

The Effect Of Mindfulness On Attention

IS THERE AN EFFECT OF A BRIEF MINDFULNESS TRAINING ON
ATTENTION SCORES AND DO DEPRESSIVE SYMPTOMS INFLUENCE
THIS RELATIONSHIP

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ABSTRACT

The aim of this study was to research if a brief mindfulness training influences attention scores and whether depressive symptoms influence this relationship. Therefore, 82 participants of both sexes (54 females and 28 males), with a wide age range (19-61) and a variety of depressive symptoms (21-51) were recruited either to be assigned to the experimental condition including a brief mindfulness training or the control condition without the mindfulness training. Attention was measured using the D2 task before and after the experiment to show possible improvement. From this research, it can be concluded that attention improves over time since results were found to be significant. The results between groups and in combination with depressive symptoms lacked significance. To optimize the effectiveness of a brief mindfulness training to improve attention, especially in combination with depressive symptoms, further research is necessary.

Keywords: mindfulness, brief mindfulness training, attention, depression

Introduction

Feelings of sadness, tearfulness and apathy can start to take over your days. The things that used to bring you joy and pleasure, like eating and sex, don't interest you anymore. You have trouble sleeping, its often disrupted and less refreshing. More and more you find yourself becoming pessimistic, dwelling on the past instead of the present and future. Don't even start with concentrating, where you experience greater difficulty maintaining your attention, it takes forever to read the newspaper and remembering what you have read is often difficult. It has become a serious obstacle to carry out ordinary day to day activities. And then... your feelings have been recognized as a clinical problem, labeled; depression (Holmes, 2008).

You are not the only one.

It has been estimated that 350 million people worldwide are affected by depression (“WHO | Depression,” 2016). By the year 2030 it is expected to be the leading cause of disability (Mathers, Fat, & Boerma, 2008). Often the feelings described above are not the final stage. Progression of these symptoms can lead to retardation, with the slowing down of movements and speech. In addition, interest and intent continue to decline and ideas of failure, hopelessness and possible guilt take over. When long-lasting and with moderate or severe intensity, depression may become a serious health condition. It causes suffering, decrease of function in work, school or social environment. Furthermore, it could lead to thoughts of death, self-harm and even suicidal acts (Holmes, 2008; “WHO | Depression,” 2016).

Although there is already a wide variety of treatments available, fewer than half of those affected receive treatment. In many countries, this is even less than 10%. Barriers such as lack of resources, trained health care providers, mis-and under-diagnosing and social stigma associated with mental disorders play a significant role (“WHO | Depression,” 2016). Treatment often takes the form of antidepressants like mono-amine oxidase inhibitors, tricyclic antidepressants, selective serotonin reuptake inhibitors, noradrenergic reuptake inhibitors and serotonin and noradrenaline reuptake inhibitors (Leonard, 2001; Schechter et al., 2005). However, higher remission rates, major side effects and the uncertainties on the effectiveness long-term make this type of treatment less than ideal (Kirsch et al., 2008)(“WHO | Depression,” 2016). More and

more alternate therapeutic possibilities are sought. There is a need for innovative conceptual and therapeutic models (Kasala, Bodduluru, Maneti, & Thipparaboina, 2014).

Beck introduced cognitive and interpersonal therapy which are known to be successful for the treatment of individual episodes (Beck, Rush, Shaw, & Emery, 1979; Cuijpers, Smit, Bohlmeijer, Hollon, & Andersson, 2010). However, they are not proven to be effective in preventing a subsequent episode, even though the increased risk of falling into relapse after every successive episode is well known (Holmes, 2008). With relapse rates of 50-80%, depression is often characterized as a chronic relapsing condition (Williams, 2008). The risk of people falling into relapse is bigger for patients who do not obtain complete recovery. Even though treatment is found to be effective for an acute episode, it often leaves a substantial minority failing to meet criteria for complete recovery. Symptoms like social withdrawal and depressive attitudes can persist for longer periods. This makes them more vulnerable for relapse or recurrence (Hollon, Stewart, & Strunk, 2006).

Even though the pattern of relapse is understood, this does not point to a magic cure. The underlying vulnerability for these future episodes remains not fully comprehended. Segal and colleagues (2006) found that relapse and recurrences rates are influenced by increased cognitive reactivity to small changes in depressed mood (Segal et al., 2006). The differential activation model explains how people differ to what degree their maladaptive cognitions or cognition styles are re-activated, triggered by these mood fluctuations. In general, it is suggested that feelings of low self-worth, hopelessness, failure and rejection originally arise as features of this negative thinking pattern prior to an earlier episode of depression. This will be created through a combination of genetic vulnerability, early adversity and also recent life events (Casi, Sugden, Moffitt, Taylor & Craig, 2003). Unfortunately, it is known that activation of such feelings and mild symptoms of depressed mood activates old patterns of thinking. These will reinstate the cognitive patterns that contribute to re-emergence of depression (Segal et al., 2006; Williams & Teasdale, 2007). This model describes the need to understand both mechanisms underlying reactivity and maladaptive mode of processing to modify risk of recurrence. It is of great importance to find ways to control variables like negative thoughts, feelings, behavior and physical sensations since these variables underlie the vulnerability mentioned above. In theory,

this would reduce the risk of recurrence and also relapse (Williams, 2008). This is where mindfulness is introduced as an intervention in the treatment of recurrent depressive episodes.

Mindfulness-based interventions are increasingly used with depressed individuals. Many interventions including mindfulness-based stress reduction (MBSR), mindfulness-based cognitive therapy (MBCT), meditation-based intervention (MBI), acceptance and commitment therapy (ACT), and dialectical behavior therapy (DBT) have been developed. They all have a mindfulness base in common (Creswell, 2016; Shonin & van Gordon, 2016; Williams, 2008).

