mindfulness inductions would improve state hope and gratitude. However, this cannot be assumed, since it remains possible that a brief, single mindfulness practice provides an insufficient dose of mindfulness to have an impact (cf. Strohmaier,

2020). Therefore, this needs to be examined empirically. Providing evidence that a brief mindfulness practice can increase state hope and gratitude would be of value, given the considerable benefits associated with hope and gratitude (e.g., Emmons & McCullough, 2003; Yang et al., 2016) and the potential greater feasibility and acceptability of brief mindfulness practice compared to longer programs.

Therefore, the current study aimed to examine the effects of a brief, single-session mindfulness practice on state hope and gratitude, as well as the possible mediating effects of state mindfulness. Following Snyder (2002), state hope was taken to be the in-the-moment sense someone has of their capability and motivation to move towards their goals, while state gratitude was considered to be individuals' in-the-moment awareness of positive things in their life combined with gratefulness towards those who had contributed to these (Emmons & Mishra, 2012; McCullough et al., 2002). The primary hypotheses were that (1) engaging in a brief mindfulness practice would result in improved state hope compared to control; and (2) engaging in a brief practice would improve state gratitude relative to control. The first of these hypotheses was grounded in Snyder's (1994) theorizing that meditation can help calm the mind and reduce focus on daily stressors, rumination, and worry, and that this in turn allows greater deployment of attentional resources to focusing on moving towards hoped for goals and so increases the current sense of hope (Munoz et al., 2018). The second hypothesis was grounded in the theory that increased mindful awareness of positive things in life, and others' contribution to these, supports greater gratitude for them (cf. Emmon and Mishra 2002; McCullough et al., 2002). It is worth noting that we did not theorize a direct relation between state hope and state gratitude, but rather saw these as distinct constructs that were both hypothesized to be increased by greater state mindfulness. Therefore, the secondary hypotheses were that (3) improvement in state mindfulness would statistically mediate the effect of mindfulness practice on state hope; and (4) the same would be true for state gratitude.

## Method

### Participants

A priori power analysis using G\*Power for finding a small to medium effect ( $ES = 0.25$ ), with  $\alpha = 0.05$  and power of 0.95 for the primary analyses, suggested a required sample size of 82 or above. For testing secondary hypotheses, a sample of at least 462 participants has been recommended for mediation analysis using bias-corrected bootstrapping for small effect sizes in both *a*- and *b*-paths (small–small condition) and power of 0.8 (Fritz & McKinnon, 2007).

A total of 474 members of the general public and university students and staff (237 each in the mindfulness practice and control groups), aged between 18 and 69, participated. The sample included the general population internationally, with the majority of participants identifying as female (69%), White (75.7%), and British (63.9%). Table 1 shows the demographic characteristics of the study sample as a whole and per group. At baseline, there was no significant difference in demographic variables.

The general population was selected as the participant pool in this study due to the largest evidence-base of effectiveness of mindfulness inductions being for the general population (Leyland et al., 2019). Most participants indicated that they did not have a previous ( $n = 329$ ) or current ( $n = 428$ ) mindfulness practice. Where participants had previously or were currently engaging in mindfulness practice, this included having used, or currently using, mindfulness apps, having previously participated in a mindfulness course (either face-to-face or online), previously having read books on mindfulness, and having previously or currently practicing yoga. Details on previous and current mindfulness practice did not differ between the two groups. As an incentive for taking part, participants could choose to be entered in a prize draw to win online shopping vouchers. Psychology undergraduates could choose to receive course credits for participating instead. The study was approved by a university ethics panel and all participants provided informed consent.

### Procedures

This single-blind, single-session, online randomized controlled experiment had two arms: the experimental group consisting of a 10-minute mindfulness meditation practice and the active control group consisting of a 10-minute non-fictional audio recording. Participants could not continue with the study until the respective 10-minute audio recordings were completed. The study was created and conducted using the online survey software Qualtrics (<https://www.qualtrics.com>).

The 10-minute mindfulness practice was recorded by a qualified mindfulness teacher (FWJ). The recording was a mindfulness of the breath meditation practice similar in style to those in MBSR and MBCT (Kabat-Zinn, 1990; Segal et al., 2013). The transcript of the mindfulness practice is available in the Supplementary Materials (SM 1). Participants in the control group were asked to listen to a 10-minute non-fiction recording on the scientific history of the universe, openly available in the public domain (Rolt-Wheeler, 2015). An active control group was chosen to reduce performance bias and enhance allocation concealment.

