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The Effect of Mindfulness on Obsessive-
Compulsive Disorder Symptoms mediated by
Intolerance of Uncertainty

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Abstract

Nowadays, mindfulness interventions are very popular and are praised to counteract stress and anxiety. Patients suffering from obsessive-compulsive disorder (OCD) experience elevated intolerance of uncertainty (IU). Accepting life's natural uncertainty through mindfulness practices is thought to lower anxiety and thereby reduce OCD symptoms. Based on this idea we propose first that individuals benefit from a mindfulness condition more than from an audiobook control condition. Second, we hypothesize that IU mediates the relationship between mindfulness and OCD symptoms. For this, we conducted an experimental study using a pre-post-follow-up design with a sample of 105 participants, ranging in age from 18 to 35 years. Through an online Qualtrics survey we assessed the participant's level of OCD symptoms pre and post intervention. The interventions included 10-minute sessions on 12 consecutive days. The results showed that our mindfulness condition did not have greater effect compared to the active control group. Further, our mediation analysis did not support our prediction that IU would mediate the relationship between mindfulness and OCD symptoms. Nevertheless, we found evidence that change in IU predicts change in OCD symptoms. These findings extend the literature on interventions and factors influencing OCD. Individuals with OCD symptoms can benefit from our findings by training their tolerance of uncertainty and thereby reducing their symptoms.

Keywords: obsessive-compulsive disorder, intolerance of uncertainty, mindfulness

The Effect of Mindfulness on Obsessive-Compulsive Disorder Symptoms mediated by Intolerance of Uncertainty

In contemporary psychology, mindfulness-based interventions are getting increased attention, as their benefits on stress, anxiety, and depression have become substantiated (Kraemer et al., 2016). The definition of mindfulness can be conceptualized as the non-judgmental experience of the present moment, including acceptance of one's internal (e.g., thoughts) and external (e.g., environmental) stimuli, while strengthening awareness (Bishop et al., 2004). It is grounded in buddhist teachings and increased in popularity over the last decades (Baer, 2003). Nowadays, mindfulness is used as a tool to improve awareness and coping with stressful events. Especially patients with chronic pain and individuals with emotional and behavioral disorders report to benefit from mindfulness (Bishop et al., 2004). In practice, mindfulness-based cognitive therapy successfully combines meditation with cognitive therapy and is known to effectively treat obsessive-compulsive disorder (OCD) (Mathur et al., 2021). With our study we aim to find out more about the mechanisms of mindfulness and aspire to strengthen the evidence for its effectiveness in lowering OCD symptoms.

Contemporary Treatment and its Limitations

The problematic nature of OCD is shown in its complex symptoms. Individuals suffering from OCD experience obsessions, compulsions, or both (Beyond OCD, 2018). Obsessions are defined by intrusive and persistent thoughts or impulses. In most cases, they result in anxiety or distress. Patients attempt to suppress or neutralize the thoughts through other thoughts or actions. Hence, by engaging in compulsions (Beyond OCD, 2018). Compulsions are repetitive behaviors (e.g., checking, hand washing) or cognitive activities (e.g., counting) that patients feel the urge to perform because of an obsession. These behaviors are supposed to reduce anxiety or prevent unwanted events. However, in reality they are highly time consuming (e.g., more than one hour per day) and cause disfunctions in daily life (Beyond OCD, 2018). The

world health organization (WHO) rates OCD among the ten most disabling disorders when it comes to both income reduction and quality of life (Vaele & Roberts, 2014). The global estimated lifetime prevalence of OCD is 1.9 – 2.5% (Kozak & Coles, 2005; Matsunaga & Seedat, 2007). Thus, research in this field is essential.

Currently, exposure is one of the standard treatments for OCD. The treatment is based on the theory of classical conditioning (Ougrin et al., 2011). According to this theory, the feared stimulus is confronted (imaginary or in vivo), until anxiety subsides. This is otherwise named as the process of habituation (Ougrin et al., 2011). There are two techniques of exposure that may lead to habituation: Gradual exposure, starting with the least feared stimuli and implosion, starting with the most feared stimuli from a list (Ougrin et al., 2011). The use of exposure and response prevention in OCD is known to be highly effective (Franklin et al., 2000; Himle & Franklin, 2009; Ougrin et al., 2011). Previous results demonstrated a recovery rate of approximately 70% after 1 and 4 years (Tjelle et al., 2021). However, following a successful treatment, a number of patients may experience relapse (Buchholz & Abramowitz, 2019). Investigations displayed that after successful treatment, 12 weeks without treatment resulted in 12% of patients experiencing relapse (Simpson et al., 2004). Therefore, investigating a variety of alternative treatment options such as mindfulness-based interventions, is important.