Mindfulness refers to nonjudgmental attention to present-moment experience (Lin & Scott, 2012). It is not a new concept as it originated 2600 years ago from Buddhist practice (Klainin-Yobas, Cho, & Creedy, 2012; Shonin & van Gordon, 2016). It is a quality of awareness, with awareness being an universal human capacity (Kabat-Zinn, 2003). Often, people's minds tend to wander, thinking about the past or worrying about the future. This way, less attention is paid to the present moment since attention cannot easily be divided (Jensen, Vangkilde, Frokjaer, & Hasselbalch, 2012; Klainin-Yobas et al., 2012). The aspect 'judgement', also included in the definition, makes peoples everyday life more complicated. It triggers unnecessary emotional reactions and stress which often results in depressed mood or anxiety (Klainin-Yobas et al., 2012). In essence, mindfulness consists of two components; (1) attention and awareness; directing attention to thoughts, feelings and sensations in the present moment, and (2) acceptance; the intentional suspension of judgment or cognitive evaluation of these features (Brown & Ryan, 2004).

Research regarding the effectiveness of mindfulness based treatments in especially treating mental issues on both a clinical and empirical level is growing. Mindfulness-based treatments target biological, psychological, social, and spiritual psychopathology determinants (Shonin & van Gordon, 2016). It has been proven to be effective in enhancing coping strategies and reducing stress through development of nonjudgmental awareness. This includes themselves, others but also the surrounding environment (Baer, 2006; Davis & Kurzban, 2012). It is believed that people who regularly practice mindfulness-based practices, will improve their control of

negative emotions, and perform better on their daily activities and overall improve their sense of well-being (Klainin-Yobas et al., 2012).

Five aspects of mindfulness that could be effective in the prevention or treatment of depressive symptoms are described by Baer (2003). Firstly, by exposure. Fear responses may be reduced because of an increased focus on observation and exposure to thoughts and feelings. Instead of avoiding these emotions and cognitions creating fear, the individual may learn to cope with negative emotions when exposed. Secondly, increasing self-awareness may lead to cognitive changes (Baer, 2003). Not judging emotions, behavior and thoughts may reduce occurrence of negative emotional reactions. Thirdly, meditation practice is known to create calmness and relaxation. This may lead to reduction of autonomic arousal. Fourthly, self-management. Self-observation skills create insight in effective use of coping skills. Fifthly, acceptance of situations, pain, body sensations, thoughts and feelings without the experience of suffering or escaping may play a crucial role in reducing depressive symptoms (Baer, 2003).

Previous research has shown the effectiveness of mindfulness based interventions (Cramer, Lauche, Langhorst, & Dobos, 2013; Munshi, Eisendrath, & Delucchi, 2014; Pilkington, Kirkwood, Rampes, & Richardson, 2005; Teasdale, Williams, Ridgeway, Soulsby, & Lau, 2000). Studies of MBSR among others have shown reductions in anxiety and depression (Ngen, 2000), and MBCT which is based on MBSR showed significant reductions in depression and prevention of depressive relapse (Teasdale et al., 2002). Also in patients with bipolar disorder, MBCT showed significantly less depressive symptoms compared to the control group and post-treatment (Davis & Kurzban, 2012). Teasdale and colleagues (2000) describe that a mindfulness based cognitive therapy teaches depressed individuals to disengage from dysphoria-activated depressogenic thinking that is the base of relapse and recurrence. A note to this is that it was only found significant with 3 or more episodes (Teasdale et al., 2000). Other research has even showed the effectiveness of MBCT long term. Participants showed decreased rumination and anxiety in combination with increased awareness and attention of cognitive patterns through mindfulness practice (Munshi et al., 2014)

Often mindfulness based interventions are of an 8-12 week duration and are a fixed program. Since this excludes a great number of individuals due to limited accessibility and high costs, more research is done on brief mindfulness interventions. Retreat programs which include intensive doses of mindfulness training variable from 3 days up to 3 months and shortened programs ranging from 3 days to 3 weeks are rising. Research demonstrates that even 5-10 minutes guided mindfulness induction and a 3-4 session mindfulness meditation training can buffer affective reactivity (Jensen et al., 2012). Schofield and colleagues (2015) have indicated an effect of a brief mindfulness induction of 7 minutes where participants were exposed to an audio guided mindfulness exercise. It was suggested that this brief exposure of mindfulness reduces inattentive blindness (Creswell, 2016; Creswell, Pacilio, Lindsay, & Brown, 2014; Kasala et al., 2014; Papies, Keesman, Pronk, & Barsalou, 2014; Rosenberg et al., 2015; Schofield, Creswell, & Denson, 2015).

In addition, internet and smartphone applications including brief mindfulness interventions arise, so called e-health programs. Research on its effectiveness often show methodological limitations like small sample sizes, no randomization, lack of standardized interviews and lack of control or comparison group in combination with small and transient effects (Schuwer & Lewis, 2016). Possible efficacy of brief mindfulness interventions may provide a widely accessible treatment or intervention with a low threshold which could be very cost effective (Creswell, 2016; Creswell et al., 2014; Kasala et al., 2014; Papies et al., 2014; Rosenberg et al., 2015; Schofield et al., 2015).

Not everyone grew up with a mindful lifestyle or has these coping mechanisms naturally. Fortunately, it can be trained. Since mindfulness is defined as non-judgmental attention to the present moment, attention training is the base of most mindfulness treatments. "Attention is a focusing of awareness to highlight selected aspects of that reality" (Brown & Ryan, 2004, p.243). Usually awareness and attention are intertwined. So is awareness where perceived stimuli are expressed and will attention focus on closer examination.

The practice of mindful meditation especially, which involves the ability to stay focused on breath, a word, a phrase (mantra) or candle, trains attention. When attention floats away, it is

thought to gently but firmly bring it back to the object of original focus (Brown & Ryan, 2004). As such, earlier research has shown a positive correlation between meditation practice and concentrative attentional performance (Brown & Ryan, 2004; Kozasa et al., 2012). It is believed that two subsystems of attentional control are involved while practicing mindfulness. Firstly, attentional switching, which is defined as the ability to switch focus from different sensations and cognitions. Secondly, sustained attention, which is defined as the ability to focus on a certain experience for a period of time. It is believed that practicing mindfulness will improve working memory and sustained attention (Chambers, Lo, & Allen, 2008). This increased attentional control improves cognitive functioning which is often disturbed in depressed individuals (Davis & Kurzban, 2012).

