Mindfulness (2023) 14:1908–1917
https://doi.org/10.1007/s12671-023-02192-7

ORIGINAL PAPER

Mindfulness in Persons with Mild Dementia and Their Caregivers: Exploring Trait Rumination as a Clinical Outcome Measure

Philipp M. Keune[1,2,3] · Franziska Bernard[1,2] · Regina Meister[1,4] · Jana Keune[1] · Romy Springer[1,2] · Rüdiger Arlt[1] · Iva Holmerová[3] · Stefanie Auer[5] · Patrick Oschmann[1] · Sascha Hansen[1,2]

Accepted: 19 July 2023 / Published online: 7 August 2023

Abstract

Objectives Mindfulness-based interventions (MBIs) have been successfully applied to persons with dementia (PwD) and their caregivers and may yield beneficial effects on depression and quality of life. However, due to inconsistent results, it may be beneficial to re-examine mindfulness in PwD cross-sectionally to identify further potential therapeutic target variables. Rumination, the maladaptive disposition to excessively think about causes and consequences of symptoms and negative mood, may represent such a target. The current study sought to confirm the validity of trait rumination and the antagonistic relationship between mindfulness, rumination, and depression in PwD and their caregivers, as this may qualify rumination as a potential process and outcome variable in future MBIs.

Method Forty patients with mild dementia completed a neuropsychological examination and provided self-report data on trait mindfulness, depression, and rumination. Self-report measures were also obtained from 30 caregivers. Regression analyses were used to examine the relation between mindfulness, depression, and rumination. We used clinical cutoffs for depression and rumination to estimate the practical implications of the opposing relationships between these variables.

Results For PwD, mindfulness was significantly negatively correlated with depression and rumination, explaining 37% and 25% of variance, respectively. In PwD with low mindfulness scores, clinical depression and rumination syndromes occurred more frequently than in those with high mindfulness. Caregiver results were compatible.

Conclusion Mindfulness shows an antagonistic relationship with clinically relevant rumination in PwD. Rumination may represent a relevant clinical outcome variable for future MBIs that can be reliably measured in PwD through validated self-report measures.

Preregistration This study is not preregistered.

Keywords Dementia · Mindfulness · Rumination · Depression · Resilience · Mindfulness-Based Interventions

The increasing prevalence of dementia syndromes represents a major challenge for healthcare professionals and the healthcare system in general (Alary et al., 2017; Auer et al., 2018; Kaplan & Berkman, 2011). For affected patients and their next of kin, a dementia diagnosis is a significant negative life event. In context of limited healthcare resources, they may receive little support during routine clinical processes in dealing with the emotional consequences involved (Schott et al., 2022; Villarejo-Galende et al., 2022). This issue may to a certain extent be addressed in group interventions, such as mindfulness-based interventions (MBIs). In these interventions, patients and caregivers may obtain skills in dealing with stress, depressive mood states, and fear that frequently accompany dementia diagnoses (Brown et al., 2016; Chacko et al., 2022; Douglas et al., 2022).

✉ Philipp M. Keune
pmkeune@gmail.com

1 Department of Neurology, Klinikum Bayreuth GmbH, Medical Campus Upper Franconia, Hohe Warte 8, 95445 Bayreuth, Germany

2 Department of Cognition, Emotion and Neuropsychology, Otto-Friedrich-University of Bamberg, Bamberg, Germany

3 Center of Expertise in Longevity and Long-Term Care, Charles University Praha, Praha, Czech Republic

4 Department of Clinical Neuropsychology, Ludwig-Maximilians-University of Munich, Munich, Germany

5 Department of Dementia Research, University for Continuing Education Krems, Praha, Austria

Patients and caregivers may benefit from MBIs due to the cultivation of mindfulness, i.e., the behavioral disposition to focus attention on the present moment experience, while keeping an open, non-judgmental, and accepting attitude, which may represent a factor of resilience in dementia (Innis et al., 2021). The concept of mindfulness is rooted in Buddhist meditation practice that has been successfully adapted for secular clinical interventions, such as Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990) and Mindfulness-Based Cognitive Therapy (MBCT; Segal et al., 2013). Several studies have examined a potentially beneficial impact of MBIs in PwD and their caregivers, with initial supportive results (Berk et al., 2018; Chan et al., 2020; Han, 2022a, 2022b; Hoffman et al., 2020; Larouche et al., 2015). The participation in MBI programs has been shown to be associated with a reduction in cognitive decline, likely attributable to a reduction in perceived stress, lower mood disturbances, depression and anxiety, as well as improved quality of life (Berk et al., 2018; Russell-Williams et al., 2018). Nevertheless, it also needs to be noted that the body of concurrent studies is still relatively limited, also includes mixed results, and that more research is required to optimize the research methodology and content of MBIs in PwD and their caregivers (Antoniou et al., 2022; Chan et al., 2020; Liu et al., 2017; Marchant et al., 2018).

In this context, Innis et al. (2021) have suggested that examining baseline (trait) mindfulness cross-sectionally in more detail may be useful for the development of future MBIs. Compatible with this rationale, Innis et al. (2021) observed that higher baseline mindfulness was related to improved patient and caregiver outcomes (e.g., quality of life, mood, cognitive performance). Particularly for patients in patient-caregiver dyads with higher mindfulness, outcomes were improved. Hence, MBIs that address mental health of both patients and their caregivers may be particularly effective. Compatible with this notion, Berk et al. (2018) suggested that it may be particularly effective to apply MBIs to the system of both patient and caregiver, to yield an increased beneficial effect.

Previous work, as indicated above, showed how MBIs may be optimized by including patient-caregiver dyads or family systems (Berk et al., 2018; Innis et al., 2021). In line with Innis et al. (2021), here we suggest that a complementary approach may be to identify further specific therapeutic target variables in cross-sectional studies. These target variables may then be operationalized as clinical outcome measures in future MBIs. A potentially relevant target variable may be rumination.