Intolerance of Uncertainty in OCD

One influential factor found in OCD is intolerance of uncertainty (IU). IU can be understood as the fear of uncertainty. This fear implies a general fear of situations of which one cannot predict the outcome with certainty (Carleton, 2016; Kraemer et al., 2016). In OCD, this manifests for example in the way that individuals feel the urge to check their oven repeatedly to ensure it is turned off (Nestadt et al., 2016). In this vein, IU has been associated with greater OCD symptoms (Besharat et al., 2019; Kraemer et al., 2016; Mathur et al., 2021). This means that as seen in the example above, patients with OCD often experience self-doubt

regarding their personal memory, attention, and perception. Individuals high in IU experience doubt as stressful and aversive (Morein-Zamir et al., 2020). This experienced IU in OCD patients is often conquered through for example rituals and other safety behaviors to regain certainty (Besharat et al., 2019). This is because rituals alleviate anxiety and individuals experience a relief from discomfort (Reuven et al., 2014). For example, an individual experiencing intrusive thoughts about stabbing their child, may feel the need to know with certainty that they will not harm their child. This will cause distress, which is then neutralized. Neutralization can occur through rituals such as repeatedly checking for their child's health to arrive at certainty that the feared event will not and did not happen (Jacoby et al., 2013). Accepting the uncertainty that comes with life in general, through mindfulness, may therefore be advantageous and strengthen one's general tolerance of uncertainty.

The Current Study and its Relevance

Relevance

There is increasing evidence for the effect of mindfulness interventions on mental disorders (Bishop et al., 2004; Mathur et al., 2021). However, relatively little is known about its mechanisms. IU represents a potential mechanism of mindfulness interventions as IU is found to be reduced by mindfulness practices (Kraemer et al., 2016; Papenfuss et al., 2021). Finding out about a construct's mechanisms is important as it helps explaining the construct's functioning as well as associated causal relations. In the context of this study, this knowledge can help us explain and predict the effects of mindfulness.

Especially in the face of the current covid-19 pandemic, OCD and related treatment options are relevant to study. The reason for this is that because of recommended safety measures, individuals are encouraged to behave in for example cleaning precautions that were initially rated as dysfunctional (Linde et al., 2022). Compared to patients with other mental illnesses, individuals suffering from OCD are highly affected by the virus outbreak. In fact, the nature of the virus fosters existing obsessive fears of contamination in numerous patients

(Fineberg et al., 2020). More specifically, 76,2% reported worse OCD symptoms since the outbreak (Wheaton et al., 2021). In comparison, 32,4% of depressed patients reported elevated symptoms since the pandemic (Brown University, 2022). Regarding OCD, these effects were especially true for patients with the subtype concerning contamination fears (30-40% of patients with OCD) (Wheaton et al., 2021). A reason for this may be the high contagiousness of covid-19, as patients with this OCD subtype are frequently concerned about contracting and spreading illnesses (Wheaton et al., 2021). Moreover, with the pandemic, conflicting messages about covid-19 and several other sources of uncertainty may be especially relevant for individuals suffering from OCD. For example, uncertainty about whether individuals have covid-19 or not and about what precautions are necessary to prevent infection can be distressing (Jassi et al., 2020). Therefore, especially during these times, shedding light on treatment options for OCD (i.e., mindfulness-based interventions) and relevant factors (i.e., IU) may be highly beneficial to help patients recover.

The Current Study

Mindfulness may help to reduce IU due to mindfulness training involving the acceptance of experiences including uncertainty. Concretely, accepting uncertainty means that individuals tolerate the notion that part of their lives is out of their control. This entails focusing on the present rather than dwelling on the future. Recent research suggests IU as a mechanism for the inverse relationship between mindfulness and anxiety. Specifically, two cross-sectional studies found that IU mediated an inverse relation between mindfulness and a variety of anxiety symptoms such as health anxiety, social anxiety, and obsessive-compulsive symptoms (Kraemer et al., 2016; Papenfuss et al., 2021). The reassurance seeking behavior in health anxiety (e.g., doctor appointments) and the rituals in OCD (e.g., checking behavior) serve similar functions. Both aim to alleviate short term discomfort (Salkovskis & Warwick, 1986).

Regarding OCD, there is a gap in research concerning the question whether mindfulness interventions would alleviate OCD symptoms. In the current study, we aim at filling this gap

by illuminating the relationship between mindfulness-based interventions, IU, and OCD. Beyond that, past research regarding the effects of mindfulness on mental disorders has been predominantly cross-sectional and not experimental. Cross-sectional studies only evaluate associations and are limited in predicting causality, whereas experimental studies can answer the question of causality (Institute for Work & Health, 2015). Our current experimental study builds on previous research of the mediating role for IU in the inverse relationship between mindfulness and anxiety. To realize this, we examined whether a mindfulness-based intervention reduces OCD symptoms and whether this change is mediated via IU.

Hypothesis 1. A mindfulness condition decreases OCD symptoms more than listening to a control audiobook condition.