Since responsible mechanisms of mindfulness are mainly focused on attentional training and improvements, it is of great importance to find an adequate measurement to gain insight on attention. The research of Jensen and colleagues (2012) pointed out the use of the d2 Test of Attention task. This test measures sustained and selective attention which is believed to be positively affected by mindfulness training (Bishop et al., 2004). Psychometric properties were well supported (Jensen et al., 2012). Other research combining attention with depression and functional remission focusing on sustained visual attention and concentration also used the d2 test (Cléry-Melin & Gorwood, 2016). Lastly a study by Moore and Malinowski concluded a positive relationship between meditation practice, self-reported levels of mindfulness, and attentional functions and cognitive flexibility. Again attention was measured using the d2 task (Moore & Malinowski, 2009).

The d2 task is the measurement for attention selected to be used in this research. The aim of the present study is to research whether a brief mindfulness training, including psycho-education, a body scan and a breathing exercise can influence attention (measured by the d2 task). It is expected that this short mindfulness training improves attention compared to a control condition (watching a documentary instead of the psycho education and receiving a visual exercise instead of the mindfulness exercises). Secondly, the influence of depressive symptoms will be investigated. Since one of the characteristics of depression is reduced attention and awareness of cognitive patterns, it is expected that people with a higher score on depressive symptoms, have

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lower attention scores before training and therefore would benefit more from a brief mindfulness training to improve the attention(Munshi et al., 2014). Thus, a positive correlation is expected between depression rate and difference score on the D2 task. The expected improvement in attention after the mindfulness training is measured using a cross-sectional design with control group.

METHOD

Design

An experiment with a control group was performed to find the effect of a brief mindfulness training on attention.

Participants

A sample of 82 participants (54 females versus 28 males) ranging in age from 19 to 61 years old, was recruited through distribution of flyers (appendix 1) at the University of Utrecht and in the near environment of the researchers. Exclusion criteria were motor or cognitive limitations. Participants were incentivized by the offer of receiving 2.5 participant credits. If they were not related to the University, they participated on a voluntary basis. 42 participants were assigned to the experimental/mindfulness condition while the other 40 participants were placed in the control condition.

Instruments

Demographic questionnaire

Demographic information including gender, age and level of education was retrieved through an online survey in Qualtrix sent at least one week before participating.

Beck Depression Inventory (to measure depression)

Together with the demographic questionnaire, the Beck Depression Inventory (BDI) was completed upon request through Qualtrix. This questionnaire is based on the belief that negativistic distorted cognitions is the core of depression and was chosen because of its comprehensive measurements and time effectiveness (Wang & Gorenstein, 2013). It is a 21-item questionnaire used to measure the severity of affective, cognitive, behavioral and somatic depressive symptoms. Scores range from 0 to 63 and is analyzed as sum score. Items include cognitive, affective, motivational, behavioral and biological symptoms of depression (Teasdale

et al., 2000; Wang & Gorenstein, 2013). It took no more than 1 hour to fill out the questionnaires online through Qualtrix.

The internal consistency (0.81) for non-psychiatric individuals, validity, and test-retest reliability are high for the BDI (Ma & Teasdale, 2004; Schuwer & Lewis, 2016).

D2 (to measure attention)

The D2 test is a cancellation test assessing individual attention and concentration ability. This is specified to select internal and external stimuli (Brickenkamp & Zillmer, 1998).

After instructions, the test starts with one trail line. The participants marked, by striping, the letter 'd' with two dashes. The other characters including the letter 'p' or a 'd' with deviating dashes should be left untouched. The test exists out of 14 lines, containing 47 characters and time is limited, for each line 20seconds. This resulted in a maximum duration of 4 minutes and 40 seconds.

Psychometric properties have been well supported which makes the D2 task a valid instrument of attention measurement (Jensen et al., 2012)

Results are shown through different indexes and measurements; (1) TN (total number of item processed), (2) F (the sum of all errors, existing out of F1 and F2/errors of omission and errors of commission), (3) F% (percentage of error in relation to the total number of processed items), (4) TN-F (number of correctly filled out characters), (5) CP (concentration performance index) which is obtained by subtracting the errors of commission (F2) from the total number of correctly crossed out relevant items, (6) VT (variation in tempo/TN) which includes the difference between extreme TN scores. (Brickenkamp, Merten, & Hansgen, n.d.; Cléry-Melin & Gorwood, 2016)

Procedure

After a warm welcome, informed consent was obtained from all participants. It was also asked how many hours they had slept last night. Then the participants received instructions to perform the d2 attention task. Depending on the condition the participants were in, they received

a brief mindfulness training (experimental) or watched a documentary with a visualization exercise (control).

Experimental condition

After filling in the D2 task, participants received further information and insight about the structure of the next 1.5 hour. This included watching a PowerPoint explaining the program.

First, the D2 task was performed as described above. Second, psychoeducation was given explaining the concept of attention. What it is, why it is used, consequences and how it is trained, including several examples. Then two exercises were executed. The first one was a 15 minute guided body scan (de Haas, 2007) and the second was a 10 minute guided breathing exercise (Wallace, 2006). Fourth, the D2 task was performed for the second time and finally a debriefing and explanation was provided.

Control condition

Just like the experimental condition, the control condition started with performing the D2 task. Second, they received further information about the planning and structure of the training. They watched a PowerPoint explaining the program. Third, they watched a documentary on the Buddhist science of the mind which lasted 50 minutes (Davis, 2013). This as a replacement of the psycho education given to the experimental group. Fourth, they also performed an exercise but this included a visualization exercise (Reinders, 2008). Finally, they performed the D2 task again, similarly to the experimental group. The session finished with closing remarks, including debriefing and explanation.

Processing and analyzing the data

IBM SPSS Statistics was used to analyze the data. A mixed analysis of variance with repeated measures was conducted with 'Condition' as a between-subject factor (mindfulness condition vs. control condition) and 'Time' as the within-subject factor (pre-test vs. post-test) to answer the main research question.

