

# Mindfulness-Based Therapy in Adults with an Autism Spectrum Disorder: Do Treatment Effects Last?

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**Abstract** Individuals with autism spectrum disorders (ASD) have a higher incidence of comorbid disorders in comparison with other patient groups. Empirical evidence on treatments targeting comorbid symptoms is however scarce. Earlier research showed that mindfulness-based therapy for individuals on the autism spectrum (MBT-AS) is effective in reducing symptoms of depression, anxiety, and rumination. In the current study, it was examined whether MBT-AS is effective in alleviating a variety of psychosomatic symptoms and whether these effects were still evident after 9 weeks. Fifty participants took part in a nine-week MBT-AS training. Self-reported symptoms were evaluated at three intervals: (1) before the first session, (2) after the last session, and (3) 9 weeks after the last session. Results showed that symptoms of anxiety, depression, agoraphobia, somatization, inadequacy in thinking and acting, distrust and interpersonal sensitivity, sleeping problems, and general psychological and physical well-being declined significantly during intervention. Positive affect increased, and rumination declined significantly during treatment. Hostility symptoms did not decline significantly during treatment. All symptoms remained stable between post intervention and follow-up. This would seem to indicate that MBT-AS is effective in reducing psychological and physical symptoms and keeping them stable over the longer term. Furthermore, the outcome indicates that rumination is an important mediating factor. In conclusion, MBT-AS appears to be an effective method for reducing a variety of symptoms, and treatment gains remain stable over the longer term.

**Keywords** ASD · Mindfulness · Rumination · Psychological and physical well-being · Depression

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## Introduction

According to the diagnostic criteria of the DSM-5, autism spectrum disorders (ASD) are characterized by persistent deficits in social communication across multiple contexts and by a restricted repertoire of behavior, interests, and/or activities (American Psychiatric Association: APA 2013). ASD are often associated with comorbid problems, especially in high-functioning adults (Bradley & Bolton, 2006; Wozniak et al., 2013). According to Gilliot and Standen (2007), anxiety disorders and depression are the most commonly seen comorbid disorders for high-functioning adults with ASD. Treatment of these comorbid disorders is deemed important, especially for these groups of adults. Research literature regarding the efficacy of the treatment of comorbid symptoms in people with ASD is limited. Bishop-Fitzpatrick et al. (2012) report that “there is a substantial need for the rigorous development and evaluation of psychosocial treatments especially for high functioning adults with ASD.” The existing research into this specific group is limited to the use of medication, cognitive behavioral therapy (CBT), and mindfulness-based interventions (MBT).

With regard to medication, McDougle et al. (1998) examined the use of the atypical antipsychotic drug Risperidone to treat comorbid depression and anxiety in adults with ASD and low intelligence. The use of Risperidone was superior to a placebo in reducing symptoms of depression and anxiety/nervousness. Williams et al. (2010) performed meta-analyses of two randomized controlled trials on the efficacy of the treatment of comorbid anxiety with an SSRI compared to a placebo in adults with ASD and normal intelligence. They reported that there is limited evidence to suggest that the use of SSRIs to treat symptoms of anxiety and hostility in adults with ASD is effective. Unfortunately, the use of SSRIs may also cause side effects; hence, the authors’ suggestion that the decision for the usage of medication should be made case

wise (Williams et al., 2010). These studies show there are mixed views on the usage of pharmacotherapy for the treatment of comorbid disorders in large groups of adults with ASD. Furthermore, longer term effects are unclear. There are few studies in which nonmedical treatments have been investigated in adults with ASD. Only cognitive behavioral therapy (CBT) and mindfulness-based therapy (MBT) were examined in this respect. According to Gaus (2011), CBT may be a well-suited intervention for adults with ASD, if the development of coping and social strategies is emphasized during CBT sessions. There is some empirical evidence concerning the efficacy of CBT in adults with ASD; two case studies and one small sample ( $N=3$ ) study reported positive treatment outcome regarding symptoms of depression and anxiety (Cardaciotto & Herbert, 2004; Hare, 1997; Weiss & Lunsky, 2010). In a more recent study, Russell et al. (2013) studied 46 adults and adolescents with ASD and reported that CBT is an effective treatment method for comorbid obsessive-compulsive disorder in high-functioning younger adults with ASD (mean age, 27.06) and that treatment gains remained stable during a 12-month follow-up. However, there are some limitations regarding the use of CBT in treatment. It took the subjects a long time to grasp the concept of CBT and to apply the techniques learned to real-life situations (Cardaciotto & Herbert, 2004; Hare, 1997; Weiss & Lunsky, 2010). Furthermore, and more importantly, it remains unclear whether the effects of the intervention remain stable over time for other high incidence comorbid disorders in adults with ASD.