The study was advertised online on internationally reaching social media channels, academic research promotion

**Table 1** Demographic information by group and group comparison at baseline

	Whole sample	Mindfulness practice group	Control group	Group comparison
<i>N</i>	474	237	237	
Age, <i>M</i> ( <i>SD</i> )	29.31 (10.79)	30.05 (11.43)	28.58 (10.07)	$t = 1.48; p = .14$
Gender, <i>N</i> (%)	327 (69%) Female 141 (29.7%) Male 3 (0.6%) Non-binary 3 (0.6%) Prefer not to say	167 (70.5%) Female 66 (27.8%) Male 2 (0.8%) Non-binary 2 (0.8%) Prefer not to say	160 (67.5%) Female 75 (31.6%) Male 1 (0.4%) Non-binary 1 (0.4%) Prefer not to say	$\chi^2 = 1.39; p = .71$
Ethnicity, <i>N</i> (%)	33 (7%) Asian 40 (8.4%) Black 359 (75.7%) White 30 (6.4%) Mixed background 8 (1.7%) Other ethnic background 4 (0.9%) Prefer not to say	21 (8.9%) Asian 15 (6.3%) Black 186 (78.5) White 6 (2.5%) Mixed background 6 (2.5%) Other ethnic background 3 (1.3%) Prefer not to say	12 (5.1%) Asian 25 (10.5%) Black 173 (73%) White 24 (10.2%) Mixed background 2 (0.8%) Other ethnic background 1 (0.4%) Prefer not to say	$\chi^2 = 19.23; p = .2$
Nationality, <i>N</i> (%)	303 (63.9%) British 97 (20.5%) European 13 (2.7%) African 21 (4.4%) North American 4 (0.8%) South American 6 (1.4%) Caribbean 22 (4.6%) North and South Asian 3 (0.6%) New Zealander 5 (1.1%) More than 1 nationality	139 (58.6%) British 57 (24%) European 6 (2.5%) African 12 (5.1%) North American 3 (1.3%) South American 3 (1.3%) Caribbean 12 (5.1%) North and South Asian 3 (1.3%) New Zealander 2 (0.8%) More than 1 nationality	164 (69.2%) British 40 (16.9%) European 7 (3%) African 9 (3.7%) North American 1 (0.4%) South American 3 (1.3%) Caribbean 10 (4.2%) North and South Asian 3 (1.3%) More than 1 nationality	$\chi^2 = 112.86; p = .36$
Occupation, <i>N</i> (%)	16 (3.4%) Arts 18 (3.8%) Construction and production 52 (11%) Education 19 (4%) Hospitality 114 (24.1%) Office and sales 3 (0.6%) Retired 48 (10.1%) Social and health care 12 (2.5%) Unemployed 185 (39%) University student 7 (1.5%) Prefer not to say	7 (3%) Arts 8 (3.4%) Construction and production 26 (11%) Education 8 (3.4%) Hospitality 55 (23.2%) Office and sales 1 (0.4%) Retired 29 (12.2%) Social and health care 7 (3%) Unemployed 91 (38.4%) University student 5 (2.1%) Prefer not to say	9 (3.7%) Arts 10 (4.2%) Construction and production 26 (11%) Education 11 (4.6%) Hospitality 59 (24.9%) Office and sales 2 (0.8%) Retired 19 (8%) Social and health care 5 (2.1%) Unemployed 94 (39.8%) University student 2 (0.8%) Prefer not to say	$\chi^2 = 21.22; p = .57$
Previous mindfulness practice, <i>N</i> (%)	329 (69.4%) No 145 (30.6%) Yes	164 (69.2%) No 73 (30.8%) Yes	165 (69.6%) No 72 (30.4%) Yes	$\chi^2 = 130.71; p = .54$
Current mindfulness practice, <i>N</i> (%)	428 (90.3%) No 46 (9.7%) Yes	218 (92%) No 19 (8%) Yes	211 (89%) No 26 (11%) Yes	$\chi^2 = 39.11; p = .51$