To test whether the variables were equally distributed between the two conditions, descriptive statistics were used. Independent *t*-tests were applied to compare the variables with a continuous scale (age, BDI score and hours of sleep) between the groups. For the variable gender, which is nominal, a chi-square test was performed and finally to compare the ordinal variable level of education, Man-Whitney *U* test was conducted.

To test whether the brief mindfulness training had effect on the several layers of attention, including TN, F, F%, TN-F, CP and VT, all characterized on continuous scale, a MANOVA was performed with the repeated measures design as mentioned above.

To further test the influence of depressive symptoms on the relationship between mindfulness and attention a correlation test was performed. Further regression analysis was not conducted since there was no effect of mindfulness on attention found.

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RESULTS

Equal distribution between groups

By performing an independent sample t-test it is shown that gender, age, score of depression and hours slept are equally distributed between the two groups. Table 1 shows p-value and confidence interval of each of the variables, mean and range for the variables with a continuous measurement scale and frequency for the nominal variable gender. On an educational level a significant difference is shown between the experimental and control condition. Tertiary education is over represented in the experimental condition.

Table 1 Descriptives for all measured variables including comparison between groups

Variable	Range & Frequency		Mean		p-value	Confidence interval	
	Exp.	Control	Exp.	Control		Lower	Upper
Gender					0.275	-	-
Female	30	24	-	-			
Male	12	16	-	-			
Educational level			-	-	0.04	-	-
Primary	0	0	-	-			
Secondary	2	8	-	-			
Tertiary (higher)	39	32	-	-			
Age	19-50	19-61	25.74	28.63	0.243	-7.781	2.007
Depression score	21-51	21-46	29.50	27.38	0.198	-1.137	5.387
Sleeping hours	0-9	3-9	6.936	7.138	0.536	-.844	.445

The calculated power of this research is 0.6 (with a medium effect size = 0.3 and alpha = 0.05) (Field, 2009)

The effect of a brief mindfulness training on several layers of an attention task

To evaluate the null hypothesis that there is no change in participant’s attention scores from the D2 test for the intervention group, when exposed to a brief mindfulness training (N=42), compared to a control group(N=40), a mixed analysis of variance with repeated measures was conducted.

Table 2 Attention scores for experimental and control condition before and after the brief mindfulness training

Layers of attention	Time	Experimental condition		Control condition	
		Mean	Std. deviation	Mean	Std. deviation
TN	Pre test	466.55	80.97	476.88	107.40
	Post test	532.10	79.54	536.73	87.32
F	Pre test	106.07	50.97	99.98	60.328
	Post test	74.21	46.33	71.43	56.21
F%	Pre test	24.06	14.33	23.51	17.48
	Post test	15.34	12.11	14.32	12.42
TN-F	Pre test	359.74	112.68	376.00	142.51
	Post test	457.52	117.03	469.95	124.52
CP	Pre test	176.74	36.41	186.00	52.31
	Post test	212.67	42.16	218.50	47.25
VT	Pre test	12.93	4.39	12.45	5.30
	Post test	10.93	4.38	9.00	4.91

Results of the repeated measures ANOVA show a significant main effect of Time on the attention layer; *Total Number of processed items (TN)*, Pillai’s Trace = .293, $F(1,80) = 193.388$, $p=0.00$, $\eta^2 = .707$. This result can be translated to both groups (Experiment and Control). Furthermore, there was found a lack of significance at $p < .05$ on the main effect between the experimental and control condition on the variable attention (TN), $F < 1$ (.268), $p = .606$, $\eta^2 = .003$. No significant interaction between the mindfulness training (Experiment) and improvement

in attention was found, Pillai's Trace = 1.00, $F < 1$ (.008), $p = .930 > 0.05$, $\eta^2 = .00$. Violation of the homogeneity variance assumption in TN pre test, $p = .021$ makes us use Pillai's Trace instead of Wilk's Lambda. Thus, even though the difference in time is significant for both groups there is no significant evidence to reject the null hypothesis and allocate the improvement of attention over time to the intervention.

Results show a significant main effect of Time on the attention layer; *Sum of all mistakes (F)* in both conditions Wilks' Lambda = .384, $F(1,80) = 128.143$, $p = .000$, $\eta^2 = .616$. The reduction of mistakes was not significant between the experimental and control condition, $F < 1$ (.148), $p = .701$, $\eta^2 = .002$. No significant interaction between the mindfulness training (experiment) and improvement in attention was found, Wilks' Lambda = .995, $F < 1$ (.384), $p = .537$, $\eta^2 = .005$. Again, it can be concluded that even though the difference in time is significant for both groups there is no significant evidence to reject the null hypothesis.

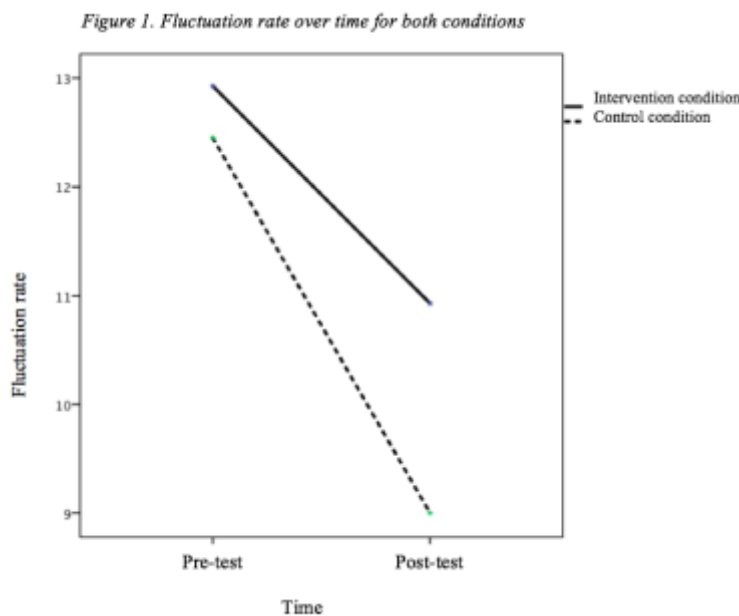
Results show a significant main effect of Time on the attention layer; *Percentage of errors (F%)*, Wilks' Lambda = .407, $F(1,80) = 116.369$, $p = .000$, $\eta^2 = .593$. The second main effect, reduction of the percentage of errors between the experimental and control condition, was not significant, $F < 1$ (.067), $p = .797$, $\eta^2 = .001$. No significant interaction between the mindfulness training (experiment) and improvement in attention was found, Wilks' Lambda = .999, $F < 1$ (.083), $p = .774$, $\eta^2 = .001$