Rumination refers to the behavioral disposition to recurrently and excessively analyze symptoms, causes, and consequences of negative mood states, as opposed to engagement in active problem-solving behavior. It has been shown to be a predisposing and maintaining factor of depressive episodes in various psychiatric groups (Nolen-Hoeksema et al., 2008). Watkins and Roberts (2020) provided an integrative model of the effects and working mechanisms of rumination based on an extensive literature review. The authors outline that rumination yields a magnification and prolongation of negative mood and reduces problem-solving behavior. Moreover, rumination yields the development of habitual negatively biased information processing. The underlying mechanisms are summarized as *h*abit development, reduced *ex*ecutive functioning, *a*bstract processing, a focus on *go*al discrepancies, and *n*egative bias (H-EX-A-GO-N model). Compatible with this model, in recurrently depressed patients, it has been shown that rumination has its detrimental effect, since it binds attentional resources to negative mood states and makes attentional resource allocation (i.e., executive attention control) less flexible (Bostanov et al., 2012). In contrast, mindfulness improves flexibility in attentional resource allocation, hence functioning as an antidote (Bostanov et al., 2012; Keune et al., 2011, 2012, 2013). In sum, mindfulness has been shown to have a positive effect on rumination, positively affecting its known mechanisms, as well as on depressive symptoms in various clinical and healthy groups.

However, to the best of our knowledge, the relation between mindfulness and rumination has not been examined in PwD and their caregivers. We suggest that an examination of these variables in a cross-sectional design may be useful for several reasons: First, it remains to be verified whether a relatively complex construct such as rumination can be reliably measured in PwD. Previous studies have shown that different psychological constructs can be reliably measured in persons with mild dementia by means of self-report measures (Russell-Williams et al., 2018). However, it appears necessary to confirm that this is also the case for rumination, as cognitive deficits, albeit mild ones, might make it difficult for patients to provide sensible responses to a certain extent. In a cross-sectional design, also convergent validity with other relevant variables, such as depression and mindfulness, may be confirmed. Based on this rationale, the current work focused on persons with *mild* dementia, as we assumed that this group of patients would indeed be able to provide sensible responses on the self-report measures.

Secondly, we suggest that the confirmation of a negative relation between mindfulness and rumination on a trait level would be compatible with the assumption that therapeutic mechanisms of MBIs in PwD might be similar to those in other patient groups, such as recurrently depressed patients. Specifically, this would imply that mindfulness may have the potential to improve flexibility in attentional resource allocation. This notion may then be followed up by future intervention studies, using similar methodology as in previous psychiatric samples (Bostanov et al., 2012).

In sum, to the best of our knowledge, studies on the validity of self-reported rumination in PwD are scarce. Based on the considerations above, the purpose of the current study was to provide new original data on the validity of self-reported rumination in PwD, in particular on its convergent validity with other relevant measures, i.e., mindfulness and depression. In this context, it was examined whether the opposing relationship between mindfulness and rumination as commonly observed in psychiatric groups without dementia could be replicated in PwD. The current work may hence inform future MBIs in PwD on the use of self-reported trait rumination and may provide valuable information on whether rumination represents a relevant clinical outcome variable and a potentially important therapeutic process variable.

Method

Participants

Patient and caregiver clinical and demographic data is presented in Tables 1 and 2. In sum, 40 patients and 30 caregivers were included in the current study. Inclusion criteria involved a mild dementia syndrome and exclusion criteria involved severe cognitive deficits that would have interfered with patients providing informed consent, apraxia, motor impairment that would have interfered with the completion of neuropsychological tests, as well as aphasia. Patient and caregiver recruitment occurred throughout the routine clinical process of the Department of Neurology, Klinikum Bayreuth GmbH, Medical Campus Upper Franconia, Germany, during the period of 01/2022–12/2022. Potential participants were approached during routine clinical care in the section of neuropsychology, where they were diagnosed as part of the formal differential diagnostic process.

Procedure

Upon inclusion in the study, participants completed a comprehensive neuropsychological examination implemented by means of the Consortium to Establish a Registry for Alzheimer's Disease (CERAD; Morris et al., 1989) test battery. Subsequently, patients also completed the Freiburg Mindfulness Inventory (FMI; Walach et al., 2006), the Geriatric Depression Scale (GDS; Hanson et al., 2004), and the Response-Styles Questionnaire (Kühner et al., 2007; RSQ; Nolen-Hoeksema & Morrow, 1991), i.e., a measure of trait rumination. The same self-report measures were also completed by patients' available caregivers who were contacted by the neuropsychologists of the study center.

In the routine clinical process, patients also underwent further diagnostic procedures including a clinical neurological examination, an MRI, and FDG-PET/CT examination, as well as a liquor-diagnostic procedure to estimate cerebrospinal levels of amyloid beta and tau proteins. In this context, the final diagnostic decision with regard to the etiology underlying respective dementia syndromes was discussed in recurrent

Table 1 Sample description

Patient demographics and clinical characteristics	Statistic
n (male/female)	20/20
Age (*M, SD*)	76.48, 9.00
Clinical characteristics	
Dementia type (*n*)	
Alzheimer's disease (AD)	11
Parkinson's disease dementia (PDD)	12
Lewy body disease (LBD)	2
Secondary Parkinson syndrome (SPS)	1
Vascular dementia (VD)	4
Mixed dementia (MD)	10
Cognitive performance	
MMSE (*z*-score *M*, *SD*)[a]	–2.45, 1.33
Self-report measures	
Depression (GDS; *M, SD*)	4.03, 3.52
Depressive syndrome (yes/no)[b]	16/24
Symptom-focused rumination (RSQ; *M, SD*)	14.18, 4.20
Clinical rumination (yes/no)[c]	10/30
Self-focused rumination (RSQ; *M, SD*)	11.73, 3.64
Clinical rumination (yes/no)[c]	4/36
Mindfulness (FMI; *M, SD*)	39.15, 7.60