Hypothesis 2. Change in IU mediates the effect of a mindfulness condition on change in obsessive-compulsive disorder symptoms.

Method

Participants

Prior to the main study, participants were screened with the generalized anxiety disorder questionnaire (GAD-7, Spitzer et al., 2006) in the paid participant pool of SONA. As we aimed at maximum sensitivity without wakening specificity, individuals with a cut-off score equal to or above eight were invited to the main study (PAR Staff, 2022). We expected a medium effect size $d = 0.5$ and to achieve a power of at least .80, we aimed to recruit 180 participants. At the point of writing this paper, data collection had not been concluded. Therefore, we are analyzing a smaller sample due to timing reasons. Until writing, 110 participants took part in the main study. Of these participants, a total of 105 participants (10.48 % men and 89,52% women) ranging in age from 18 to 39 ($M_{\text{age}} = 22$) were eligible for statistical analysis. The remaining five were excluded due to completion of less than six sessions ($n = 2$), due to not participating in session 2 ($n = 1$) or both ($n = 2$). The participants were randomly assigned to two conditions, 52 were allocated to the active control group

(listening to an audiobook) and 53 took part in the mindfulness condition. According to an post hoc analysis, with our sample of $n = 105$, we arrived at a power of .81 to detect medium effect sized effects. We calculated this with the program G*Power. Lastly, all individuals received a compensation of 30 Euro.

Materials

Measures

The data was gathered online via Qualtrics. Participants were asked to fill-in questionnaires assessing amongst other characteristics, their obsessive-compulsive disorder symptoms with the obsessive-compulsive inventory (OCI-R) (Foa et al., 2002). The scale consisted of 18 items (e.g., “I check things more often than necessary.”) using a scale ranging from 0 (not at all) to 4 (extremely). The items are specifically assessing checking, ordering, hoarding, obsessions, and fear of contamination (Foa et al., 2002). Internal consistency was adequate ($\alpha = .90$). We assessed their IU with the 12 items of the intolerance of uncertainty scale (IUS-12, Carleton et al., 2007). The items (e.g., “I must get away from all uncertain situations.”) constituted a scale ranging from 1 (not at all characteristic of me) to 5 (entirely characteristic of me) and demonstrated good internal consistency ($\alpha = .90$) (Carleton et al., 2007). Specifically, the items of the IUS-12 measure how one responds to unforeseen situations and in what way this affects their functioning (Carleton et al., 2007).

Conditions

First, individuals were measured at baseline. Then they were randomly split into conditions. The two conditions were mindfulness and audiobook control. The mindfulness group listened each day for 12 days to a ten-minute guided meditation via audio recordings. Hereby, participants were supposed to learn to become aware of their present moment experience through awareness exercises. They were instructed to focus on their breath and to observe their senses one after the other, without judgement. In week two, participants were additionally asked to remember situations in which they felt anxious. Here they were

instructed to again concentrate on their breath and then notice sensations that come up when thinking of the stressful situation. Again, without judgement or evaluation. The reason for including mindfulness of stressful situations was that practicing mindfulness in such contexts improves coping with stressful situations in daily life. The control condition consisted of listening to parts of an audiobook (Harry Potter) each day for 12 days. The rationale for using such an active control group is that this controls for the possibility that the effect of mindfulness resulted from a placebo effect. Generally, comparing a mindfulness condition with an audiobook was reasonable. According to Youngs et al. (2021), activities such as mindfulness and listening to an audiobook (here “The Hobbit”) require similar attention and concentration skills.

Procedure and Research Design

We used a pre-post-follow-up design in our study. The measuring points were specified as (1) pre-intervention, (2) post-intervention, and (3) one month follow-up. However, we did not include the follow up assessment in our analysis, because the participants had not yet finished the study and we did not have time to wait due to the approaching end of the academic year. At the measuring points, participants were instructed to fill-in the online questionnaires mentioned earlier. Prior to the main study, a screening procedure was performed to assess participant’s eligibility for the study. The intervention-period was stretched over of 12 days.

Analysis

We used a repeated measures ANOVA to analyze the data for hypothesis one. The within subject variable consisted of comparing an individual’s OCD symptom score before and after the intervention. The between-subjects variable consisted of comparing the OCD symptom scores between the two conditions. The mediation effect evaluates the effect of mindfulness condition on OCD through IU. We used a mediation analysis with SPSS PROCESS macro (Hayes, 2013) for hypothesis two. The mediation model constituted the pre-

post-intervention difference score of the dependent variable of obsessive-compulsive disorder (OCD) symptoms, the independent variable of mindfulness, and the difference score of the mediating factor of Intolerance of uncertainty (IU).