In MBT, the focus lies on the acceptance of thoughts and feelings without the need to change them (Kabat-Zinn, 1982). Learning to accept and therefore to handle these experiences might reduce ruminative thinking and negative mood (Nyklíček & Kuijpers, 2008). A number of studies showed that MBT has positive effects on mental well-being, anxiety, depression, and sleeping problems in both patient and non-patient subjects (Bränström et al., 2011; Brown & Ryan, 2003; Hofmann et al., 2010; Nyklíček & Kuijpers, 2008; Shapiro et al., 2003). Since individuals with ASD often have impaired imagination skills (Baron-Cohen, 2001) and difficulties in communication (Minschew et al., 1995). Spek et al. (2013) tailored the MBT protocol to fit the needs of adults with ASD (mindfulness-based therapy for individuals on the autism spectrum: MBT-AS). In a randomized controlled trial, they examined whether individuals with ASD can benefit from MBT-AS. In this study, a significant decline was reported in symptoms of anxiety, depression, and rumination in the intervention group in comparison with the control group. Furthermore, they found increased positive affect in the intervention group. Spek et al. (2013) argued that this improvement was due to a reduction in rumination. This is in line with the reported mediator relationship of rumination between the effect of mindfulness and symptoms of depression and anxiety in other patient groups (McLaughlin & Nolen-Hoeksema,

2010; Ramel et al., 2004). Although the study may implicate that adults with ASD can benefit from MBT-AS, the authors did not examine whether the investigated effects were longer lasting, which is extremely important given the limited generalizability of treatment in individuals with ASD (Schreibman & Ingersoll, pp. 882–896 as cited by Volkmar, Paul, Klin & Cohen, 2005). The current study aims to investigate the longer term effects of mindfulness-based therapy in high functioning adults with ASD.

Given that the classification of ASD in adulthood is relatively “new” in the field of clinical diagnostics, it is anticipated that the group of adults with ASD will increase vigorously in the coming years. Regrettably, for this group of adults, there are very few evidence-based therapies available. As adults with ASD generally display higher incidence rates of comorbid psychiatric disorders (Bradley & Bolton, 2006; Wozniak et al., 2013), therapies for adults with ASD that address comorbid symptoms are needed.

The aim of the present study is to examine the effects of MBT-AS on psychological and physical well-being of adults with ASD and to determine whether treatment effects of MBT-AS last over a longer period of time. Furthermore, we will investigate whether and how these factors are related to changes in self-reported rumination. The data of 20 (out of 50) of the subjects used in this study has been used in earlier research of Spek et al. (2013). Because we used a considerably larger sample size, this generates an increased statistical power which makes it possible to analyze a much greater number of symptoms than in this former study. Furthermore, the aim of the current study is to investigate long-term effects, which was beyond the scope of the earlier research because these data were not yet measured during that publication.