[a]A *z*-score of –1 indicates that individual MMSE performance corresponded to –1 standard deviation relative to the age- and education-corrected normative database of the CERAD

[b]Clinically relevant depressive syndrome according to cutoff score of the GDS

[c]Clinically relevant rumination behavior relative to normative RSQ data

Table 2 Caregiver self-report data

Measure	Statistic
Self-report measures	
Depression (GDS; *M, SD*)	3.13, 2.30
Depressive syndrome (yes/no)[a]	7/23
Symptom-focused rumination (RSQ; *M, SD*)	13.13, 4.30
Clinical rumination (yes/no)[b]	5/25
Self-focused rumination (RSQ; *M, SD*)	11.20, 3.16
Clinical rumination (yes/no)[b]	3/37
Mindfulness (FMI; *M, SD*)	39.47, 6.21

[a]Clinically relevant depressive syndrome according to cutoff score of the GDS

[b]Clinically relevant ruminative behavior relative to normative RSQ data

interdisciplinary team meetings of clinical staff and obtained from patients' files for the current study. With regard to dementia syndromes, patients were included in case of scoring at least 18 points on the Mini-Mental Status Examination (MMSE; Folstein et al., 1975) while scoring $z \leq -1$ in one of the memory domains of the CERAD (verbal, non-verbal) and $z \leq -1$ in one other domain of the CERAD test battery, relative to the age- and education-corrected normative database of the CERAD. Patients whose cognitive performance fell into this range were diagnosed as displaying a mild dementia syndrome. CERAD domains were classified based on an established procedure that assorts CERAD subscales to domains according to a three-factor solution, i.e., verbal memory, non-verbal memory, and general verbal cognitive abilities (Hansen et al., 2022).

Measures

For the examination of depressive symptoms, the German version of the Geriatric Depression Scale (GDS; Hanson et al., 2004) was administered. The GDS is a 15-item scale on which positively and negatively formulated simple statements relevant for depression addressing mood, interests, activity level, and life satisfaction can be confirmed or disconfirmed, e.g., "Are you basically satisfied with your life?" "Do you feel that your life is empty?". Validity and reliability of the German version of the GDS have been established as excellent (Cronbach's $\alpha = 0.91$; Gauggel & Birkner, 1999). The scale provides a single sum score for statements in which depressive symptoms were confirmed. The following categorization has been established: 0–4 normal, 5–8 mild, 9–11 moderate, and 12–15 severe depression.

Rumination was assessed by means of the Response-Styles Questionnaire (Kühner et al., 2007; RSQ; Nolen-Hoeksema & Morrow, 1991). The RSQ was developed based on notions of the Response-Styles Theory (RST). According to RST, the recursive analysis of the origin and consequences of symptoms and negative affect yields an increase and maintenance of negative affective states, preventing the engagement in effective problem-solving behavior (Nolen-Hoeksema et al., 2008). The RSQ includes 23 items rated on a Likert scale from 1 to 4. The items yield three scales, i.e., symptom-focused rumination, self-focused rumination, and distraction tendencies. The current work focused on outcomes of symptom-focused and self-focused rumination. The former refers to behavioral tendencies to excessively think about reasons and consequences of symptoms and negative affective states (maximum score: 32). The latter refers to the tendency to engage in recurrent thinking about negative self-aspects (maximum score: 28). Internal consistency has been established as sufficient for each scale (Cronbach $\alpha = 0.81$–0.84; Kühner et al., 2007). Normative data is provided by the authors, based on which individual scores obtained in the current work were transformed into percentage rank scores and a percentage rank ≥ 80 was used as the cutoff for clinically relevant rumination.

The Freiburg Mindfulness Inventory (FMI; Cronbach's $\alpha = 0.86$; Walach et al., 2006) is a 14-item self-report measure that assesses a single factor of trait mindfulness. Items are rated on a Likert scale from 1 to 4 and a single sum score is derived (maximum score: 56).

Neuropsychological Examination

The neuropsychological examination was implemented by means of the CERAD test battery (Morris et al., 1989). In the version administered here (CERAD Plus), the test battery contains a total of 12 tests. These tests address the domains of declarative episodic verbal long-term memory (word-list learning with immediate recall, delayed recall, and discrimination task) and visuospatial episodic long-term memory (figure drawing with delayed recall). They further address executive functioning in terms of divergent problem solving on a verbal fluency task, information processing, and psychomotor speed in combination with visual scanning (Trail Making Test), as well as object recognition (Boston Naming Test). Finally, the CERAD also includes the Mini-Mental Status Examination (MMSE; Folstein et al., 1975) as a screening instrument. The CERAD has been established as a widely used measure in dementia diagnostics and has been shown to be a reliable, accurate instrument in this context (Hansen et al., 2022). Individual test scores were evaluated based on the CERAD database of an age- and education-corrected healthy comparison group by deriving individual z-scores, relative to this database.

Statistical Analyses

The statistical analysis was implemented by means of SPSS (Version 20.0. Armonk, NY: IBM Corp.). In a first step, descriptive intercorrelations (Pearson correlation coefficient) between the primary variables (mindfulness, depression, rumination) were computed for patients and their caregivers. In order to reduce the risk of Type-1 error inflation, the significance threshold was set at $p < 0.01$, i.e., $p = 0.05/5$, reflecting five correlations in each group (symptom-focused and self-focused rumination correlated with mindfulness and depression; mindfulness correlated with depression). As symptom-focused and self-focused rumination are known to be highly correlated, subsequently, a linear regression model was implemented, in which these two scales were regressed on the mindfulness scale simultaneously, in order to determine which scale primarily drove the correlation between rumination and mindfulness. Finally, in order to obtain descriptive information on the potential clinical relevance of the assumed antagonistic relationship between mindfulness on the one hand and rumination and depression on the other

hand, the clinical cutoff of the RSQ was used. This clinical cutoff was used to determine the proportion of patients with clinically elevated rumination scores in a high- and low-mindfulness group, respectively. Groups were formed using a median split. The same procedure was applied for depression scores obtained by means of the GDS and in case of self-report data provided by caregivers.