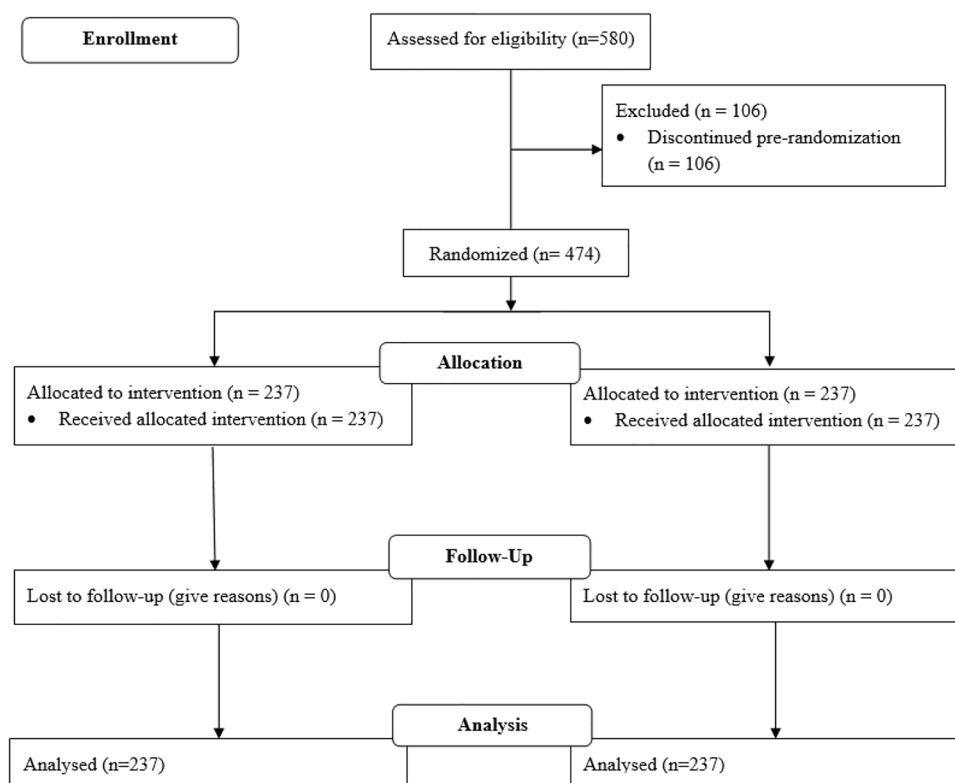
*N*, number; *M*, mean; *SD*, standard deviation

websites (such as Call for Participants), and university staff and student news outlets (newsletters, notices), using opportunity and snowball sampling. Participants were informed that they would be asked to listen to something for 10 minutes and to make sure they were not disturbed during this time. For study advertising, the briefer title “study examining a brief online mindfulness and listening exercise” was used, which does not disclose the effect being examined; participants only learned this at the end of the study. Participants were included if they were aged 18 or over but excluded if they self-identified as currently experiencing severe difficulties with their mental health, in order to

minimize the risk of possible harmful effects (cf. Britton, 2019; Dobkin et al., 2012). Participants were also excluded if they withdrew from the study prior to randomization.

Participants were automatically randomized to the two groups with equal probability, using the Qualtrics random block allocation procedure (Qualtrics, 2019). Prior to randomization, 106 participants withdrew. There were no significant differences between participants who withdrew and those who completed the study, in either demographics or for any of the outcome variables at baseline. Figure 1 shows the CONSORT flowchart of participant flow through the study.

**Fig. 1** CONSORT flow diagram (Moher et al., 2001)



## Measures

After providing informed consent and demographic information, participants were asked to complete the below self-report measures. Each of these was completed both before and after the mindfulness practice/control listening exercise, except for the Five Facet Mindfulness Questionnaire (FFMQ-15), which was only completed at baseline. Shorter versions of measures were selected where available and psychometrically robust, since previous research has suggested that participants are less likely to complete longer measures accurately (Galesic & Bosnjak, 2009).

### State Hope Scale (SHS; Snyder et al., 1996)

The SHS is a six-item measure of state hope with the two subscales agency and pathways, which have three items each. Total state hope ranges from six to 48, and each subscale ranges from three to 24, with higher scores indicating greater state hope, agency, or pathways, respectively. The SHS has been validated with a large sample of university students, showing high reliability and concurrent and discriminant validity (Snyder et al., 1996). In the current sample, the total scale SHS, as well as both subscales, had high internal consistency (total state hope: Cronbach's  $\alpha = 0.91$ ,  $\omega = 0.93$ ; agency:  $\alpha = 0.88$ ,  $\omega = 0.88$ ; pathways:  $\alpha = 0.86$ ,  $\omega = 0.86$ ).

### Gratitude Adjective Checklist (GAC; McCullough et al., 2002)

The GAC is a three-item measure of the affect adjectives grateful, thankful, and appreciative used to assess gratitude. State as opposed to trait gratitude was measured by including “how you feel right now” in the instructions as detailed in McCullough et al. (2002). The GAC ranges from three to 15, with higher scores indicating greater state gratitude. This measure has shown high internal consistency and concurrent validity (Waters, 2012). In the current sample, the GAC showed high internal consistency (Cronbach's  $\alpha = 0.95$ ,  $\omega = 0.95$ ).