For our first hypothesis, we checked the assumptions of repeated measures ANOVAs. These assumptions are independence, normality, and sphericity (Zach, 2021). All assumptions were met except for sphericity, as Mauchly's test of sphericity was significant. However, as the variables in our repeated measures ANOVA did not include more than two levels, Mauchly's test of sphericity can be disregarded (Harrison, 2018). To answer the question of a mediation effect, we examined whether the statistical assumptions for linear regression analyses were met (Regorz, 2021). None of the assumptions (autocorrelation, normality, linearity, homoscedasticity, multicollinearity) were violated (see Figure 3 and 4).

Results

Preliminary Analyses

In order to test hypotheses 1 and 2, we looked at the descriptive statistics and run a correlational analysis as seen in Table 1 and 2. Through Cook's distance, we found that there were no outliers in our data. Because of this and as the assumption of linearity was met, we used Pearson correlation to investigate the strength of the relationship between the variables for hypothesis 2. As shown in Table 2, the difference score between IU levels at baseline and after intervention was significantly positively correlated with the difference score between OCD levels at pre- and post-intervention.

Table 1*Descriptive Statistics of the Variables at Pre- and Post- Intervention for Hypothesis 1*

	<i>M</i>	<i>SD</i>	<i>n</i>
MeanOCI			
Audiobook Condition	1.3	.7	52
Minfulness Condition	1.3	.7	53
Total	1.3	.7	105
MS2_OCI			
Audiobook Condition	1.2	.7	52
Mindfulness Condition	1.2	.7	53
Total	1.2	.7	105

Note. MeanOCI indicates the mean score of OCD symptoms at baseline. MS2_OCI explains the mean score of OCD symptoms post intervention.

Table 2*Descriptive Statistics and Pearson Correlation of the Variables for Hypothesis 2*

	<i>M</i>	<i>SD</i>	<i>N</i>	<i>Time_OCI</i>	<i>Condition</i>	<i>Time_IUS</i>
Time_OCI	-.14	.4	105	1.00	.06	.286**
Condition	.5	.5	105	.06	1.00	-.069
Time_IUS	-.16	.5	105	.286**	-.069	1.00

** $p < .01$., two-tailed

Note. Time_OCI indicates the difference score between OCD symptoms at baseline and post treatment. Time_IUS explains the difference score between IU levels at baseline and post treatment.

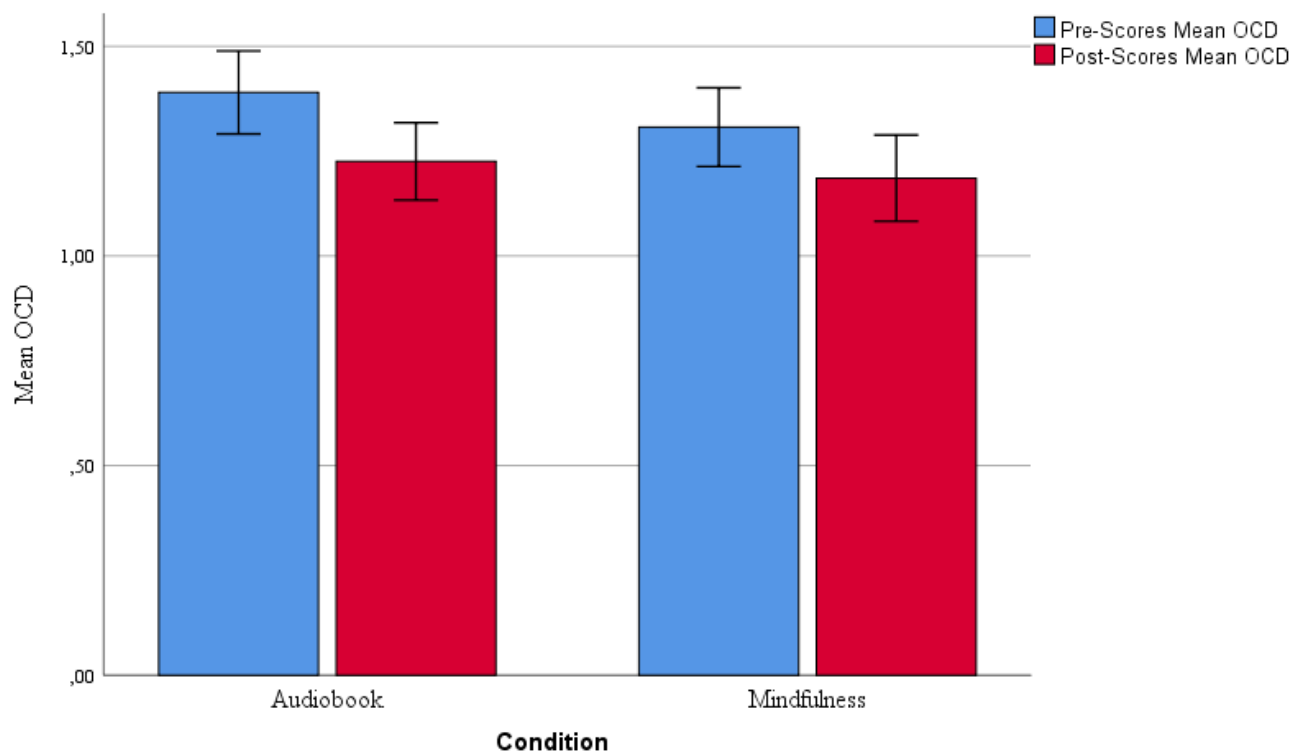
Effect of Mindfulness versus Audiobook on OCD Symptoms

The first hypothesis in our study was that a mindfulness intervention decreases OCD symptoms more than an intervention of listening to parts of an audiobook (Harry Potter).