A power analysis was implemented by means of G*Power software (Faul et al., 2009). Previous work on the relation between mindfulness, depression, and rumination has revealed that these variables show moderate to strong systematic intercorrelations in various psychiatric, neurological, and healthy groups (Keune et al., 2011, 2012; Sauder et al., 2021a, 2021b). However, to the best of our knowledge, such findings have not been replicated in PwD with the common instruments used in the current work. It appears feasible that even in mild dementia, there might be a disruption of semantic processing, albeit minor, that might yield difficulties for patients when responding to questions that address complex constructs such as mindfulness and rumination. Nevertheless, given the exhaustive diagnostics administered in the current work and the requirement of a minimum of 18 points on the MMSE as an inclusion criterion, we assumed that it would be possible for patients to provide sensible and systematic responses on the self-report measures. Consequently, we expected at least moderate intercorrelations in a range between $r = 0.45$ and 0.65 between the administered scales.

Based on these considerations, the power analysis indicated that in context of a one-tailed bivariate normal correlation model, a correlation coefficient of 0.45 would be detectable in combination with an α-error probability of 0.05 and a power of $\beta = 0.80$ using a sample size of $n = 29$ (G*Power; Faul et al., 2009). We assumed that it would not be possible to obtain complete self-report data from all caregivers of included patients and based on these considerations decided to include a minimum of 40 patients to ensure that the minimally required sample size of $n = 29$ would also be surpassed in case of caregivers. The final sample of 40 patients yielded 30 datasets of caregivers which in sum is sufficient to address the main issue of the current work.

Results

Mindfulness, Depression, and Rumination in PwD

Descriptive intercorrelations between mindfulness, depression, and rumination reported by PwD are presented in Table 3. As assumed, trait mindfulness showed consistent negative correlations with depression as well as with the maladaptive characteristics of self-focused and symptom-focused rumination, i.e., the rumination subscales of the RSQ. The negative correlations with depression and symptom-focused rumination remained significant following the Bonferroni correction procedure using a threshold of $p < 0.01$. Mindfulness accounted for 37% of variance of depression and 25% of variance of symptom-focused rumination.

Table 3 Correlations between mindfulness, depression, and rumination in patients with mild dementia

	Depression	Self-focused rumination	Symptom-focused rumination
Mindfulness	–0.61***	–0.34*	–0.50**
Symptom-focused rumination	0.60***	0.76***	
Self-focused rumination	0.56***		

p-values: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

Table 4 Regression model using self-focused rumination and symptom-focused rumination as predictors of mindfulness

	B	*SE B*	*β*	*t*	*p*
Constant	51.54	3.95		13.06	< 0.001
Symptom-focused rumination	–1.05	0.39	–0.58	–2.69	0.011
Self-focused rumination	0.22	0.46	0.10	0.47	0.64

Even though correlations between depression and the rumination scales were not of primary interest in the analysis, it appears noteworthy that these also showed highly significant intercorrelations. This indicates that self-report measures could be completed sensibly and systematically by patients and confirms the convergent validity of the obtained measures.

Results of the regression model in which both rumination scales were regressed on the mindfulness scale simultaneously are depicted in Table 4. As suggested by the descriptive intercorrelations, this model confirmed that the association between mindfulness and rumination was primarily driven by the significant negative correlation between mindfulness and symptom-focused rumination. Figure 1 provides an illustration of the identified correlations between mindfulness on the one hand and symptom-focused rumination (Fig. 1a) and depression (Fig. 1b) on the other hand.

Mindfulness, Rumination, and Depression in Caregivers

Descriptive intercorrelations of mindfulness, depression, and rumination in caregivers are displayed in Table 5. In this case, mindfulness also showed a significant negative correlation with depression, which remained significant following the Bonferroni correction procedure. Mindfulness also showed a marginally significant negative correlation with symptom-focused rumination, even though this correlation did not remain significant following Bonferroni correction.

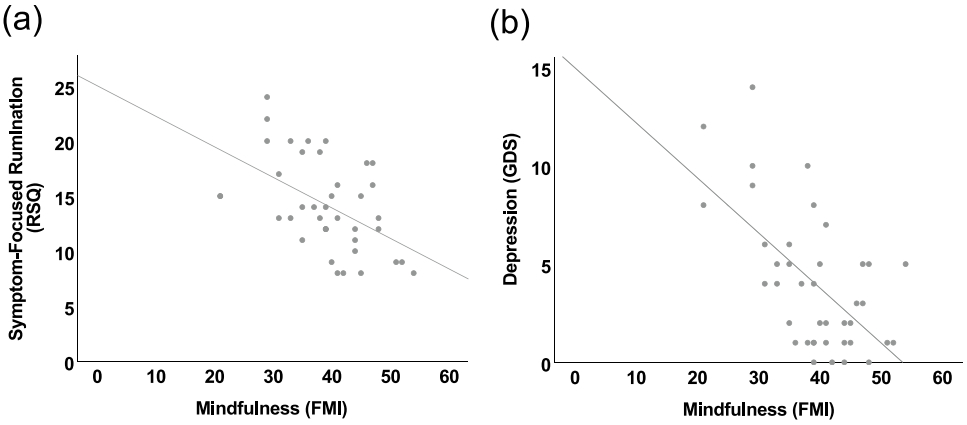

Fig. 1 Scatterplots of the correlations between self-reported mindfulness and symptom-focused rumination (**a**) and depression (**b**) in patients with mild dementia

Table 5 Correlations between mindfulness, depression, and rumination in caregivers

	Depression	Self-focused rumination	Symptom-focused rumination
Mindfulness	–0.45**	–0.18	–0.35*
Symptom-focused rumination	0.48**	0.72***	
Self-focused rumination	0.43**		

p-values: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

Table 6 Depression syndromes and rumination in patients with mild dementia with low vs. high mindfulness