Results show a significant main effect of Time on the attention layer; *Total number of items minus error scores (TN-F)*, Wilks' Lambda = .248, $F(1,80) = 242.282$, $p = .000$, $\eta^2 = .752$. The increase of items minus error scores was not significant between the experimental and control condition, $F < 1$ (.286), $p = .594$, $\eta^2 = .004$. No significant interaction between the mindfulness training (experiment) and improvement in attention was found, Wilks' Lambda = .999, $F < 1$ (.097), $p = .756$, $\eta^2 = .001$

Results show a significant main effect of Time on the attention layer; *Concentration performance (CP)*. Violation of the homogeneity variance assumption in CP pre test, $p = .012$ makes us use Pillai's Trace instead of Wilk's Lambda, Pillai's Trace = .748, $F(1,80) = 237.189$,

$p=0.00$, $\eta^2 = .748$. The increase in concentration performance was not significant between the experimental and control condition, $F < 1 (.613)$, $p = .436$, $\eta^2 = .008$. No significant interaction between the mindfulness training (experiment) and improvement in attention was found, Pillai's Trace = .007, $F < 1 (.595)$, $p = .443$, $\eta^2 = .007$

Results show a significant main effect of Time on the attention layer; *Fluctuation rate (VT)*, Wilks' Lambda = .794, $F(1,80) = 20.699$, $p = .000$, $\eta^2 = .206$. From the graphical display (figure 1), it seems that the participants in the experimental condition (the ones with the brief mindfulness training) have a less steep slope of fluctuation rate over time. This would mean that the decrease of fluctuation rate is less for the experimental group when pre- and post-test are compared. Statistical testing shows that these observations are not significant. The reduction of fluctuation rate was not significant between the experimental and control condition, $F(1,80) = 1.951$, $p = .166$, $\eta^2 = .024$. No significant interaction between the mindfulness training (experiment) and improvement in attention was found, Wilks' Lambda = .982, $F(1,80) = 1.465$, $p = .0230$, $\eta^2 = .018$.



Depression correlates with the relationship between mindfulness and attention

To evaluate the null hypothesis that there is a correlation between depressive symptoms and participant’s attention score when exposed to a brief mindfulness training, a bivariate correlation test is performed.

Depression is defined as the sum score of the 21 questions of the BDI and ranges from 21 till 51 with a mean of 29.50, SD of 8.52 and 2 missing items which leaves the sample size at 80 participants (Nexperiment = 40, Ncontrol = 40).

Results show that there is no significant link between depressive symptoms and improvement of attention score in any of the layers of attention (TN, F, F%, TNF, CP, VT) in the experimental condition. Table 3 shows Pearsons correlation and the representing p-values with standardized confidence intervals.

Table 3 correlation between improvement in attention over time and depressive symptoms in the experimental condition

Layers of attention	Pearsons correlation	P-value	Confidence interval	
			Lower	Upper
Difference in TN	.098	.547	-.232	.431
Difference in F	-.105	.520	-10.899	5.605
Difference in F%	-.056	.733	-.389	.276
Difference in TNF	.025	.877	-.310	.361
Difference in CP	-.024	.884	-.355	.307
Difference in VT	.043	.792	-.297	.361

DISCUSSION

The present research aim is to evaluate if a brief mindfulness training affects attention scores and whether depressive symptoms influence this relationship.

From the results, it can be concluded that the first hypothesis; that a brief mindfulness training improves attention, is not significant. Even though the attention scores improved over time in both groups, this improvement cannot be assigned to the mindfulness training, because there was no significant difference between intervention and control condition. This contradicts earlier research where mindfulness based interventions are positively linked with attention (Chambers et al., 2008; Hodgins & Adair, 2010; Jensen et al., 2012; Kozasa et al., 2012; Moore & Malinowski, 2009). The lack of significant results in the present study can be ascribed to several factors. First, the duration of the experiment. Earlier research about brief mindfulness trainings which have found significant results exists out of multiple days, a few hours a day or even longer retreats or treatment programs. Chambers et al., (2008) describes a 10 day intensive meditation retreat and are MBSR programs designed as 8-week programs with 2.5 hour of developing mindfulness skills a day (Chambers et al., 2008; Jensen et al., 2012). The current experiment was only 1.5 hours which might be too limited a time to develop mindfulness skills. Brief mindfulness trainings have been performed effectively, as mentioned in the introduction, but these were never single sessions (Jensen et al., 2012). From this we can conclude that brief mindfulness training can be effective but now the challenge is to find the right content, exact duration and amount of sessions to create maximum effectiveness.

Also, possible factors that influence mindfulness which have not been measured could have been responsible for the lack of significant results. Only gender, age, depressive symptoms and hours of sleep have been accounted for. Earlier research has shown the impact of stress and attentional effort (Jensen et al., 2012). Feelings of stress and expectations of improved focus have been mentioned by two of the participants, who indicated a planned exam, 2 hours after participating. Also, personality characteristics could have influenced the results. Neuroticism, negative affect and conscientiousness are other characteristics related to mindfulness but not measured during this research (Giluk, 2009). From this, a possible explanation for the lack of

significant findings could be the influence of other factors contributing to the effectiveness of the mindfulness training on attention. The level of stress for example could have been very high in the intervention group which voided the positive effect of the training on attention compared to the control condition.

