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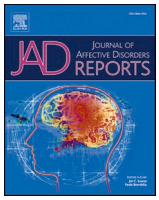

Research Paper

Seasonal patterns in mindfulness in people with seasonal affective disorder (SAD)

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ABSTRACT

Background: Mindfulness-based cognitive therapy (MBCT) is a well-known, effective treatment in the prevention of relapse in Major Depression Disorder (MDD). However, a recent study in people with Seasonal Affective Disorder (SAD) showed that MBCT given in spring was ineffective in preventing a next depressive episode. To test the hypothesis that people with SAD may experience sufficient levels of mindfulness in spring and therefore less benefit from MBCT, this study examines variations in levels of mindfulness over seasons.
Methods: This longitudinal prospective study followed 77 people with SAD over a two-year period. Participants filled out a self-report questionnaire, Five Facet Mindfulness Questionnaire (FFMQ) on a quarterly basis.
Results: Levels of mindfulness differed throughout the seasons, with overall results suggesting lower levels of mindfulness in winter.
Limitations: The results are limited by the small sample size and varying levels of mindfulness over the two years of the study period.
Conclusion: Findings suggest a seasonal component in levels of mindfulness exists, implying that people with SAD are less mindful during the winter compared to other seasons. Future research is needed to examine to what extent the motivation of people with SAD to participate in MBCT and benefit from it is higher in the winter.

1. Introduction

Mindfulness-based cognitive therapy (MBCT) is a well-known relapse prevention program helping people at high risk of depression recurrence to learn the skills to stay well in the long term. Mindfulness can be defined as bringing one's attention to the experiences occurring in the present moment, in a non-judgmental, open and accepting way (Kabat-Zinn, 1991).

In people with a recurrent depression, there is evidence for the efficacy of MBCT in relapse prevention (Kuyken et al., 2016). A meta-analysis revealed that, on average, MBCT reduced the risk of relapse in patients with three or more prior episodes by 43% relative to treatment as usual (Piet and Hougaard, 2011). Some researchers have expressed their concerns about the popularity of MBCT, given the empirical evidence, and call for more research to examine who benefits and when (Faria and Wikholm, 2016).

A specific type of recurrent depressive disorder is Seasonal Affective Disorder (SAD). Common symptoms include a depressed mood and feelings of lethargy. SAD is characterized by spontaneous recovery from depressive symptoms in spring and summer, with a worsening of symptoms in autumn and winter (Meesters and Gordijn, 2016). The course of symptoms of SAD has been linked to sunshine duration (Sarran et al., 2017).

Because of the recurring character of SAD, previous research has looked at preventive treatment options. A recent Cochrane review by Forneris et al. (2019) examined the efficacy of preventive treatment for SAD and found one study meeting the criteria. This study by Fleer et al. (2014) examined the efficacy of MBCT, when administered in spring to people with SAD. No significant effects of MBCT were found with patients who followed MBCT experiencing their first recurrence of SAD at the same time and with the same intensity as those in the control group.

One explanation for the weak efficacy of MBCT when offered in springtime to people with SAD, may be that their mood is generally better in this period. Research in MBCT has shown that people with less

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depressive symptoms at entry to treatment are less likely to benefit of MBCT, compared with those with more depressive symptoms (Kuyken et al., 2016). People with higher treatment credibility perceptions are more likely to benefit from MBCT (Brotto et al., 2020). Such perceptions may be weakened in people with SAD in the spring, given the low levels of symptoms. On the other hand, fewer depressive symptoms in spring are likely to relate to experiencing more mindfulness, given the consistent finding that mindfulness is strongly negatively related to the presence of psychological symptoms (Carpenter et al., 2019). Higher pretreatment levels of mindfulness have been related to larger reductions in psychological symptoms (Shapiro et al., 2011). To reach more insight into the possibility that mindfulness levels vary over the seasons in people with SAD, this longitudinal study in people with SAD examined changes over time in mindfulness in the different seasons over a period of two years. We hypothesized that people with SAD experience lower levels of mindfulness in winter as compared to other seasons.