## Method

### Participants

All participants ( $N=50$ ) were recruited from the Adult Autism Center (Eindhoven, the Netherlands) and were assessed according to a standardized diagnostic process. An experienced and trained psychologist diagnosed the ASD based on an evaluation of historic and current symptomatology. The sample consisted of 34 males (mean age 42.1; SD 10.5) and 16 females (mean age 37.9; SD 14). The participants were matched on age ( $F(1, 49)=1.422, p=0.239$ ). The Dutch translation of the revised version of the Autism Diagnostic Interview (ADI-R: Lord et al., 1994) was used to interview parents in order to gather developmental information and information about the participant’s early childhood. When no parental information was available, older siblings were interviewed using the ADI-R. The participant also took part in a semi-structured interview, which has been used in previous studies

for diagnostic classification (e.g., Spek et al., 2008, 2009), which addresses all the DSM-IV-TR criteria for ASD (American Psychiatric Association, 2000). Following the primary testing of the criteria of the DSM-IV-TR, more in-depth questions were posed in order to determine whether the diagnostic criteria of the DSM-IV-TR were met. The Autism Diagnostic Observation Schedule (ADOS: Lord et al., 1999) is an instrument that can be used to assess ASD characteristics. However, research showed that the ADOS is under-inclusive in diagnosing mild, verbally able adolescents and adults with ASD (Lai et al., 2011; Lord et al., 2000). Therefore, we decided not to use the ADOS in our assessment protocol.

In concordance with recent developments in the DSM-5 criteria (APA, 2013) and the notion that ASD is best represented as a single diagnostic category, all participants with ASD were included in this study. The following criteria were determined for inclusion: (1) participants had been diagnosed with ASD; (2) participants were between 20 and 65 years of age; and (3) participants were experiencing symptoms of depression, anxiety and/or rumination as identified by their referring clinicians. Participants were excluded from this research if (1) they had a below-average intelligence on Full scale intelligence (score <85) and below average verbal ability (score <85) as measured by the WAIS-III (Wechsler, 1997), (2) they were institutionalized, (3) they suffered from other (genetic) conditions or neurodevelopmental disorders other than ASD, (4) medication was altered during the study, and (5) the person had a drugs and/or alcohol dependency. Fifty-eight participants met the described criteria for inclusion. Eight of the participants dropped out of the study before completion, resulting in data being collected on fifty participants.

### Procedure

The participants were divided into five training groups consisting of 10 participants each. A trained and experienced psychologist and clinical psychologist led the group sessions. Both trainers had followed an 8-day MBCT educational program for therapists in the Netherlands with a view to conducting mindfulness training sessions. Over a period of 8 months, both therapists instructed adults with ASD on the use of MBT after which the original protocol (Segal et al., 2002) was adapted to suit the specific needs of adults with ASD (Spek et al., 2013; Spek, 2010). The most important adjustments to the original protocol of Segal et al. (2002) concerned the following: (1) cognitive elements, for example the examination of one's thoughts was omitted because of deficits in information processing that characterize ASD (Spek et al., 2013); (2) metaphors and words or sentences that are ambiguous or require imagination skills were avoided; (3) the original program was extended by one week resulting in a nine-week protocol in order to compensate for the relatively

slow information processing of this population (Spek et al., 2008); and (4) the three-minute breathing exercise was extended to 5 min for the same reason (Spek et al., 2013).

The tailored MBT-AS protocol consisted of nine weekly sessions of 2.5 hours each. The participants were asked to practice 40–60 min of meditation at home during 6 days of the week in order to incorporate the mindfulness skills into the home environment and into their daily routine. To account for impairment in executive functioning, special attention was paid to planning the homework program (e.g., daily meditation exercises). Any difficulties with planning were discussed individually. Participants were encouraged to explore which exercises were most helpful to them in daily life. Further assistance was given to determine the best place and time to perform individual meditation exercises. The exercises were available as mp3 audio files that could be downloaded from the internet. The weekly sessions are further described in detail by Spek (2010; Spek et al., 2013).

### Measures

Effects were measured at three intervals: (1) the baseline assessment, performed 1 week before the start of MBT, (2) the assessment of short-term effects immediately after completing the ninth session, and (3) the assessment of longer term effects 9 weeks after the last session. The procedure with regard to the measurements was identical for all three evaluations. Three self-report questionnaires were used in order to investigate the short- and long-term effects of MBT-AS. Psychology students who were experienced in the assessment of ASD and who were not involved in the treatment procedure administered the questionnaires. Participants were encouraged to ask questions during the administration of the questionnaires to ensure the data gathered was as accurate as possible. To ensure complete data, the students checked whether all the items were filled in after the participant completed the questionnaires.