Another explanation of the lack of findings is a possible effect of the video or visual exercise in the control condition. If the documentary or exercise had a positive effect on attention instead of the desired neutral effect, this could have voided the effect of the mindfulness training. It cannot be said with certainty that this video and exercise didn't have any effect on the attention scores of the D2 test. Also, both groups have performed the D2 test twice which could cause a practice effect. This could explain the main effect, increase of performance over time and not between the groups.

Recruitment was one of the strengths of this research since the training was described as an attention training and not mindfulness. This blinded the participants and excluded preference or preconceptions towards the possible effect of mindfulness.

Another strength was the diversity of the sample. A wide range of age and diversity in gender characterized the study and excluded the possibility of confounding. Besides, this high level of generalizability increased the external validity.

The second part of the hypothesis, the influence of depressive symptoms on attention, was neither supported by the results. Our findings did not support the influence of depressive symptoms on the relationship of mindfulness and attention, while a positive correlation between improvement of attention and depressive symptoms was expected since one of the characteristics of depression is attention deficit (Baer, 2003).

A first explanation for this lack of significance could be the lack of evidence to support the relationship of mindfulness and attention to begin with. Without a relationship between these two main variables, a possible influence of depressive symptoms is very hard to establish.

Secondly, in contrary with most literature, we worked with participants who were not diagnosed with depression but only measured the symptoms, this could have influenced the severity of the depressive symptoms. Other research shows the effectiveness of interventions, mostly to prevent relapse, that are mindfulness based and we named it a training instead of a treatment. Also, did we lack information about any earlier episodes of depression.

Recommendations for future research

The unequal distribution of education which led to a slight, but not significant overrepresentation of higher educated participants in the experimental condition could have led to bias since education level is a variable that includes several other variables that possibly relate to mindfulness. In these results, there was no difference between the groups but for further research it is important to randomize for factors like education. Several factors like higher levels of stress, different cultural backgrounds, prejudice and social exclusion are all prevalent to different degrees in the education hierarchy (Hyland, 2009). Other researchers have already tried to formulate and discuss the possible influence of level of education on outcomes like attention (Rosselli, Tappen, Williams, & Salvatierra, 2006). In this research, the unequal distribution of education and overrepresentation of highly educated participants can be explained through the way of recruitment. Since participants were mainly recruited on and around the university of Utrecht and from the direct environment of the researchers, which were also high educated.

Other recommendations for future research include the measurement of the variable; “mindfulness”. This can be measured several ways including the Five Facet Mindfulness Questionnaire, the Mindful Attention and Awareness Scale, the Toronto Mindfulness Scale, Freiburg Mindfulness Inventory or many others (Vago, 2009) . Since level of mindfulness was not measured at baseline, there is a possibility that some participants had more experience practicing mindfulness compared to others. Even though there was no difference found between the groups, baseline levels should be as equal possible.

Another limitation, and at the same time recommendation for future research, is the tool that was used to measure attention. In this research, attention was only measured using the D2 task. Other research shows a combination with the Stroop color-word task, selective attention task or

sustained attention task (Chajut & Algom, 2003; Hodgins & Adair, 2010; Jensen et al., 2012; Tomporowski & Tinsley, 1996) This more in depth way of measuring attention might create a better insight into possible improvements.

A final suggestion for future research would be measuring depressive symptoms directly after the experiment. It is possible that even though attention was not improved, depressive symptoms might be reduced. A short-term depression questionnaire should be used to clearly represent these symptoms. A questionnaire focused on depressive feeling in the exact moment instead of the BDI, which focusses on behavior and feelings over the past week. Also, insight in past episodes to find possible effectiveness for relapse is necessary. This to establish findings of earlier research which already suggests mindfulness as treatment for depression and prevention for relapse (Baer, 2003, 2006; Davis & Kurzban, 2012; Klainin-Yobas et al., 2012).

Conclusion

To summarize, evidence for the effect of a brief mindfulness training to improve attention scores was not found. Neither was the influence of depressive symptoms on this relationship found significant. Further research is needed to gain more insight in confounding variables and to optimize the effectiveness of brief mindfulness trainings regarding improved attention.

REFERENCES

- Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology: Science and Practice, 10*(2), 125–143.
<https://doi.org/10.1093/clipsy/bpg015>
- Baer, R. A. (2006). Mindfulness-Based Treatment Approaches.
- Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression. Cognitive Therapy of Depression.*
- Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., ... Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*(3), 230–241. <https://doi.org/10.1093/clipsy/bph077>
- Brickenkamp, R., Merten, T., & Hansgen, K. D. (n.d.). d2 - Manual. Retrieved February 14, 2017, from <http://www.unifr.ch/ztd/HTS/infest/WEB-Informationssystem/en/4en001/ab32207d19534fa3acbc806c7e57d7ef/hb.htm>
- Brickenkamp, R., & Zillmer, E. A. (1998). *D2 test of attention.* Seattle: Hogrefe & Huber Publishers.
- Brown, K. W., & Ryan, R. M. (2004). Perils and promise in defining and measuring mindfulness: Observations from experience. *Clinical Psychology: Science and Practice, 11*(3), 242–248. <https://doi.org/10.1093/clipsy/bph078>
- Burdett, B. R. D., Charlton, S. G., & Starkey, N. J. (2016). Not all minds wander equally: The influence of traits, states and road environment factors on self-reported mind wandering during everyday driving. *Accident Analysis and Prevention, 95*, 1–7.
<https://doi.org/10.1016/j.aap.2016.06.012>
- Capsi A, Sugden K, Moffitt TE, Taylor A, Craig IW, H. H. (2003). Influence of life stress on depression: moderation by a polymerisation in the 5-HTT gene. *Science, New Series, 301*(1531), 386–389. <https://doi.org/10.1017/CBO9781107415324.004>
- Chajut, E., & Algom, D. (2003). Selective attention improves under stress: Implications for theories of social cognition. *Journal of Personality and Social Psychology, 85*(2), 231–248.
<https://doi.org/10.1037/0022-3514.85.2.231>
- Chambers, R., Lo, B. C. Y., & Allen, N. B. (2008). The Impact of Intensive Mindfulness