2. Methods

2.1. Participants

Participants were recruited through the SAD outpatient clinic of the University Medical Center Groningen, the Netherlands. All participants had been diagnosed with a major depressive disorder (MDD) with a seasonal pattern (winter type) according to the DSM-IV-TR criteria (APA, 1994). All patients with SAD diagnosis were approached, regardless of time elapsed since diagnosis, type of treatment, treatment duration or severity of diagnosis. Other inclusion criteria were age range from 18 years onwards and sufficient Dutch reading skills.

2.2. Procedure

From December 2014 to February 2017 participants were asked to fill out a self-report questionnaire every season (i.e. four times a year), as an additional part of an SAD outpatient program in which participants' mood is normally assessed at weekly intervals from September to April.

Winter was defined as the six weeks before and after the winter solstice, 5th November – 6th February, summer as the six weeks before and after the summer solstice, 5th May – 6th August. Spring was the period between winter and summer and autumn between summer and winter. These periods of time were linked to daylight duration, which is essential in SAD.

2.3. Measurements

Mindfulness was assessed with the Dutch version of the Five Facet Mindfulness Questionnaire (FFMQ) (Baer et al., 2006; de Bruin et al., 2012), which measures mindfulness by five facets (i.e.: observe, describe, act aware, nonjudging, and nonreactivity). This questionnaire consists of 39 five-scale questions rating from *never or very rarely true* (1) to *very often or always true* (5). A total score can be calculated by adding up all 39 items, with possible scores ranging from 39-195, with a higher score indicating a higher level of mindfulness. Previous research has demonstrated that this total score on the FFMQ is a reliable and valid instrument to measure mindfulness and is sensitive to changes in measured levels of mindfulness over time (Bohlmeijer et al., 2011; Carpenter et al., 2019). Cronbach's alpha in the current study was adequate, 0.69 at baseline.

2.4. Statistical analysis

The primary outcome of the analysis is the sum of FFMQ per patient measurement moment. Due to the fact that a year was divided into four periods (winter, spring, summer and autumn) and that data was collected from the end of 2014 to begin of 2017, this study includes the following nine time periods: 1) winter 2014 (5 Nov. 2014 – 6 Feb. 2015), 2) spring 2015 (6 Feb. 2015– 5 May 2015), 3) summer 2015 (5 May 2015– 6 Aug. 2015), 4) autumn 2015 (6 Aug. 2015– 5 Nov. 2015), 5 winter 2015 (5 Nov. 2015– 6 Feb. 2016), 6) spring 2016 (6 Feb. 2016– 5 May 2016), 7) summer 2016 (5 May 2016– 6 Aug. 2016), 8) autumn 2016 (6 Aug. 2016– 5 Nov. 2016), 9) winter 2016 (5 Nov. 2016– 6 Feb. 2017). These nine time periods are a combination of the four periods (seasons) and the four years (2014, 2015, 2016 and 2017).

From December 2014 to February 2017 participants were asked to complete a self-report questionnaire each season (i.e. four times a year, around 21 of March, June, September or December), as an additional part of an outpatient SAD program in which participants' mood is normally assessed weekly from September to April, using our Routine Outcome and Quality Assessment (RoQua) via the internet. Sometimes the completion of a questionnaire escaped to the attention of some participants. This created the situation that no questionnaire was completed per season or that two questionnaires were completed, resulting in two completed questionnaires in that season. For the analyses, we included only the first completed questionnaire of the season.

A two-level random intercept multilevel regression model was used with the time periods nested within patients. The variable with the nine time periods is a categorial variable that must be represented by dummy variables. The winter 2014 category becomes the reference category. The first step was the creation of a null model (also known as unconditional means model) serving as a baseline. The next step was the introduction of the time, in this particular case time periods, also known as the unconditional growth model (Singer and Willett, 2003). The following model is intended to add patient characteristics with or without interaction terms. In the final model non-significant estimates will be removed. Reference categories used are 'male' for gender, 'winter 2014' for variable with the nine time periods. Age is centered at 19 years. Bonferroni correction has been applied to take into account multiple comparisons and results have been controlled for age, gender, and duration of therapy.