### SCL-90-R

The Symptom Checklist-90-Revised (Derogatis, 1994) is a 90-item self-report symptom inventory. In the Netherlands, this checklist is most commonly used to evaluate a broad range of psychological problems and symptoms of psychopathology, consisting of nine symptom dimensions and a global severity index (Pearson Assessments, 2013). Responses are given on a 5-point Likert scale. Cronbach's alpha for the original individual scales varied from 0.80 to 0.90 (Derogatis, 1994). In the current sample, Cronbach's alpha varied between 0.959 and 0.981 over the intervals, which is excellent (George & Mallery, 2003).

The Dutch version of the Symptom Checklist-90-Revised (SCL-90-R) consists of the following subscales: anxiety

(experiencing anxiety and fear), depression (experiencing symptoms of depression), agoraphobia (being afraid of open spaces), somatization (experiencing physical complaints), inadequacy in thinking and acting (experiencing obsessive thoughts), distrust and interpersonal sensitivity (having difficulty trusting others and feeling socially insecure), hostility (feeling irritated or angry easily), sleeping problems (having difficulties falling asleep, waking up early or other sleeping problems), and general psychological and physical well-being (total score of all separate subscales). Reliability and construct validity of the original SCL-90-R and of the Dutch version have been described as excellent (Arrindell & Ettema, 2003; Buckelew et al. 1988).

### RRQ

The Rumination-Reflection Questionnaire (RRQ, Trapnell & Campbell, 1999) distinguishes rumination from reflection. Rumination and reflection are characterized by an alleviated attention to the self, but the motives behind the attention differ (Alberts, 2013). Trapnell & Campbell (1999) describe rumination as “self-attentiveness motivated by perceived threats, losses, or injustices to the self”. Rumination can also be described as experiencing “self-related, recurrent, negative thoughts”. Reflection was defined as “self-attentiveness motivated by curiosity or epistemic interest in the self”. In this study, only the Rumination scale was used. Responses are given on a 5-point Likert scale. A Cronbach’s alpha of 0.90 has been reported for the Rumination subscale for both the original version and the Dutch version, while correlations with related and unrelated constructs showed its discriminant and concurrent validity (Nyklíček & Denollet, 2009; Trapnell & Campbell, 1999). In the current sample, the Cronbach’s alpha varied between 0.547 and 0.882, indicating a decreased reliability in comparison with other studies. However, the reliability is assumed to be satisfying according to the Cronbach’s alpha scores (George & Mallery, 2003).

### GMS

The Dutch Global Mood scale (GMS) consists of 20 items that measure negative and positive affect (Denollet, 1993). In the present study, we used the positive affect subscale. This subscale is positively associated with quality of life and with the ability to initiate activities, resulting in a pleasant mood. This indicates the construct and predictive validity (Denollet, 1993; Watson & Pennebaker, 1989). Since the negative mood scale and the SCL-90 most probably measure a similar construct, the negative affect scale was omitted in this study. Given a Cronbach’s alpha of 0.94, a high internal reliability is expected (Denollet, 1993). Cronbach’s alpha varied from 0.696 to 0.769 in the current sample, which is acceptable (George & Mallery, 2003).

## Results

Statistical analyses were conducted using SPSS version 19 (IBM Corp., 2010). Eight missing values were replaced with the mean score of the corresponding scale. Means and standard deviations for each variable are presented in Table 1. First, a repeated measures multivariate analyses of variance (MANOVA) was carried out with time as independent variable and the SCL-90 subscales, rumination (subscale RRQ) and positive affect (subscale GMS) as dependent variables. In this way, it could be determined whether there was a main effect of time on the scales in total. Secondly, a MANOVA was carried out to determine whether differences between the intervals were significant and if so, for which scales. Thirdly, correlations were computed in order to determine if assumptions for repeated measures multivariate analyses of variance with rumination as covariate (MANCOVA) were met. Subsequently, a MANCOVA was carried out with time as independent variable, depression, anxiety and general psychological and physical well-being as dependent variables and rumination as a covariate.