- Training on Attentional Control, Cognitive Style, and Affect. *Cognitive Therapy and Research*, 32(3), 303–322. <https://doi.org/10.1007/s10608-007-9119-0>
- Cléry-Melin, M.-L., & Gorwood, P. (2016). A simple attention test in the acute phase of a major depressive episode is predictive of later functional remission, 5(August), 1–12. <https://doi.org/10.1002/da.22575>
- Cramer, H., Lauche, R., Langhorst, J., & Dobos, G. (2013). Review, 1083, 1068–1083. <https://doi.org/10.1002/da.22166>
- Creswell, J. D. (2016). Mindfulness Interventions. *Annual Review of Psychology* 2, (September), 1–26. <https://doi.org/10.1146/annurev-psych-042716-051139>
- Creswell, J. D., Pacilio, L. E., Lindsay, E. K., & Brown, K. W. (2014). Brief mindfulness meditation training alters psychological and neuroendocrine responses to social evaluative stress. *Psychoneuroendocrinology*, 44, 1–12. <https://doi.org/10.1016/j.psyneuen.2014.02.007>
- Cuijpers, P., Smit, F., Bohlmeijer, E., Hollon, S. D., & Andersson, G. (2010). Efficacy of cognitive-behavioural therapy and other psychological treatments for adult depression: Meta-analytic study of publication bias. *British Journal of Psychiatry*, 196(3), 173–178. <https://doi.org/10.1192/bjp.bp.109.066001>
- Davis, L., & Seth Kurzban. (2012). Mindfulness-Based Treatment for People with Severe Mental Illness: A Literature Review. *American Journal of Psychiatric Rehabilitation*, 15(2), 202–232. <https://doi.org/10.1080/15487768.2012.679578>
- Davis, W. (2013). The Buddhist Science of the Miind - YouTube. Retrieved December 28, 2016, from <https://www.youtube.com/watch?v=weLwDSS2LwA&feature=youtu.be>
- Field, A. (2009). *Discovering Statistics Using SPSS* (3rd ed., p. 58). SAGE publications.
- Giluk, T. L. (2009). Mindfulness, Big Five personality, and affect: A meta-analysis. *Personality and Individual Differences*, 47(8), 805–811. <https://doi.org/10.1016/j.paid.2009.06.026>
- de Haas, N. (2007). Korte mindfulness bodyscan, 10 minuten. Retrieved December 28, 2016, from <http://www.maxximize.nl/beheer/Audio/Mindfulness MP3/2 korte bodyscan.mp3>
- Hodgins, H. S., & Adair, K. C. (2010). Attentional processes and meditation. *Consciousness and Cognition*, 19(4), 872–878. <https://doi.org/10.1016/j.concog.2010.04.002>
- Hollon, S. D., Stewart, M. O., & Strunk, D. (2006). Enduring effects for cognitive behavior

- therapy in the treatment of depression and anxiety. *Annual Review of Psychology*, 57, 285–315. <https://doi.org/10.1146/annurev.psych.57.102904.190044>
- Holmes, J. (2008). *Mindfulness and Mental Health: Therapy, Theory and Science*. *The British Journal of Psychiatry* (Vol. 193). <https://doi.org/10.1192/bjp.bp.108.049874>
- Hyland, T. (2009). Mindfulness and the therapeutic aims of education. *Journal of Philosophy of Education*, 43(1), 119–131. <https://doi.org/10.1111/j.1467-9752.2008.00668.x>
- Jensen, C. G., Vangkilde, S., Frokjaer, V., & Hasselbalch, S. G. (2012). Mindfulness training affects attention—Or is it attentional effort? *Journal of Experimental Psychology: General*, 141(1), 106–123. <https://doi.org/10.1037/a0024931>
- Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, 10(2), 144–156. <https://doi.org/10.1093/clipsy/bpg016>
- Kasala, E. R., Bodduluru, L. N., Maneti, Y., & Thipparaboina, R. (2014). Effect of meditation on neurophysiological changes in stress mediated depression. *Complementary Therapies in Clinical Practice*, 20(1), 74–80. <https://doi.org/10.1016/j.ctcp.2013.10.001>
- Kirsch, I., Deacon, B. J., Huedo-Medina, T. B., Scoboria, A., Moore, T. J., & Johnson, B. T. (2008). Initial severity and antidepressant benefits: A meta-analysis of data submitted to the food and drug administration. *PLoS Medicine*, 5(2), 0260–0268. <https://doi.org/10.1371/journal.pmed.0050045>
- Klainin-Yobas, P., Cho, M. A. A., & Creed, D. (2012). Efficacy of mindfulness-based interventions on depressive symptoms among people with mental disorders: A meta-analysis. *International Journal of Nursing Studies*, 49(1), 109–121. <https://doi.org/10.1016/j.ijnurstu.2011.08.014>
- Kozasa, E. H., Sato, J. R., Lacerda, S. S., Barreiros, M. A. M., Radvany, J., Russell, T. A., ... Amaro, E. (2012). Meditation training increases brain efficiency in an attention task. *NeuroImage*, 59(1), 745–749. <https://doi.org/10.1016/j.neuroimage.2011.06.088>
- Leonard, B. E. (2001). The immune system, depression and the action of antidepressants. *Progress in Neuro-Psychopharmacology and Biological Psychiatry*, 25(4), 767–780. [https://doi.org/10.1016/S0278-5846\(01\)00155-5](https://doi.org/10.1016/S0278-5846(01)00155-5)
- Lin, G. G., & Scott, J. G. (2012). The Mindful Brain and Emotion Regulation in Mood