Table 1a
Number of participants (N), mean, standard deviation (SD) and 95% confidence interval of mindfulness (CI 95%) for the period between winter 2014 and winter 2016.

	Period	N	Mean	SD	Lower CI 95%	Upper CI 95%
1	Winter 2014*	77	126.94	20.45	122.29	131.58
2	Spring 2015	64	133.69	23.10	127.92	139.46
3	Summer 2015	35	139.11	18.97	132.60	145.63
4	Autumn 2015	63	136.40	20.44	131.25	141.54
5	Winter 2015	61	135.21	21.24	129.77	140.65
6	Spring 2016	51	139.57	18.37	134.40	144.73
7	Summer 2016	36	141.22	18.60	134.93	147.51
8	Autumn 2016	52	141.79	17.73	136.85	146.72
9	Winter 2016	48	139.33	20.24	133.46	145.21

* Significant difference compared to the other periods.

3. Results

3.1. Sample characteristics

In the winter of 2014 a total of 77 subjects started completing the first questionnaires. Their mean age was 45.2 years (SD=13.8; range 19-77 years), with 23 male subjects (30%) and 54 (70%) females. Their mean time of therapy duration for SAD was 4.6 years (SD 5.2; range 0-25 years). There is a variation in the return of questionnaires, reflected in the number of participants per time period (Table 1a).

3.2. Changes in mindfulness over time

Table 1a shows the mean mindfulness levels over the nine time points in the 77 patients. Winter 2014 is statistically significant different from the other time points (Table 1a). The average levels of mindfulness

Table 1b
Numbers of measurement points (N), mean, standard deviation (SD) and 95% confidence interval (CI 95%) of mindfulness for the aggregated seasons of Table 1a.

Season	N	Mean	SD	Lower CI 95%	Upper CI95%
Winter	186	132.85	21.20	129.78	135.92
Spring	115	136.30	21.25	132.37	140.22
Summer	71	140.18	18.68	135.76	144.60
Autumn	115	138.83	19.37	135.26	142.41

for each season are shown in Table 1b, based on aggregation of Table 1a.

Table 2 is an overview of how a two-level model results in a final model. The final model, including time periods and control for age (after gender and time since the start of treatment left out), shows significantly lower mindfulness levels in winter 2014, compared to all other eight time periods (take into account Bonferroni correction), and age is a significant covariate.

4. Discussion

This study examines seasonal patterns in levels of mindfulness in people with SAD. Findings suggest that people with SAD report lower levels of mindfulness during the winter than in other seasons. This result is preliminary, given the relatively small sample size and the variance in mindfulness levels over the two years of the study.

In line with the hypothesis, it was found that levels of mindfulness were relatively lower in the winter compared to other seasons. This pattern of levels of mindfulness over time follows the same trend as the seasonal pattern of symptoms of SAD with more SAD symptoms in winter when daily sunshine duration is relatively short (KNMI, 2020; Sarran et al., 2017). In order to interpret the lower levels of mindfulness in winter in people with SAD, the mean FFMQ levels in this study were compared with those found in other studies. Studies on the general population using the FFMQ found mean mindfulness levels from 132 to 140 (Cladder-Micus et al., 2019; Van der Donk et al., 2020). This suggest that the mindfulness levels reported by patients with SAD in winter in this study are slightly low. These levels, however, are considerably higher than those found in a study among patients with chronic treatment-resistant depression, with current symptoms of moderate to severe depression (Cladder-Micus et al., 2019). An explanation for this may be that in this study, patients with SAD received treatment in the winter period, which may have reduced their depressive symptoms.

Over the two-year study period, levels of mindfulness increased over time, with levels in a particular season being higher than in the same season in the previous year. When the study started in 2014, some subjects of the sample had not received light treatment in previous years and had experienced serious suffering from depression in wintertime. In the following years, they may have experienced positive effects of light therapy, so they no longer had to anticipate a bad wintertime with severe depression. This positive effect of light therapy on mood over time might explain the slight increase in level of mindfulness in subsequent years.