A repeated measures multivariate analyses of variance (MANOVA) for all dependent variables showed a significant omnibus main effect of time ( $F(24, 25)=2.21, p=0.027$ , partial  $\eta^2=0.68$  and a main effect of time for anxiety ( $F(2, 96)=10.86, p=0.000$ , partial  $\eta^2=0.185$  and positive affect ( $F(2, 96)=9.561, p=0.000$ , partial  $\eta^2=0.166$ ). After correcting the degrees of freedom using Huynh-Feldt estimates of sphericity, a significant main effect for time was found on the following variables: somatization ( $F(1.64, 81.2)=7.78, p=0.002$ , partial  $\eta^2=0.139$ ), inadequacy in thinking and acting ( $F(1.59, 78.7)=18.4, p=0.000$ , partial  $\eta^2=0.277$ ), depression ( $F(1.68, 83)=13.2, p=0.000$ , partial  $\eta^2=0.215$ ), agoraphobia ( $F(1.67, 83.1)=5.61, p=0.008$ , partial  $\eta^2=0.105$ ), distrust and interpersonal sensitivity ( $F(1.67, 82.7)=7.34, p=0.002$ , partial  $\eta^2=0.133$ ), sleeping problems ( $F(1.71, 84.8)=12.4, p=0.000$ , partial  $\eta^2=0.205$ ), general psychological and physical well-being ( $F(1.65, 81.6)=15.4, p=0.000$ , partial  $\eta^2=0.243$ ), and rumination ( $F(1.75, 86.9)=12.5, p=0.000$ , partial  $\eta^2=0.207$ ). The results showed no significant main effect of time on hostility ( $F(2, 96)=1.63, p<0.201$ , partial  $\eta^2=0.033$ ).

Table 2 shows the differences and levels of significance between the three evaluations for each variable. The results show that the difference between the first and second evaluations are significant for all dependent variables ( $p$  value < 0.01), whereas there are no significant differences on any of the scales between the second and third evaluations (lowest  $p$  value = 0.187). This indicates significant positive effects of MBT-ASD right after completing treatment, which remains stable over a 9 week period after completing therapy.

To determine whether changes in time are related to changes in rumination, an explorative correlation analysis was conducted. The results show significant correlations between the

**Table 1** Means and standard deviations of the SCL-90-R, GMS, and RRQ scales for the intervals

	Interval 1	Interval 2	Interval 3	<i>p</i> value
Anxiety	20.2 (0.95)	16.8 (0.72)	17.4 (0.92)	0.000**
Depression	35.8 (1.61)	30.6 (1.57)	29.65 (1.21)	0.000**
Agoraphobia	11.8 (0.67)	10.6 (0.56)	10.6 (0.60)	0.007**
Somatization	22.6 (1.26)	20.1 (0.78)	19.5 (0.76)	0.002**
Inadequacy in thinking and acting	23.9 (1.08)	19.9 (0.80)	20 (0.95)	0.000**
Distrust and interpersonal sensitivity	38.7 (1.64)	34.4 (1.64)	33.9 (1.99)	0.002**
Hostility	9.6 (0.48)	8.8 (0.42)	9.4 (0.54)	0.201
Sleeping problems	8 (0.42)	6.2 (0.39)	6.4 (0.44)	0.000**
General psychosomatic well-being	170.6 (44.85)	146.4 (34.5)	147.8 (46.7)	0.000**
Rumination	40.8 (1.27)	36.7 (1.09)	36.4 (0.94)	0.000**
Positive affect	16.2 (1.10)	19.2 (1.05)	20 (1.14)	0.000**

*F* statistic is of group by time interaction effect

\*\**p*<0.001 (reflects level of significance)

change of rumination (between evaluations one and two) and symptoms of depression ( $r=0.31$ ,  $p=0.031$ ). Significant correlations are also found in the change of rumination between the second and third evaluations, and in the change between the second and third evaluations in anxiety ( $r=0.319$ ,  $p=0.024$ ), depression ( $r=0.479$ ,  $p<0.01$ ) and general psychological and physical well-being ( $r=0.386$ ,  $p=0.006$ ). Assumptions were met for repeated measures multivariate analyses of variance with anxiety, depression, and general psychological and physical well-being as dependent variables and rumination as covariate.