- Disorders. *Can J Psychiatry*, 57(2), 70–77.
<https://doi.org/10.1016/j.pestbp.2011.02.012>. Investigations
- Ma, S. H., & Teasdale, J. D. (2004). Mindfulness-based cognitive therapy for depression: replication and exploration of differential relapse prevention effects. *Journal of Consulting and Clinical Psychology*, 72(1), 31–40. <https://doi.org/10.1037/0022-006X.72.1.31>
- Mathers, C., Fat, D. M., & Boerma, J. T. (2008). *The global burden of disease : 2004 update*. World Health Organization.
- Moore, A., & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Consciousness and Cognition*, 18(1), 176–186.
<https://doi.org/10.1016/j.concog.2008.12.008>
- Munshi, K., Eisendrath, S., & Delucchi, K. (2014). preliminary long-term follow-up of Mindfulness-based cognitive therapy-induced remission of depression. *Mindfulness*, 4(4), 354–361. <https://doi.org/10.1007/s12671-012-0135-0>. Preliminary
- Ngen, M. A. A. (2000). A Randomized , Wait-List Controlled Clinical Trial : The Effect of a Mindfulness Meditation-Based Stress Reduction Program on Mood and Symptoms of Stress in Cancer Outpatients, 622(12), 613–622.
- Papies, E. K., Keesman, M., Pronk, T. M., & Barsalou, L. W. (2014). The benefits of simply observing: Mindful attention modulates the link between motivation and behavior. *Journal of Personality & Social Psychology*, 31(12), 1–79. <https://doi.org/10.1037/a0038032>
- Pilkington, K., Kirkwood, G., Rampes, H., & Richardson, J. (2005). Yoga for depression : The research evidence, 89, 13–24. <https://doi.org/10.1016/j.jad.2005.08.013>
- Reinders, L. (2008). 64 visualisaties.
- Rosenberg, E. L., Zanesco, A. P., King, B. G., Aichele, S. R., Jacobs, T. L., Bridwell, D. A., ... Saron, C. D. (2015). Intensive meditation training influences emotional responses to suffering. *Emotion (Washington, D.C.)*, 15(6), 775–90. <https://doi.org/10.1037/emo0000080>
- Rosselli, M., Tappen, R., Williams, C., & Salvatierra, J. (2006). The relation of education and gender on the attention items of the Mini-Mental State Examination in Spanish speaking Hispanic elders. *Archives of Clinical Neuropsychology*, 21(7), 677–686.
<https://doi.org/10.1016/j.acn.2006.08.001>
- Schechter, L. E., Ring, R. H., Beyer, C. E., Hughes, A., Khawaja, X., Malberg, J. E., &

- Rosenzweig-lipson, S. (2005). Innovative Approaches for the Development of Antidepressant Drugs : Current and Future Strategies, 2(October), 590–611.
- Schofield, T. P., Creswell, J. D., & Denson, T. F. (2015). Brief mindfulness induction reduces inattention blindness. *Consciousness and Cognition*, 37, 63–70.
<https://doi.org/10.1016/j.concog.2015.08.007>
- Schuver, K. J., & Lewis, B. A. (2016). Mindfulness-based yoga intervention for women with depression. *Complementary Therapies in Medicine*, 26, 85–91.
<https://doi.org/10.1016/j.ctim.2016.03.003>
- Segal, Z. V, Kennedy, S., Gemar, M., Hood, K., Pedersen, R., & Buis, T. (2006). Cognitive reactivity to sad mood provocation and the prediction of depressive relapse. *Archives of General Psychiatry*, 63(July 2006), 749–755. <https://doi.org/10.1001/archpsyc.63.7.749>
- Shonin, E., & van Gordon, W. (2016). The Mechanisms of Mindfulness in the Treatment of Mental Illness and Addiction. *International Journal of Mental Health and Addiction*, 1–6.
<https://doi.org/10.1007/s11469-016-9653-7>
- Teasdale, J. D., Moore, R. G., Hayhurst, H., Pope, M., Williams, S., & Segal, Z. V. (2002). Metacognitive awareness and prevention of relapse in depression: empirical evidence. *Journal of Consulting and Clinical Psychology*, 70(2), 275–287.
<https://doi.org/10.1037/0022-006X.70.2.275>
- Teasdale, J. D., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of Relapse / Recurrence in Major Depression by Mindfulness-Based Cognitive Therapy, 68(4), 615–623. <https://doi.org/10.1037//0022-006X.68.4.615>
- Tompsonski, P. D., & Tinsley, V. F. (1996). Effects of Memory Demand and Motivation on Sustained Attention in Young and Older Adults. *The American Journal of Psychology*, 109(2), 187. <https://doi.org/10.2307/1423272>
- Vago, D. R. (2009). Measures of Mindfulness. Retrieved December 27, 2016, from <http://davidvago.bwh.harvard.edu/measures-of-mindfulness/>
- Wallace, B. A. (2006). *The attention revolution. Unlocking the power of the focused mind.* Somerville, USA: Wisdom Publications.
- Wang, Y. P., & Gorenstein, C. (2013). Psychometric properties of the Beck Depression Inventory-II: A comprehensive review. *Revista Brasileira de Psiquiatria*, 35(4), 416–431.

<https://doi.org/10.1590/1516-4446-2012-1048>

WHO | Depression. (2016). *WHO*.

Williams, J. (2008). Mindfulness, Depression and Modes of Mind. *Cognitive Therapy and Research*, 32(6), 721–733.

Williams, J. M. G. (2008). Mindfulness, depression and modes of mind. *Cognitive Therapy and Research*, 32(6), 721–733. <https://doi.org/10.1007/s10608-008-9204-z>

Williams, Z. V, & Teasdale, J. M. G. (2007). Mindfulness-Based Cognitive Therapy for Depression: A New Approach to Preventing Relapse Segal. *Cognitive Behavioral Therapy Book Reviews*, 1(11), 1–2. <https://doi.org/10.1176/appi.ps.56.9.1165>

APPENDIXES

Recruitment Flyer

Concentratietraining



Is this you?

Wil jij je concentratie verhogen? EN 2.5 proePersoon uren verdienen?

Wat houdt het in?

- vooraf vul je thuis 4 vragenlijsten in (1 uur)
- woon een concentratietraining bij op de universiteit van Utrecht (1 uur)
- Doe de aandachtstaak om te kijken of jou concentratie is verbeterd

Wat moet je doen?

- Heb je geen motorische of cognitieve beperkingen?
- Wanneer?**
week 2
week 3
week 4
- geef je beschikbaarheid door;
aandachtstaak.thesis@gmail.com