Another explanation for the lower mindfulness levels in winter is that people with SAD are more neurotic in winter (Meesters, 1992). These higher levels of neuroticism have been related to lower levels of mindfulness (Elliot et al., 2019). The underlying mechanisms of seasonal effects on neuroticism, mindfulness and mood are not exactly known yet and may depend on cognitive attribution and biological and meteorological sensitivities. In a recent paper, Smetter et al. (2021) describe the rather complex symptom structure of SAD in the context of the dual vulnerability theory. In this theory, SAD is described as the outcome of biological and seasonal vulnerabilities. This study also suggest that SAD is not homogenous in its origin, as they found that SAD is defined by a cluster of symptoms, which may be different in SAD and MDD. This might explain differences in the efficacy of psychological interventions between SAD and MDD (Fleer et al., 2014).

This study has several limitations. First, its sample size is small, so the results are preliminary and need verification in larger studies. Second, participants were invited to visit the outpatient clinic for light therapy when they started experiencing SAD symptoms. When interpreting results, the fact that participants received light therapy in the fall and winter should be taken into account. It can be hypothesized that due to an expected positive effect from light therapy, participants' SAD symptoms improved, and that an observational naturalistic longitudinal study would show greater differences in changes of SAD symptoms and therefore in mindfulness. A strength of this study is its longitudinal character.

5. Conclusion

The findings of the present study suggest that there is a seasonal

Table 2
Unstandardized estimators and standard errors (s.e) from two-level model between winter 2014 and winter 2016 of mindfulness controlled for gender, age and time since start.

		Unconditional means model (N=77)		Unconditional growth model (N=77)		Unconditional growth model with control variables (N=74)		Final model (N=75)	
		Estimate	s.e.	Estimate	s.e.	Estimate	s.e.	Estimate	s.e.
	Intercept	133.24	2.19	126.94	2.33	114.84	6.38	114.46	4.51
1	Winter 2014			ref.		ref.		ref.	
2	Spring 2015			5.25	1.60	4.91	1.62	5.15	1.62
3	Summer 2015			6.13	1.96	5.67	2.00	6.14	2.00
4	Autumn 2015			7.62	1.61	7.22	1.63	7.67	1.63
5	Winter 2015			7.10	1.63	7.34	1.66	7.19	1.66
6	Spring 2016			9.18	1.73	9.33	1.75	9.28	1.75
7	Summer 2016			10.34	1.94	9.89	1.98	10.55	1.98
8	Autumn 2016			12.53	1.71	12.61	1.73	12.79	1.74
9	Winter 2016			8.63	1.76	8.69	1.77	8.88	1.79
	Gender (ref.=male)					-0.43	4.75		
	Age*					0.47	0.18	0.49	0.15
	Time since start					0.13	0.47		
	Variance components								
	Patient level	346.94		331.71		304.96		291.62	
	Measurement level	97.43		85.79		84.68		86.48	
	Goodness of fit								
	AIC	3845.5		3760.4		3602.5		3669.4	
	BIC	3850.2		3765.1		3607.1		3674.0	

* Age centered on 19.

component to mindfulness, showing that people with SAD are less mindful during the winter. It is unclear whether this is also the case in the general population or specifically in the SAD population, so further research is needed. Based on the findings from this study, an interesting future research option would be to examine whether MBCT offered in winter is more effective for people with SAD and whether people are also more motivated to do the training, given the burden of the symptoms.

Data Availability Statement

Research data are not shared.

Author Statement

All authors have contributed significantly and agree with the content of the manuscript. The study protocol was designed by JF and YM. AM collected the data and drafted the first version of the manuscript in collaboration with MS and YM; RES conducted statistical analysis. All authors reviewed the manuscript critically and contributed comments for editing.

Declaration of Competing Interest

Declarations of interest: none

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