### Toronto Mindfulness Scale (TMS; Lau et al., 2006)

The TMS is a 13-item questionnaire assessing state mindfulness, with the two subscales curiosity and decentering. The curiosity subscale ranges from zero to 24, the decentering subscale from zero to 28, and the total state mindfulness scale from zero to 52, with higher scores indicating greater curiosity, decentering, and overall state mindfulness, respectively. This scale has shown good reliability and incremental as well as criterion validity, in participants with and without previous meditation experience from the general population (Lau et al., 2006; Medvedev et al., 2017). In the current sample, the total scale TMS showed high internal consistency (Cronbach's  $\alpha = 0.92$ ,  $\omega = 0.93$ ), as did subscales (curiosity:  $\alpha = 0.92$ ,  $\omega = 0.93$ ; decentering:  $\alpha = 0.82$ ,  $\omega = 0.82$ ).



### Five Facet Mindfulness Questionnaire (FFMQ-15; Baer et al., 2012)

The FFMQ-15 measures trait mindfulness. This questionnaire has shown high levels of convergent validity before and after MBPs, as well as high reliability in a general population sample (Gu et al., 2016). For calculation of the total scale score, it is recommended to omit the observe subscale items (Baer et al., 2012; Gu et al., 2016), resulting in scores of trait mindfulness ranging between 12 and 60. Each FFMQ-15 subscale ranges between three and 15. With the current sample, the total FFMQ-15 showed good internal consistency (Cronbach's  $\alpha=0.86$ ,  $\omega=0.82$ ), as did all but the observe subscale (observe:  $\alpha=0.69$ ,  $\omega=0.63$ ; describe:  $\alpha=0.81$ ,  $\omega=0.74$ ; acting with awareness:  $\alpha=0.75$ ,  $\omega=0.75$ ; non-judging:  $\alpha=0.84$ ,  $\omega=0.85$ ; non-reactivity:  $\alpha=0.77$ ,  $\omega=0.73$ ). However, the observe subscale has previously been found problematic, especially in people new to mindfulness practice, hence why it is recommended to be omitted when calculating the total scale FFMQ-15 (Gu et al., 2016). The FFMQ-15 was administered at baseline only.

### Compliance Check

As a compliance check, immediately after the recording was played, participants in both groups were asked to indicate from one (not at all) to 10 (completely) how well they paid attention to the recording. Participants in the mindfulness practice group were also asked to indicate how much they felt they were following the guidance during the practice on the same scale (1–10).

### Mindfulness Practice Experience

Along with demographic questions, participants were asked whether they had previously practiced or were currently regularly practicing mindfulness and, if so, to provide details. This information was collected to be able to control for participants' previous and current mindfulness practice, since it is possible that the effects of a single mindfulness induction might vary between participants who are new to mindfulness and those who have either some historical or current experience of mindfulness practice.

### Data Analyses

To test primary Hypotheses 1 and 2, two (group: mindfulness vs. control) by two (time point: pre vs. post) mixed analyses of variance (ANOVA) were performed in SPSS version 24 (IBM Corp., 2016), on the outcomes state hope, with the two subscales of agency and pathways, and state gratitude. Significant interactions were decomposed by running separate one-way ANOVAs for each group and for

the two time points. Due to minor deviation from normality for some variables, the above analyses were repeated using robust methods of ANOVA on trimmed means using the package WRS2 (Mair & Wilcox, 2019) in R versions 4.0.2 to 4.1.1 (The R Foundation for Statistical Computing, 2020; 2021). Results of standard and robust methods did not meaningfully differ, and thus, only standard results are reported in the main text, with robust results presented in Supplementary Materials.

To test Hypotheses 3 and 4, mediation analyses were completed using model 4 of Hayes' (2019) PROCESS macro version 3.4, with bootstrapping set to 5000 and controlling for baseline levels of the respective outcome. To control for possible inflation of family-wise alpha levels due to multiple comparisons and thus the possibility of a Type I error having occurred, the Bonferroni correction was applied to significant results in mediation analyses.

## Results

### Demographic Characteristics and Pre and Post Scores

Table 2 shows outcomes for each group at pre and post time points. Scores were within the range of what would be expected for a general population sample across state hope (Snyder et al., 1996), state gratitude (Waters, 2012), state mindfulness (Lau et al., 2006), and trait mindfulness (Gu et al., 2016) measures.