The effect of time was significant, $F(1,103) = 16.66, p < .001, \eta^2 = .139$. Thus, OCD symptoms decreased over time in our sample. The interaction effect between condition and OCD however was not significant, $F(1, 103) = 0.37, p = .54, \eta^2 = .004$.

Figure 1

Comparison of the Effect of the Conditions on OCD Symptoms



Error bars: +/- 1 SE

Note. Pre-Scores Mean OCD refers to assessment pre-intervention, Post-Scores Mean OCD refers to assessment post-intervention. The error bars represent +/- 1 SE with a 95% CI. The effect of condition on OCD is not significant. Derived from SPSS.

Mediating Effect of Intolerance of Uncertainty

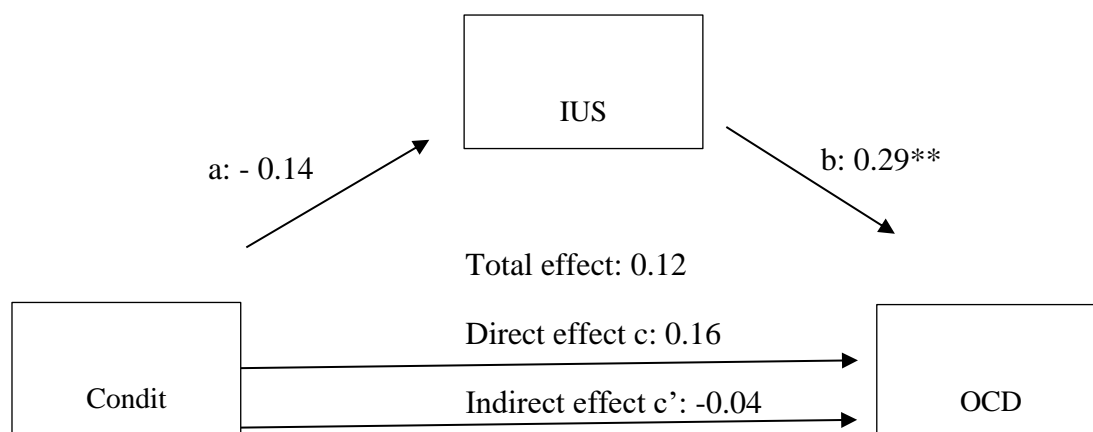
We further assessed our second hypothesis whether change in IU would mediate the effect of mindfulness-based Interventions on obsessive-compulsive disorder symptoms. For this, we standardized all variables entered into the mediation, to make the results more

interpretable. First, we focused on the total effect of condition on OCD symptoms. Secondly, we examined the direct effect of condition on OCD symptoms, when IU is in the model. Lastly, we looked at the indirect effect, to conclude whether a mediation effect is present in our model. In our results we found regarding the total effect, that condition does not significantly predict OCD when IU is not in the model, $b = 0.12$, 95% CI [-0.27, 0.51], $t(105) = 0.61$, $p = 0.54$, $R^2 = 0.3\%$. Further, our findings concerning the direct effect indicated that condition does not significantly predict OCD with IU in the model, $b = 0.16$, 95% CI [-0.21, 0.53], $t(105) = 0.85$, $p = 0.40$, $R^2 = 8.8\%$. Lastly, we did not find a significant indirect effect of condition on OCD, $b = -0.04$, 95% BCa CI [-0.16, 0.09]

Interestingly however, we found in an additional analysis that IU significantly predicts OCD, $b = 0.29$, 95% CI [0.10, 0.48], $t(105) = 3.08$, $p < .01$, $R^2 = 8.8\%$.

Figure 2

Mediation Model: IUS Mediating the Relationship Between Condit and OCD



** = $p < 0.01$.

Note. Condition (Condit), obsessive-compulsive disorder (OCD), intolerance of uncertainty (IU).