	Low-mindfulness group	High-mindfulness group
Depression syndromes (*n*, percentage)	11/20, 55%	5/20, 25%
Mild depression syndrome	6/20, 30%	4/20, 20%
Moderate depression syndrome	3/20, 15%	1/20, 5%
Severe depression syndrome	2/20, 10%	0/20, 0%
Clinical symptom-focused rumination	8/20, 40%	2/20, 10%

Estimation of Clinical Relevance of the Potentially Protective Effect of Mindfulness

The proportion of patients with clinically relevant rumination and depression syndromes in the high- and low-mindfulness groups ($n = 20$, respectively) are presented in Table 6. In sum, 40% of the patients in the low-mindfulness group reported elevated rumination based on established clinical cutoffs. In contrast, the incidence of clinically elevated rumination in patients with high mindfulness levels was 10%. A chi-square test revealed that clinically elevated rumination occurred significantly less frequently in the high-mindfulness than in the low-mindfulness group [$\chi^2(1) = 4.80$, $p < 0.05$]. Similarly, the occurrence and intensity of clinically relevant depressive syndromes was significantly lower in the high-mindfulness than in the low-mindfulness group [$\chi^2(1) = 3.75$, $p < 0.05$].

Table 7 Depression syndromes and rumination in caregivers with low vs. high mindfulness

	Low-mindfulness group	High-mindfulness group
Depression syndromes (*n*, percentage)	6/15, 40%	1/15, 7%
Mild depression syndrome	6/15, 40%	1/15, 7%
Moderate depression syndrome	0/15, 0%	0/15, 0%
Severe depression syndrome	0/15, 0%	0/15, 0%
Clinical symptom-focused rumination	0/15, 0%	0/15, 0%

The proportion of caregivers with clinically relevant depression syndromes and rumination is presented in Table 7. Of those caregivers with low mindfulness scores, 40% reported clinically relevant depression syndromes, all of which were mild. In caregivers with high mindfulness only in one case (7%), a mild depression syndrome was reported. Unlike patients, caregivers did not surpass the clinical cutoff of elevated rumination, i.e., did not provide responses on the self-report measure that exceeded a percentage rank of 80, relative to normative data provided by the authors of the self-report measure (Kühner et al., 2007).

Discussion

The purpose of the current cross-sectional study was to examine rumination as a candidate for a potentially relevant clinical outcome measure in future MBIs in PwD and their caregivers. To this end, the relation between mindfulness, rumination, and depression was examined, in order to obtain information

about the convergent validity of self-report rumination measures in mild dementia. Further, it was supposed to be examined whether the antagonistic relationship between mindfulness and rumination as commonly observed in psychiatric groups without dementia could be replicated in PwD. Mindfulness-based interventions (MBIs) have received considerable attention in recent years, as interventions with the potential to provide further support for PwD and their caregivers (Berk et al., 2018; Chacko et al., 2022; Han, 2022a; Shim et al., 2021). To further optimize the methodology of intervention studies, Innis et al. (2021) suggested that it may be helpful to identify further therapeutic target variables. Rumination might represent such a target and hence also reflect a useful process and outcome measure in intervention studies. While the antagonistic relationship between trait mindfulness on the one hand, and rumination and depression on the other hand, has been shown in healthy, different psychiatric and neurological groups (Keune et al., 2012, 2013; Sauder et al., 2021a, 2021b), to the best of our knowledge, it has not been replicated in and extended to PwD with the common measures employed in the current work (FMI, RSQ, GDS).

Mindfulness, Rumination, and Depression in Patients: Methodological Considerations

In the current study, trait mindfulness showed consistent, systematic antagonistic relationships with rumination and depression in PwD. From a methodological perspective, one may conclude that the convergent validity of self-report measures addressing the constructs of mindfulness, rumination, and depression is given in this group of patients. Even though it could be assumed that PwD might have some mild semantic difficulties when responding to the self-report items, this issue did not have a considerable impact on the obtained results. Consequently, it appears feasible to suggest that measures of trait rumination, as operationalized here, may be implemented in future MBIs in PwD.

Mindfulness, Rumination, and Depression in Patients: Clinical Implications

Our results also suggest that implementing rumination measures in future work is not only feasible from a methodological perspective. In the current study, trait mindfulness explained 37% of variance of depression and 25% of rumination. One may speculate that this substantial congruency of variance suggests that trait mindfulness may represent a protective factor against rumination and depression. This is supported by the finding that clinically relevant depressive syndromes and clinically relevant rumination occurred significantly less frequently in individuals with high trait mindfulness than in those with low trait mindfulness. Despite the limitation that these findings were obtained in the context of a cross-sectional study, in sum, they are generally compatible with the notion that trait mindfulness expresses a protective effect against rumination and depression in PwD. In turn, rumination may represent a useful outcome and process variable in intervention studies.

According to a proposition by Watkins and Roberts (2020), rumination leads to an increased intensity and duration of negative mood states and reduces problem-solving behavior. According to the authors, an important mechanism underlying this process is the development of habitual negatively biased information processing. Based on the results of the current study, one may hence speculate further that PwD and caregivers characterized by high trait mindfulness may be able to avoid a biased rigid focus on goal discrepancies. Affected families might be able to cope with the discrepancy between the goal of leading a healthy life versus the reception of a dementia diagnosis. They might achieve this by retaining flexibility in attentional resource allocation and an accepting, nonjudgmental (mindful) attitude. This in turn may help them in dealing with everyday life challenges associated with dementia and reduce depressive symptoms. Even though currently these notions remain speculative, the current study provides important information on how they may be addressed in future intervention studies in more detail.