### Outcomes

Group by time mixed ANOVAs showed significant interactions for total state hope, and both hope subscales, and state gratitude (Table 3). Subsequent one-way ANOVAs revealed that groups significantly differed at the post mindfulness/control exercise time point whereas they did not at baseline. Thus, mindfulness practice resulted in significantly higher levels of state hope and state gratitude compared to controls, confirming Hypotheses 1 and 2. One-way ANOVAs on each group separately showed significant pre to post increases for the mindfulness group but not the controls (see Tables SM.1–SM.3 in the Supplementary Materials for more detailed standard and robust results). See Fig. 2 for pre to post change in state hope and state gratitude by group. In subsidiary follow-up analyses, all significant findings remained so when controlling for previous and current mindfulness practice experience and when controlling for compliance to listening to recordings. Similarly, when repeating analyses with participants with low compliance (compliance < 5) removed, findings did not differ from the main analyses.

**Table 2** Outcome data at pre and post time points for mindfulness and control groups

Outcome	Mindfulness group ( <i>N</i> =237)		Control group ( <i>N</i> =237)	
	Pre M (SD)	Post M (SD)	Pre M (SD)	Post M (SD)
State hope (SHS total)	29.48 (8.27)	34.62 (7.37)	28.31 (9.06)	28.91 (9.17)
SHS agency	14.09 (4.6)	16.83 (4.28)	13.56 (5.03)	14.51 (5.08)
SHS pathways	15.38 (4.33)	17.79 (3.71)	14.75 (4.68)	12.63 (4.73)
State gratitude (GAC)	10.14 (3.25)	12.04 (2.29)	9.74 (3.68)	8.62 (3.67)
State mindfulness (TMS total)	22.33 (9.74)	30.55 (10.1)	22.65 (10.96)	21.95 (11.19)
TMS curiosity	11.96 (5.84)	14.76 (5.28)	12.02 (6.28)	11.62 (6.33)
TMS decentering	10.33 (4.93)	15.79 (5.59)	10.63 (5.52)	10.33 (5.65)
Trait mindfulness (FFMQ-15 total)	35.09 (4.11)	-	35.7 (3.96)	-
FFMQ-15 Observe	9.23 (2.47)	-	8.91 (2.44)	-
FFMQ-15 Describe	8.59 (2.57)	-	9.35 (1.96)	-
FFMQ-15 Act aware	9.08 (1.85)	-	8.91 (1.74)	-
FFMQ-15 Non-judge	9.85 (2.3)	-	9.68 (2.1)	-
FFMQ-15 Non-react	8.99 (2.47)	-	8.62 (2.3)	-

*M*, mean; *SD*, standard deviation; *SHS*, State Hope Scale; *GAC*, Gratitude Adjective Checklist; *TMS*, Toronto Mindfulness Scale; *FFMQ-15*, Five Facet Mindfulness Questionnaire (pre only)

**Table 3** Results of mixed ANOVA, between-group ANOVA, and within-group ANOVA

Outcome	Group × time	Between groups		Within group (time)	
		Pre	Post	Mindfulness group	Control group
Hope	$F(1, 472) = 154.94^{***}$ part. $\eta^2 = .25$	$F(1, 472) = 2.14$	$F(1, 472) = 71.92^{***}$ $d = 0.68$	$F(1, 236) = 147.78^{***}$ $d = 0.79$	$F(1, 236) = 8.82$
Agency	$F(1, 472) = 135.94^{***}$ part. $\eta^2 = .21$	$F(1, 472) = 1.44$	$F(1, 472) = 59.24^{**}$ $d = 0.49$	$F(1, 236) = 135.57^{**}$ $d = 0.75$	$F(1, 236) = 1.45$
Pathways	$F(1, 472) = 129.64^{***}$ part. $\eta^2 = .23$	$F(1, 472) = 2.34$	$F(1, 472) = 65.54^{***}$ $d = 1.21$	$F(1, 236) = 122.36^{***}$ $d = 0.72$	$F(1, 236) = 7.6$
Gratitude	$F(1, 472) = 133.63^{***}$ part. $\eta^2 = .22$	$F(1, 472) = 1.58$	$F(1, 472) = 74.05^{***}$ $d = 1.12$	$F(1, 236) = 124.05^{***}$ $d = 0.72$	$F(1, 236) = 10.38$

Hope, agency, and pathways measured with State Hope Scale (SHS); gratitude measured with Gratitude Adjective Checklist. *part.*  $\eta^2$ , partial eta-squared; *d*, Cohen's *d*.  $^{***}p < .001$ ;  $^{**}p < .01$

### Effect of the Mediator State Mindfulness

Bias-corrected bootstrapped mediation analyses examined whether pre to post change in state mindfulness statistically mediated the relationship between group assignment and state hope at the post time point, while controlling for baseline state hope. The same analysis was repeated for state gratitude, and both analyses were repeated with change in the TMS subscales curiosity and decentering taking their respective turns as the mediator.