A repeated measures MANCOVA with rumination as covariate shows that the difference in symptoms of depression between time point 1 and 2 is no longer significant after adding the covariate (degrees of freedom were corrected using Huynh-Feldt estimates of sphericity:  $F(1.67, 82.9)=0.511$ ,  $p=0.569$ , partial  $\eta^2=0.011$ ). This indicates that rumination is a complete mediator in the relation between time and depression. With regard to the difference between intervals 2 and 3, the MANOVA shows that the time interaction effect was significant for depression after adding rumination as covariate

(degrees of freedom were corrected using Huynh-Feldt estimates of sphericity:  $F(1.67, 75.1)=8.13$ ,  $p=0.001$ , partial  $\eta^2=0.153$ ). The interaction between time and anxiety for the difference between measurement 2 and 3 became significant after adding rumination as covariate ( $F(1.89, 90)=4.29$ ,  $p=0.017$ , partial  $\eta^2=0.087$ ). Furthermore, rumination is mediating in the interaction effect between evaluations 2 and 3 for general psychological and physical well-being (degrees of freedom were corrected using Huynh-Feldt estimates of sphericity:  $F(1.63, 80.8)=5.48$ ,  $p=0.01$ , partial  $\eta^2=0.109$ ).

## Discussion

The aim of this study was to investigate whether psychological and physical symptoms, rumination, and positive affect change after MBT-AS or whether these remain stable over time. Symptoms of anxiety, depression, agoraphobia, somatization, inadequacy in thinking and acting, distrust and interpersonal sensitivity, sleeping problems, general psychological and physical well-being, and rumination declined

**Table 2** Means and standard deviations of the SCL-90-R, GMS, and RRQ scales for the difference between intervals 2-1 and 3-2

	Difference intervals 1 and 2	<i>p</i> value	Difference intervals 2 and 3	<i>p</i> value
Anxiety	3.35 (0.7)	0.000**	0.59 (0.78)	0.451
Depression	-6.29 (1.08)	0.000**	1.08 (1.25)	0.391
Agoraphobia	-1.24 (0.37)	0.000**	-0.01 (0.39)	0.986
Somatization	-2.47 (0.84)	0.000**	-0.63 (0.64)	0.325
Inadequacy in thinking and acting	-3.92 (0.76)	0.000**	0.08 (0.54)	0.880
Distrust and interpersonal sensitivity	-4.32 (1.27)	0.000**	-0.49 (1.17)	0.675
Hostility	-0.84 (0.44)	0.000**	0.59 (0.44)	0.187
Sleeping problems	-1.76 (0.38)	0.000**	0.2 (0.32)	0.522
General psychosomatic well-being	-24.17 (4.37)	0.000**	1.12 (4.22)	0.738
Rumination	-0.34 (0.07)	0.000**	-0.03 (0.08)	0.735
Positive affect	2.96 (0.9)	0.000**	0.84 (0.85)	0.330

*F*-statistic is of group by time interaction effect

\*\**p*<0.001 (reflects level of significance)

significantly during the intervention. The increase in positive affect during treatment was also significant. Only symptoms of self-reported hostility did not decline significantly during treatment. Relevant in this respect is that this specific sample did not report elevated hostility symptoms before the intervention, as one might expect in a psychiatric population. This might explain why the intervention did not influence this variable. In general, it is still unclear whether high functioning adults with ASD experience more hostility symptoms as compared to the general population (Långström et al., 2008). However, it is also possible that MBT-AS is not effective in decreasing symptoms of hostility.