Results of the current work generally also complement previous findings by Innis et al. (2021) who examined the relation between mindfulness and depression in a considerably larger and more heterogeneous sample than in the current work. The sample examined by Innis et al. included patients with mild cognitive impairment (MCI) as well as dementia in different stages ($n=291$) and in this case, mindfulness and depression showed a correlation of $r=-0.38$, i.e., lower than in the current work (see Table 3 for comparison). This may be attributed to the fact that in the current work, only patients with mild dementia were included, whereas, the sample in the work by Innis et al. (2021) was more heterogeneous. It is conceivable that exacerbated cognitive deficits in patients with moderate dementia may to some extent interfere with sensible completion of self-report measures, yielding unsystematic variance and therefore a lower congruency of variance of the examined constructs. Irrespective of these considerations, based on the results of the current work, rumination can be regarded as a clinically relevant outcome measure in PwD that can be effectively operationalized by means of the RSQ.

Mindfulness, Rumination, and Depression in Caregivers

Convergent support for these conclusions may be derived from results obtained from caregivers. Here, the same pattern of intercorrelations between the implemented measures arose. Moreover, whereas 40% of caregivers in the group characterized by low mindfulness reported a clinically relevant mild

depressive syndrome, this was only the case for 7% in the high-mindfulness group. In case of caregivers, rumination did not surpass a clinical threshold, in contrast to what was observable in patients. Nevertheless, the fact that the same antagonistic relationship between mindfulness, rumination, and depression was observed in caregivers suggests that MBIs administered to patient-caregiver dyads and incorporating rumination as an outcome and process variable may be feasible.

Implications for Future MBIs in Patients with Dementia

Incorporating the findings of the current work in future MBIs tailored to PwD and their caregivers may be achieved by including measures of rumination as a process variable throughout the intervention and as an outcome variable. Concerning the content of MBIs, the current results also suggest that it may be indicated to include psychoeducative session elements that highlight the detrimental impact of rumination. For example, meditation exercises could be preceded by an explanation of what rumination is, why it is commonly engaged in, and why it may exacerbate negative mood. In this context, mindfulness as a state and trait may be introduced as an antidote to rumination.

The response-styles theory further postulates that distraction strategies are also effective to some extent in reducing negative effects of ruminative tendencies (Nolen-Hoeksema et al., 2008). It would be conceivable that these issues may be addressed in MBIs by means of a solution-focused therapeutic approach in a group setting. A solution-focused approach would involve patients and caregivers in generating resource-oriented behavioral alternatives to rumination based on an exploration of their personal values, their own personal experience, and examples from everyday life (De Shazer et al., 1986).

Limitations and Future Directions

The current study involved several noteworthy limitations, particularly a relatively small sample size and a cross-sectional design, based on which no direct conclusions with regard to a potentially protective effect of trait mindfulness against rumination and depression can be derived. On the other hand, a power analysis based on results from relevant previous studies warranted the current sample size as sufficient and all inter-correlations between operationalized variables were consistently observable, as assumed. This may in part be attributed to the stringent diagnostic procedure that was implemented. Further, despite the indicated limitations, the current work provides new, original information on rumination as a clinically relevant measure for which it appears feasible to be included in future intervention studies in PwD. This is in line with previous suggestions by Innis et al. (2021) to identify more therapeutic targets of MBIs in PwD and may support further development of MBIs in this group of patients.

In sum, rumination could be identified as a clinically relevant outcome measure for future intervention studies using MBIs in PwD. Assessments of rumination in PwD are characterized by convergent validity and the operationalization of rumination by means of the RSQ is feasible in this group of patients. Finally, the current results suggest that mindfulness represents a protective factor in PwD which shows an antagonistic relationship with rumination and depression. Future MBI in PwD may be refined based on results reported in the current work.

Acknowledgements The authors express their gratitude to the research commission of the Klinikum Bayreuth GmbH, Medical Campus Upper Franconia, Germany.

Author Contribution Philipp M. Keune: conceptualization, support of funding acquisition, methodology, statistical analysis, writing–original draft preparation. Franziska Bernard: conceptualization, patient recruitment, study implementation, writing–reviewing and editing. Regina Meister: conceptualization, patient recruitment, study implementation, writing–reviewing and editing. Jana Keune: conceptualization, writing–reviewing and editing. Romy Springer: conceptualization, patient recruitment, study implementation, writing–reviewing and editing. Rüdiger Arlt: conceptualization, writing–reviewing and editing. Iva Holmerová: conceptualization, writing–reviewing and editing. Stefanie Auer: conceptualization, writing- reviewing and editing. Patrick Oschmann: conceptualization, writing–reviewing and editing. Sascha Hansen: conceptualization, funding acquisition, methodology, writing–original draft preparation.

Funding This study was supported by personal funding granted to SH by the Klinikum Bayreuth GmbH, Medical Campus Upper Franconia, Germany.

Data Availability Data of this study can be made available by the corresponding author upon reasonable request.

Declarations

Ethics Approval This study was approved by the ethics committee of the University of Bamberg, Germany, REF: 2021–12/54 17/01/2022.

Informed Consent All the participants gave informed consent to participate in the study.

Conflict of Interest The authors declare that they have no competing interests.

Use of Artificial Intelligence AI was not used to edit the manuscript nor to improve English language.