Discussion

Because mindfulness is known to be an effective treatment for OCD (Mathur et al., 2021), the present study questioned first whether a mindfulness condition decreases OCD symptoms more effectively than listening to a control audiobook condition (Harry Potter). Secondly, we examined whether intolerance of uncertainty (IU) would mediate the relationship between mindfulness and obsessive-compulsive disorder (OCD) symptoms. This hypothesis was based on the theoretical link between mindfulness and IU, mindfulness fostering an accepting attitude to uncertain parts of life (Kraemer et al., 2016; Papenfuss et al., 2021). Following from that, this accepting attitude (through lower levels of IU) was thought to decrease OCD symptoms (Morein-Zamir et al., 2020). Through these hypotheses, we aimed at extending the present literature by using an experimental pre-post-follow up design instead of an online cross-sectional survey as Kraemer et al. (2016) used in their research. In contrast to non-experimental designs, experimental designs render more information about the effectiveness of interventions, as they give insights regarding causality (O'Leary & Israel, 2019).

Interpretation of the Findings

In our preliminary analysis, we found that change in OCD was significantly correlated with change in IUS. Thus, large difference scores between OCD at baseline and post-intervention are associated with large difference scores between IUS at baseline and post-intervention. Despite this, our findings did not suggest evidence for our first hypothesis, that a mindfulness condition reduces OCD symptoms more effectively than listening to a control audiobook condition. Past research, however, did find an effect of mindfulness on OCD (Hanstede et al., 2008; Mathur et al., 2021). The reason why we did not find a significant effect may be because we compared two conditions that are both similarly relaxing in nature (Baylan et al., 2018; Mantzios et al., 2021). Listening to an audiobook as well as meditation can be calming as listening generally helps us escape the daily chaos of our lives (Baylan et

al., 2018). In line with our findings, previous research did not find a difference between meditation and listening to the beginning of “The Hobbit” by Tolkien (2005) regarding anxiety reducing effects (Youngs et al., 2021).

Patients with OCD report higher levels of IU, expressed in elevated self-doubt, found in for example checking rituals (Besharat et al., 2019; Mathur et al., 2021; Morein-Zamir et al., 2020). This led to our prediction that change in IU could mediate the relationship between mindfulness and OCD. Ultimately, we did not find a significant mediation effect of IU on the relationship between a mindfulness condition and OCD symptoms. We did not find evidence for the idea that a mindfulness condition would influence IU tendencies. This is in line with past research on generalized anxiety disorder (Alimehdi et al., 2016) which did not find an effect of mindfulness on IU either. In fact, Alimehdi et al. (2016) found that patients with GAD prefer the certainty of negative situations over uncertainty. It should be investigated further whether this holds true for OCD patients as well.

On another note, we found that IU levels influence OCD symptoms. According to these results, change in IU leads to change in OCD symptoms. The significant, positive, cross-sectional Pearson correlation we reported in Table 2, explained the strength of the relation between change in IU and change in OCD. This additional correlation finding adds a causal equation and the slope, explaining how much OCD is changed by increasing IU. Hence, the level of IU predicts the level of OCD and $b = 0.29$ indicates a moderate positive linear relationship. This is in line with previous findings, that IU is an important factor in OCD and underlines, that reductions in IU predicted reductions in OCD symptoms (Besharat et al., 2019; Mathur et al., 2021). For example, individuals with OCD feel the urge to repeatedly check whether they turned off the oven as they have difficulties tolerating the uncertainty of whether they did so or not. This goes as far as them engaging in increased self-doubt regarding their own mental functions (attention, memory, and perception) (Nestadt et

al., 2016). Nevertheless, based on our research, we were not able to confirm our main hypotheses.

Theoretical and Practical Implications

Theoretical Implications

Our study adds new insights to past literature because of its experimental design. Previously, mindfulness and its effect on mental health has been studied with predominantly cross-sectional studies. With our design we were able to shed light on causality, whereas cross-sectional studies can only talk about associations (Institute for Work & Health, 2015). Knowledge about causality is important to fully understand a relationship, predict mental health, and to build interventions.

With this study, we further contributed to the literature by adding findings to the research collection that contradict previous results. This is important as it helps to add to the picture of which interventions are effective in reducing OCD symptoms. In line with findings by Youngs et al (2021), we were not able to confirm that a mindfulness intervention has superior effects on OCD compared to a listening to audiobooks. Additionally, in a previous study conducted by Cludius et al. (2015), they compared the effect of mindfulness with progressive muscle relaxation on OCD. Both approaches did not yield significant effects. Their investigations, just like ours, were conducted in a self-help context (Cludius et al., 2015). They argued that this could have been the determining factor for the results not being significant. Other studies focusing on different mental disorders included face to face sessions with therapists and found significant effects of mindfulness (Cludius et al., 2015; Kim et al., 2009). For example, in the study conducted by Kim et al. (2009), mindfulness in combination with therapist contact, significantly reduced anxiety and ameliorated PD and GAD symptoms (Kim et al., 2009). In a similar vein, Sarris et al. (2012) proposed in their paper that reducing rumination and ‘letting go’ may both be central parts of the effects of mindfulness meditation.

With our results, we invited further examination of the relationship between IU and OCD, as the mechanisms of change are still rather unclear.