In the present study, no significant differences were found between reported psychological and physical symptoms immediately after treatment and 9 weeks after treatment. This implies that the treatment results from the pre- to post intervention period remain stable over time and therefore seems to indicate that MBT-AS is effective on the shorter as well as the longer term in reducing a variety of psychological and physical symptoms. These results are in line with studies that show that MBT has positive effects on psychological well-being, anxiety, depression, and sleeping problems in other patient and non-patient subjects (Bränström et al., 2011; Brown & Ryan, 2003; Chiesa & Serretti, 2011; Fjorback, Ørnbøl, Fink & Walach, 2011; Hofmann et al., 2010; Nyklíček & Kuijpers, 2008; Salmon et al., 2004; Shapiro et al., 2003). Furthermore, the results of the current study are in line with findings of Spek and colleagues (2013), who reported that MBT-AS resulted in a decline in comorbid symptoms in adults with ASD. The longer term effectiveness of MBT-AS in adults with ASD can be considered a very positive and promising finding, especially considering the fact that the generalization of skills learned in an instructional setting into a functional setting is usually very limited (Schreibman & Ingersoll, pp. 882–896 as cited by Volkmar, Paul, Klin & Cohen, 2005; Swettenham, as cited by Baron-Cohen, Tager-Flusberg & Cohen, 2000). Possibly, the focus of the tailored MBT protocol on applying the acquired skills into one's private life had a positive effect on the generalization of acquired skills: the participants were frequently asked how the meditations might benefit them the most and what could help them to actually use the meditation techniques. Another explanation may be that average to highly intelligent adults with ASD can be taught how to generalize skills for their general benefit. We already know that intelligent adults with ASD can process global information when explicitly instructed to do so (Happé & Frith, 2006). A similar process might occur for generalizing skills: they may be able to incorporate techniques into their daily routine, if they are also taught how and when to do this. This would be worth investigating in future studies.

Furthermore, we investigated whether the positive effects of MBT-AS could be attributed to a decline in rumination. The results showed that a decline of rumination was related to the

effect of MBT-AS on symptoms of depression, both during the intervention and after the intervention. Furthermore, rumination influenced the effect of MBT-AS on anxiety symptoms during the 9 weeks after treatment. These results are in line with previous results of Mclaughlin and Nolen-Hoeksema (2010), Spek et al. (2013), and Ramel and colleagues (2004), who found rumination to be an important factor in the effectiveness of MBT. Rumination furthermore mediated the treatment effect on overall psychological and physical well-being, which is in line with previous studies describing an overall negative effect of rumination on physical and psychopathological health (Kirkegaard et al., 2004; Nolen-Hoeksema et al., 2008; Sansone & Sansone, 2012). This stresses the importance of rumination on the effectiveness of mindfulness-based therapy and consolidates the theoretical background of mindfulness in which it is stated that the goal of mindfulness is to permeate ruminative tendencies (Segal et al., 2002). However, rumination did not influence increased positive affect during and after treatment. The significant increase of positive affect appears to be solely due to the effect of MBT-AS.

In conclusion, the results of the current study indicate that MBT-AS appears to be an effective treatment for a variety of symptoms and overall psychological and physical well-being in high functioning adults with ASD, yielding both short and longer term positive effects.

#### Limitations and Future Research

The present study has several limitations. Firstly, the follow-up was carried out 9 weeks after the last therapy sessions. We therefore have no information on whether treatment gains remain evident beyond those 9 weeks. Secondly, in the current study, no control group was incorporated. As a result, we are not sure whether the effects of treatment during the follow-up period are indeed attributable to MBT-AS. Future research should address this issue. Thirdly, although the current study indicates that MBT-AS is effective in reducing and then stabilizing psychological and psychological and physical symptoms, it is not clear whether this method is superior to interventions based on pharmacotherapy or cognitive behavioral therapy. Future studies should compare the efficacy of different forms of treatment in order to provide individuals with ASD the best possible health care. The present study was limited to adults with ASD with average to high intelligence, which means that the results cannot be generalized to non-adult groups and to individuals with below average intelligence. The use of data from an earlier study might be noted as a limitation to this study (Spek et al. (2013)). However, this group made the results more robust and more extensive analyses could be conducted. Since the current study had a much wider scope than the former research and the substantial part of the data was measured in unique subjects.

A final remark that has to be made is that one of the lead trainers was also one of the researchers in this article which might lead to an experimenter's bias. In order to prevent bias, the first author of this article was not involved in the training program in any way.

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