References

Alary, F., Goldberg, J., & Joanette, Y. (2017). When the rising tide impacts the world: Addressing the global challenge of dementia. *Canadian Journal on Aging / La Revue Canadienne Du Vieillissement, 36*(3), 415–418. https://doi.org/10.1017/S0714980817000265

Antoniou, R., Toli, D. G., Lerner, H., Callahan, P., Coble, R., Ortiz, B., Sideman, A. B., Shdo, S. M., Levenson, R. W., Ferreira, N., Moskowitz, J. T., & Rankin, K. P. (2022). A mindfulness-based intervention adapted to dementia caregivers: A study protocol for a randomized clinical control trial. *Frontiers in Psychology, 13*, 1062452. https://doi.org/10.3389/fpsyg.2022.1062452

Auer, S. R., Höfler, M., Linsmayer, E., Beránková, A., Prieschl, D., Ratajczak, P., Šteffl, M., & Holmerová, I. (2018). Cross-sectional study of prevalence of dementia, behavioural symptoms, mobility, pain and other health parameters in nursing homes in Austria and the Czech Republic: Results from the DEMDATA project. *BMC Geriatrics, 18*(1), 178. https://doi.org/10.1186/s12877-018-0870-8

Berk, L., Warmenhoven, F., van Os, J., & van Boxtel, M. (2018). Mindfulness training for people with dementia and their caregivers: Rationale, current research, and future directions. *Frontiers in Psychology, 9*, 982. https://doi.org/10.3389/fpsyg.2018.00982

Bostanov, V., Keune, P. M., Kotchoubey, B., & Hautzinger, M. (2012). Event-related brain potentials reflect increased concentration ability after mindfulness-based cognitive therapy for depression: A randomized clinical trial. *Psychiatry Research, 199*(3), 174–180. https://doi.org/10.1016/j.psychres.2012.05.031

Brown, K. W., Coogle, C. L., & Wegelin, J. (2016). A pilot randomized controlled trial of mindfulness-based stress reduction for caregivers of family members with dementia. *Aging & Mental Health, 20*(11), 1157–1166. https://doi.org/10.1080/13607863.2015.1065790

Chacko, E., Ling, B., Avny, N., Barak, Y., Cullum, S., Sundram, F., & Cheung, G. (2022). Mindfulness-based cognitive therapy for stress reduction in family carers of people living with dementia: A systematic review. *International Journal of Environmental Research and Public Health, 19*(1), 614. https://doi.org/10.3390/ijerph19010614

Chan, J., Leung, D. K. Y., Walton, H., Wong, G. H. Y., & Spector, A. (2020). Can mindfulness-based interventions benefit people with dementia? Drawing on the evidence from a systematic review in populations with cognitive impairments. *Expert Review of Neurotherapeutics, 20*(11), 1143–1156. https://doi.org/10.1080/14737175.2020.1810571

De Shazer, S., Berg, I. K., Lipchik, E., Nunnally, E., Molnar, A., Gingerich, W., & Weiner-Davis, M. (1986). Brief therapy: Focused solution development. *Family Process, 25*(2), 207–221. https://doi.org/10.1111/j.1545-5300.1986.00207.x

Douglas, S., Stott, J., Spector, A., Brede, J., Hanratty, É., Charlesworth, G., Noone, D., Payne, J., Patel, M., & Aguirre, E. (2022). Mindfulness-based cognitive therapy for depression in people with dementia: A qualitative study on participant, carer and facilitator experiences. *Dementia, 21*(2), 457–476. https://doi.org/10.1177/14713012211046150

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods, 41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). 'Mini-mental state'. A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189–198. https://doi.org/10.1016/0022-3956(75)90026-6

Gauggel, S., & Birkner, B. (1999). Validität und Reliabilität einer deutschen Version der Geriatrischen Depressionsskala (GDS). [Validity and reliability of a German version of the geriatric depression scale]. *Zeitschrift für Klinische Psychologie und Psychotherapie, 28*(1), 18–27. https://doi.org/10.1026//0084-5345.28.1.18

Han, A. (2022). Effects of mindfulness-based interventions on depressive symptoms, anxiety, stress, and quality of life in family caregivers of persons living with dementia: A systematic review and meta-analysis. *Research on Aging, 44*(7–8), 494–509. https://doi.org/10.1177/01640275211043486

Han, A. (2022). Mindfulness-based interventions for older adults with dementia or mild cognitive impairment: A meta-analysis. *Clinical Gerontologist, 45*(4), 763–776. https://doi.org/10.1080/07317115.2021.1995561

Hansen, S., Keune, J., Küfner, K., Meister, R., Habich, J., Koska, J., Förster, S., Oschmann, P., & Keune, P. M. (2022). The congruency of neuropsychological and F18-FDG brain PET/CT diagnostics of Alzheimer's disease (AD) in routine clinical practice: Insights from a mixed neurological patient cohort. *BMC Neurology, 22*(1), 83. https://doi.org/10.1186/s12883-022-02614-4

Hanson, A. E., Scogin, F. R., Welsh, D. L., & Karpe, J. M. (2004). Geriatric depression scale. In M. E. Maruish (Ed.), *The use of psychological testing for treatment planning and outcomes assessment: Instruments for adults* (pp. 379–397). Lawrence Erlbaum Associates Publishers.

Hoffman, L., Hutt, R., Yi Tsui, C. K., Zorokong, K., & Marfeo, E. (2020). Meditation-based interventions for adults with dementia: A scoping review. *The American Journal of Occupational Therapy: Official Publication of the American Occupational Therapy Association, 74*(3), 7403205010p1-7403205010p14. https://doi.org/10.5014/ajot.2020.037820

Innis, A. D., Tolea, M. I., & Galvin, J. E. (2021). The effect of baseline patient and caregiver mindfulness on dementia outcomes. *Journal of Alzheimer's Disease, 79*(3), 1345–1367. https://doi.org/10.3233/JAD-201292

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. Delacorte Press.

Kaplan, D. B., & Berkman, B. (2011). Dementia care: A global concern and social work challenge. *International Social Work, 54*(3), 361–373. https://doi.org/10.1177/0020872810396255

Keune, P. M., Bostanov, V., Hautzinger, M., & Kotchoubey, B. (2011). Mindfulness-based cognitive therapy (MBCT), cognitive style, and the temporal dynamics of frontal EEG alpha asymmetry in recurrently depressed patients. *Biological Psychology, 88*(2–3), 243–252. https://doi.org/10.1016/j.biopsycho.2011.08.008

Keune, P. M., Bostanov, V., Kotchoubey, B., & Hautzinger, M. (2012). Mindfulness versus rumination and behavioral inhibition: A perspective from research on frontal brain asymmetry. *Personality and Individual Differences, 53*(3), 323–328. https://doi.org/10.1016/j.paid.2012.03.034

Keune, P. M., Bostanov, V., Hautzinger, M., & Kotchoubey, B. (2013). Approaching dysphoric mood: State-effects of mindfulness meditation on frontal brain asymmetry. *Biological Psychology, 93*(1), 105–113. https://doi.org/10.1016/j.biopsycho.2013.01.016

Kühner, C., Huffziger, S., & Nolen-Hoeksema, S. (2007). *Response styles questionnaire – deutsche Version [Response styles questionnaire - German version]*. Hogrefe.