As can be seen from Table 4, change in state mindfulness, as well as change in curiosity and decentering, significantly mediated the relationship between group allocation and each of the four outcomes (i.e., state hope, the two hope subscales, and state gratitude), thus confirming Hypotheses 3 and 4. These results remained significant when controlling for the inflation of alpha levels

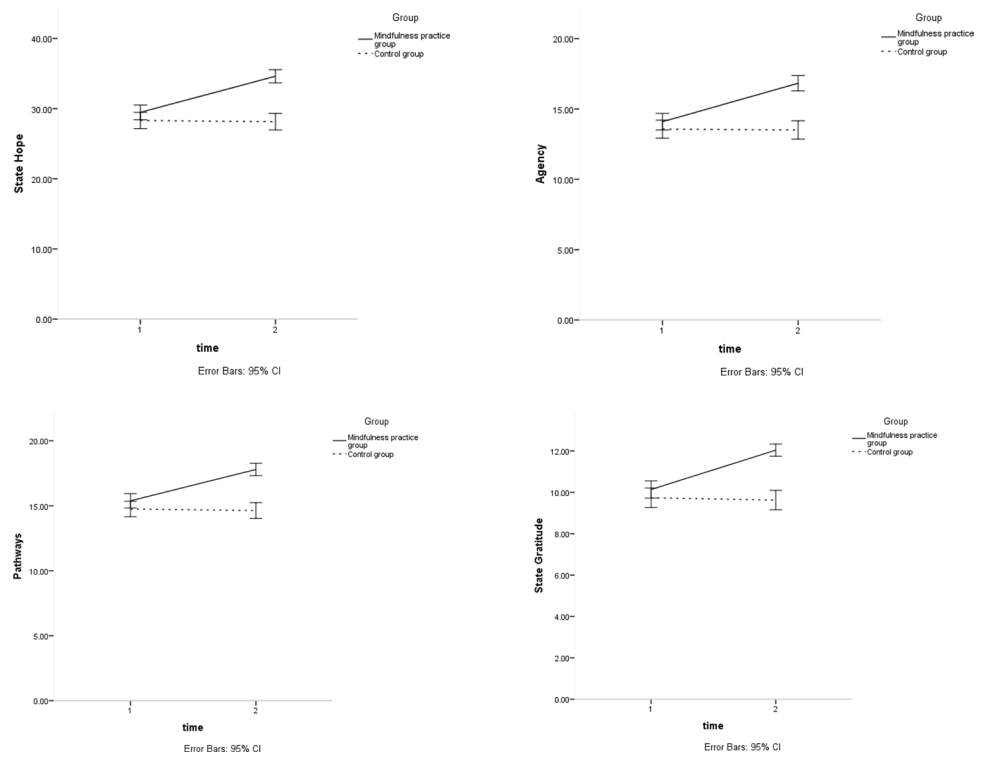
due to multiple comparisons by applying the Bonferroni correction.

Figure SM.1 in the Supplementary Materials shows the change of state mindfulness, curiosity, and decentering from pre to post for both groups. As an example, Fig. 3 shows the mediation model for the outcome state hope (total-SHS) and the mediator change in state mindfulness (total-TMS). Remaining mediation models are available in the online Supplementary Materials (Figure SM.2).

### Discussion

The purpose of this study was to examine the effect of a brief, online, mindfulness of the breath induction on state hope and state gratitude. Results showed that, relative to a listening exercise control, mindfulness practice increased

**Fig. 2** Mean outcome measures at pre (time 1) and post (time 2), for the mindfulness and control groups. Top left: state hope (total-SHS); top right: agency (SHS); bottom left: pathways (SHS); bottom right: state gratitude (GAC)



**Table 4** Indirect effects in bias-corrected bootstrapped mediation models with group allocation as the independent variable, post mindfulness/control exercise outcome as the dependent variable, and baseline outcome as the covariate (each row represents a separate mediation model)