Practical Implications

On the basis of these theoretical contributions to the literature, the following practical implications can be derived. First, clinicians, therapists and especially individuals with OCD symptoms can benefit from these research findings, as our results underline the association between IU tendencies and OCD symptoms. Because of these findings, interventions that are aimed at increasing one's tolerance for uncertainty, may have a beneficial effect for OCD patients. For example, cognitive behavior therapy for IU (CBT-IU) consists of training to recognize uncertainty, evaluation of the functionality of worrying, problem-oriented training, and cognitive exposure (Robichaud, 2013). Cognitive exposure includes repeated confrontation with a written text about the feared situation (Robichaud, 2013). CBT-IU can lessen IU as it can be used to change the threatening valiance of future events and improve problem-solving skills (Robichaud, 2013). If uncertain events are reevaluated as less threatening, tolerance of uncertainty can be strengthened (Dugas & Ladouceur, 2000, Robichaud, 2013). Hence, through interventions such as CBT-IU applied in practice, patients can learn to deal with uncertainty more adaptively.

Limitations and Further Directions

There are mentionable aspects that limit the informative value of our research results. First, as mentioned before, our sample was not a clinical sample. Hence, our results cannot be generalized to the whole population of people with OCD symptoms. Another limitation is that we did not include a one-month follow-up measurement in our analysis. However, there could have been long-term differences in effectiveness between the conditions. We did not include this assessment in our analysis due to a lack of time.

Regarding our first hypothesis, past research posits that especially in the context of relaxation, longer interventions were more effective than shorter interventions (Yusufov et al.

2019). For example, Kim et al. (2009) used one 90-minute session per week for 8 weeks in their study. This means their subjects engaged in 720 hours in mindfulness training. Our study, on the other hand, only included 120 hours of mindfulness training. Thus, our intervention might have been too short to yield significant results. However, longer interventions also require more resources and more motivation on the participant's side. Likewise, our lack of significant results may lie in the intensity of our mindfulness condition. Previous findings investigated the difference between long-term effect of intensive meditation and relaxation (Hwang et al., 2018). Interestingly, three months after their intervention program, participants in the intensive meditation group still displayed higher levels in mindfulness and resilience. This effect however had dissolved in the control group individuals (relaxation) (Hwang et al., 2018). Similarly, another study examined the effect of an intensive vipassana meditation retreat of ten days in which participants performed 110 meditation sessions (Chambers et al., 2018). Their findings suggest that in contrast to no mindfulness training, intensive mindfulness training ameliorates psychological functioning (Chambers et al., 2018). Hence, a rather intensive meditation intervention has robust and long-term effects compared to low or no intensity relaxation (Chambers et al., 2018; Hwang et al., 2018). In this vein, it would be insightful to replicate our study by using a mindfulness intervention with greater intensity and longer duration.

A direction for further research could focus on the constitution of a sample balanced in gender. The majority (89,52%) of our sample was female, which makes it difficult to generalize the findings to the male population. In general, women are almost 2 times more likely to suffer from OCD (Fawcett et al., 2020), which made our sample reasonable. However, the male population of patients should not be overlooked. As there are many differences in men and women regarding mental disorders (Boyd et al., 2015), it would be meaningful to include an adequate number of men in future research samples. This way, it

could be investigated whether the same interventions are effective across gender. This could be done via stratified sampling.

Conclusion

Taken together, with this study we aimed at investigating two hypotheses. First, whether mindfulness is more effective in reducing OCD than listening to an audiobook. Second, we examined our prediction that IU would mediate the relationship between a mindfulness condition and OCD. Our findings regarding our hypotheses were not significant. However, results yield by an additional analysis indicated that change in IU tendencies results in change in OCD symptoms. More clearly, reduced IU leads to less OCD symptoms. Concluding, this experimental study provides evidence, that non-clinical individuals with OCD symptoms can experience a reduction of their symptoms through a higher tolerance of uncertainty.