Larouche, E., Hudon, C., & Goulet, S. (2015). Potential benefits of mindfulness-based interventions in mild cognitive impairment and Alzheimer's disease: An interdisciplinary perspective. *Behavioural Brain Research, 276*, 199–212. https://doi.org/10.1016/j.bbr.2014.05.058

Liu, Z., Chen, Q.-L., & Sun, Y.-Y. (2017). Mindfulness training for psychological stress in family caregivers of persons with dementia: A systematic review and meta-analysis of randomized controlled

trials. *Clinical Interventions in Aging, 12*, 1521–1529. https://doi.org/10.2147/CIA.S146213

Marchant, N. L., Barnhofer, T., Klimecki, O. M., Poisnel, G., Lutz, A., Arenaza-Urquijo, E., Collette, F., Wirth, M., Schild, A.-K., Coll-Padrós, N., Reyrolle, L., Horney, D., Krolak-Salmon, P., Molinuevo, J. L., Walker, Z., Maillard, A., Frison, E., Jessen, F., Chételat, G., SCD-WELL Medit-Ageing Research Group. (2018). The SCD-Well randomized controlled trial: Effects of a mindfulness-based intervention versus health education on mental health in patients with subjective cognitive decline (SCD). *Alzheimer's & Dementia, 4*, 737–745. https://doi.org/10.1016/j.trci.2018.10.010

Morris, J. C., Heyman, A., Mohs, R. C., Hughes, J. P., van Belle, G., Fillenbaum, G., Mellits, E. D., & Clark, C. (1989). The consortium to establish a registry for Alzheimer's disease (CERAD). Part I. Clinical and neuropsychological assessment of Alzheimer's disease. *Neurology, 39*(9), 1159–1165. https://doi.org/10.1212/wnl.39.9.1159

Nolen-Hoeksema, S., & Morrow, J. (1991). Response styles questionnaire. *APA PsycTests*. https://doi.org/10.1037/t03823-000

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*(5), 400–424. https://doi.org/10.1111/j.1745-6924.2008.00088.x

Russell-Williams, J., Jaroudi, W., Perich, T., Hoscheidt, S., El Haj, M., & Moustafa, A. A. (2018). Mindfulness and meditation: Treating cognitive impairment and reducing stress in dementia. *Reviews in the Neurosciences, 29*(7), 791–804. https://doi.org/10.1515/revneuro-2017-0066

Sauder, T., Hansen, S., Bauswein, C., Müller, R., Jaruszowic, S., Keune, J., Schenk, T., Oschmann, P., & Keune, P. M. (2021). Mindfulness training during brief periods of hospitalization in multiple sclerosis (MS): Beneficial alterations in fatigue and the mediating role of depression. *BMC Neurology, 21*(1), 390. https://doi.org/10.1186/s12883-021-02390-7

Sauder, T., Keune, P. M., Müller, R., Schenk, T., Oschmann, P., & Hansen, S. (2021). Trait mindfulness is primarily associated with depression and not with fatigue in multiple sclerosis (MS): Implications for mindfulness-based interventions. *BMC Neurology, 21*(1), 115. https://doi.org/10.1186/s12883-021-02120-z

Schott, B. H., Voetlause, J. C., Amoah, J. L., Kratzenberg, A., Belz, M., Knipper, T., Timäus, C., Beskow, C., Sweeney-Reed, C. M., Wiltfang, J., & Radenbach, K. (2022). Establishment of a teaching hospital-based dementia consultation service for rurally-based regional district general hospitals. *Frontiers in Public Health, 10*, 849161. https://doi.org/10.3389/fpubh.2022.849161

Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2013). *Mindfulness-based cognitive therapy for depression* (2nd ed.). Guilford Pres.

Shim, M., Tilley, J. L., Im, S., Price, K., & Gonzalez, A. (2021). A systematic review of mindfulness-based interventions for patients with mild cognitive impairment or dementia and caregivers. *Journal of Geriatric Psychiatry and Neurology, 34*(6), 528–554. https://doi.org/10.1177/0891988720957104

Villarejo-Galende, A., García-Arcelay, E., Piñol-Ripoll, G., Del Olmo-Rodríguez, A., Viñuela, F., Boada, M., Franco-Macías, E., de la Peña, A. I., Riverol, M., Puig-Pijoan, A., Abizanda-Soler, P., Arroyo, R., Baquero-Toledo, M., Feria-Vilar, I., Balasa, M., Berbel, Á., Rodríguez-Rodríguez, E., Vieira-Campos, A., García-Ribas, G., Rodrigo-Herrero, S., Lleó, A., Maurino, J. (2022). Awareness of diagnosis in persons with early-stage Alzheimer's Disease: An observational study in Spain. *Neurology and Therapy, 11*(3), 1183–1192. https://doi.org/10.1007/s40120-022-00367-3

Walach, H., Buchheld, N., Buttenmüller, V., Kleinknecht, N., & Schmidt, S. (2006). Measuring mindfulness—The Freiburg Mindfulness Inventory (FMI). *Personality and Individual Differences, 40*(8), 1543–1555. https://doi.org/10.1016/j.paid.2005.11.025

Watkins, E. R., & Roberts, H. (2020). Reflecting on rumination: Consequences, causes, mechanisms and treatment of rumination. *Behaviour Research and Therapy, 127*, 103573. https://doi.org/10.1016/j.brat.2020.103573