Outcome	<i>b</i>	SE (boot)	99.9% CI (boot)
Mediator: Change in state mindfulness			
Hope (total)	3.02	0.42	[1.62, 4.55]*
Agency	1.46	0.22	[0.7, 2.14]*
Pathways	1.53	0.21	[0.84, 2.32]*
Gratitude	1.12	0.16	[0.67, 1.72]*
Mediator: Change in curiosity			
Hope (total)	1.81	0.33	[0.87, 3.01]*
Agency	0.88	0.17	[1.31, 2.69]*
Pathways	0.92	0.17	[0.43, 1.47]*
Gratitude	0.69	0.13	[0.27, 1.16]*
Mediator: Change in decentering			
Hope (total)	3.26	0.44	[0.97, 3.58]*
Agency	1.58	0.22	[0.52, 2.08]*
Pathways	1.65	0.22	[0.96, 2.47]*
Gratitude	1.14	1.16	[0.67, 1.72]*

*b*, effect size of indirect effect; *SE boot*, bootstrapped standard error; *99.9% C.I.*, 99.9% confidence interval. \**p* < 0.05 after the application of the Bonferroni correction

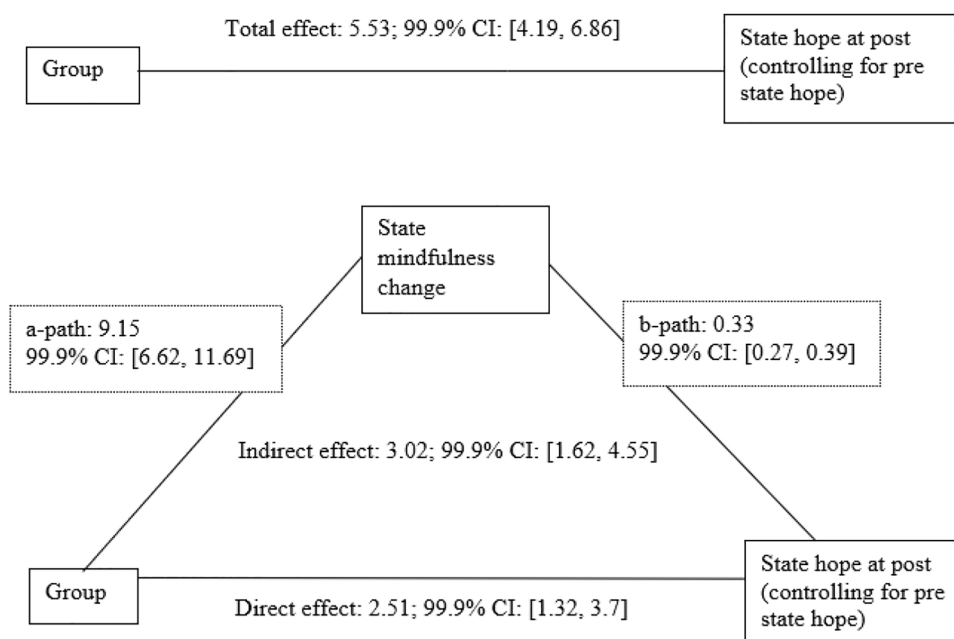
state hope and state gratitude, with medium to large between-group effect sizes. Thus, primary Hypotheses 1 and 2 were confirmed. These findings correspond with previous research on the effectiveness of mindfulness on hope (Munoz et al., 2018; Sears & Kraus, 2009) and gratitude (Bluth & Eisenlohr-Moul, 2017; Geschwind et al., 2011), but extend them to a brief, single-session mindfulness practice. Furthermore, findings provide further evidence on the

effectiveness of mindfulness inductions, which previously included psychological distress (Johnson et al., 2015; Leyland et al., 2019) and other positive psychological outcomes such as optimism (Kiken & Shook, 2011).

The positive benefits of a brief, single-session mindfulness practice are arguably impressive, not least considering the brevity of the practice. The current finding of effects on state hope and gratitude adds weight to the idea of including



**Fig. 3** Mediation model for the dependent variable post state hope, with group as the independent variable, state mindfulness change as the mediator, and baseline state hope as a covariate. Top diagram: total effect when excluding mediator. Bottom diagram: indirect and direct effects when including mediator



brief practices in well-being and positive psychology programs, given the considerable benefits associated with hope and gratitude (e.g., Emmons & McCullough, 2003; Yang et al., 2016). Furthermore, the fact that these findings were observed despite the remote (online) mode of delivery suggests that brief mindfulness inductions might usefully be included in self-help programs designed to promote hope and/or gratitude.