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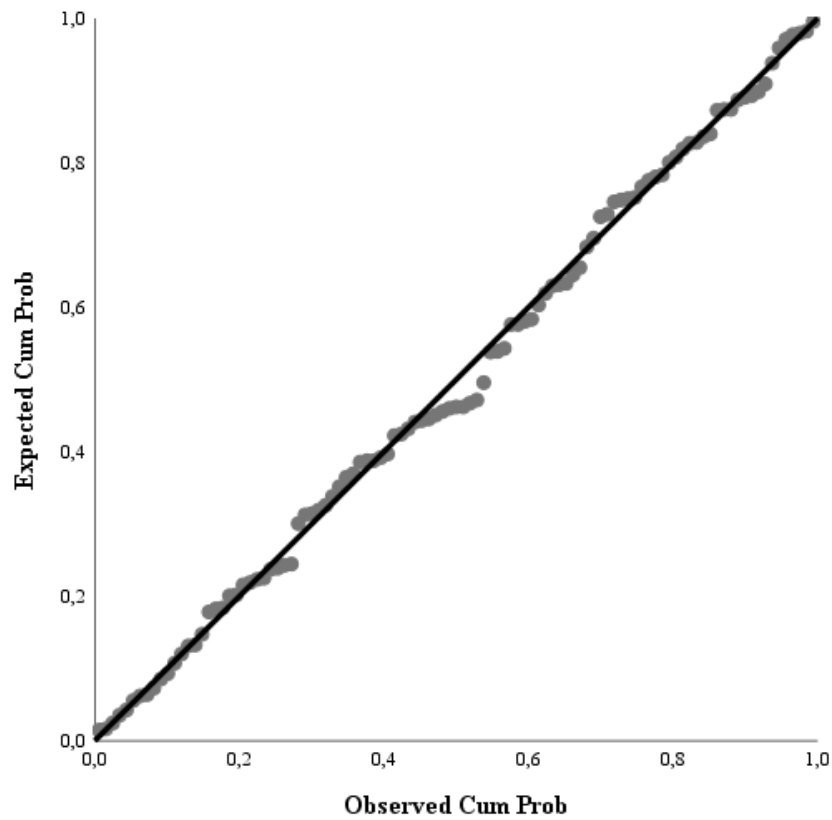
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Appendix

Figure 3

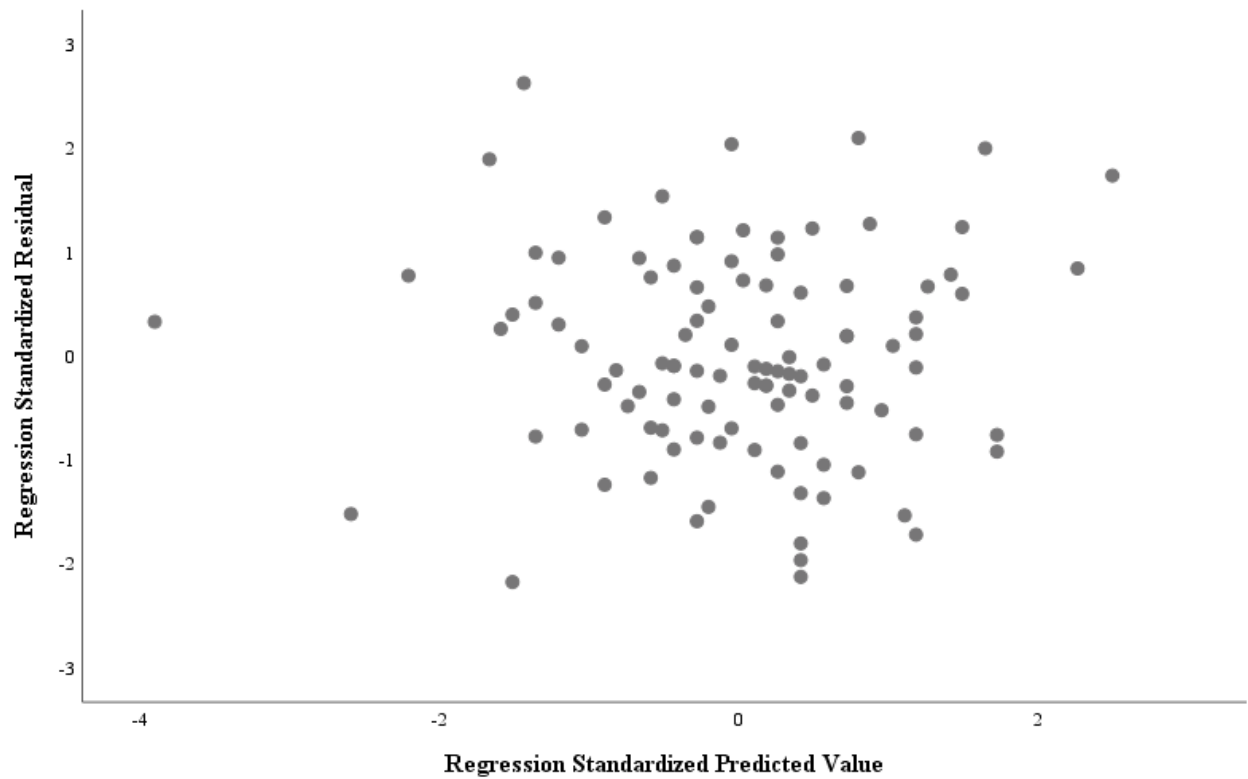
Normal P-P Plot to Predict Normality



Note. The dependent variable is the difference score between OCD symptoms at baseline and post treatment (Time_OCI). Derived from SPSS.

Figure 4

Scatterplot to Predict Homoscedasticity and Linearity.



Note. The dependent variable is the difference score between OCD symptoms at baseline and post treatment (Time_OCI). Derived from SPSS.