Mediation analyses showed that improvement in state mindfulness, including in both curiosity and decentering, statistically mediated the relationship between mindfulness practice (vs. control) and improvements in state hope and state gratitude. This result remained significant when correcting for multiple statistical comparisons and thus appears to be a reliable finding. This finding coincides with previous research observing a positive effect of a computer-delivered brief mindfulness meditation practice on state mindfulness compared to controls (Mahmood et al., 2016). Additionally, this result corresponds with findings from a recent review of mindfulness inductions relating to enhanced mindful states, which in turn were associated with positive health-related outcomes (Heppner & Shirk, 2018). Furthermore, the statistical mediating role of state mindfulness fits with the theoretical stance that engaging in a mindfulness practice increases individuals' state mindfulness, thus reducing negativity bias (Brown et al., 2007) and in turn supporting other positive outcomes.

### Limitations and Future Research

Any study examining effects of mindful practice is open to the question of to what extent participants actually engaged

with the practice; this may be particularly pertinent when the study is conducted online, in the absence of any direct researcher monitoring of participants' engagement. However, there is reason to think that this was not a substantial concern in this case, as if anything, disengagement would reduce the impact of a program, but significant medium to large effects were nevertheless observed. Furthermore, processes were included to support and monitor engagement. In particular, a timer was added to ensure participants could not complete post-measures until after the mindfulness/control audio had finished, and participants were asked to rate their level of engagement.

A second potential limitation is that the mediator and outcome variables were all measured by self-report questionnaires, which could have introduced common method bias due to social desirability effects and/or demand characteristics which could have inflated the evidence of mediating effects in the mediation analysis (Podsakoff et al., 2003). Efforts were made to minimize possible bias by having an active control group and by not disclosing in advance the effects being examined nor which was the intervention and which the control group. However, since double-blinding is generally not possible in evaluations of psycho-social interventions, the possibility of such bias could not be eliminated. In particular, the insufficient control of demand characteristics is still an issue, since participants may have realized from the combination of the study title and the audio they listened to which group they were allocated to. Furthermore, due to the measures assessing state mindfulness, state hope, and state gratitude being administered at pre and post time points with only a 10-minute practice in between, there is a possibility that

participants remembered questionnaire items and their responses, thus increasing the risk of response bias. Some caution in the interpretation of the findings is therefore warranted, and if it were possible to replicate this study using measures that did not rely on self-report, that would be helpful. However, it is currently unclear how state hope and gratitude could be measured other than through self-report, since arguably, a person can best tell themselves how they feel. One possibility might be to explore implicit attitude measures of hope and gratitude. However, to the best of the authors' knowledge, there are not yet such tests available for these constructs. If/when such measures exist, they might also help address issues related to demand characteristics in the current study.

Thirdly, due to absence of additional measurement time points after the post mindfulness/control time point, it was not possible to determine how long-lasting the effects of mindfulness practice on state gratitude and hope were. Future research would therefore benefit from examining the longevity of the observed outcomes.

Fourthly, while the use of the Bonferroni correction controlled the risk of Type I errors, Bonferroni-type corrections have been criticized as being too stringent and for inflating Type II errors (Nakagawa, 2004). However, findings of mediation analyses remained significant after applying the Bonferroni correction and therefore, the correction did not appear to be too stringent in this case.

Fifthly, although the findings provide evidence that improvement in state mindfulness statistically mediated the effect of the mindfulness induction on state hope and gratitude, they fall short of meeting Kazdin's (2007) criteria for providing good evidence of a causal mediation pathway. For example, the mediator and outcome variables were measured at the same time points, and the mediator was not experimentally manipulated. That said, convincing evidence that meets Kazdin's criteria is likely to be accumulated across a range of studies, rather than by one study alone (cf. Gu et al., 2015).

Finally, most participants in this study identified as female, white British, and from the general population. The findings should therefore be generalized with caution to the wider population. In future, it will be important to repeat this research with a more representative sample. Replication of this study for population groups other than the general population (e.g., populations with physical or mental health difficulties) would also be valuable to complete in future research to perhaps be usefully incorporated into therapeutic programs. Nevertheless, the finding that engaging in a single, brief, mindfulness practice can improve state mindfulness, state hope, and state gratitude is encouraging.

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**Author Contribution** SS: designed and executed the study, completed all data collection and analyses, and wrote the paper. FWJ and JEC: collaborated in the design of the study, and in editing the final manuscript.

**Data Availability** Materials used in this study are fully referenced; the transcript of the mindfulness practice is available in the online Supplementary Materials. Participant permission was not sought to make raw data available, though it is planned to do so for future studies.

This research was reviewed and approved by an Institutional Review Board, namely a Canterbury Christ Church University, UK Research Ethics Committee.

## Declarations

**Consent to Participate** All participants gave their informed written consent prior to their inclusion in the study.

**Conflict of Interest** The authors declare no competing interests.

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