
Mindfulness and Attention Deficit Hyperactivity Disorder



Susan L. Smalley

Mindful Awareness Research Center, Jane and Terry Semel Institute for Neuroscience and Human Behavior, University of California, Los Angeles



Sandra K. Loo

Center for Neurobehavioral Genetics, Jane and Terry Semel Institute for Neuroscience and Human Behavior, University of California, Los Angeles



T. Sigi Hale

Mindful Awareness Research Center, Jane and Terry Semel Institute for Neuroscience and Human Behavior, University of California, Los Angeles



Anshu Shrestha

Department of Epidemiology, School of Public Health, University of California, Los Angeles



James McGough

Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles

Dr. McGough has served as a consultant to and received research support from Eli Lilly & Company, Janssen Pharmaceuticals, Novartis, and Shire Pharmaceuticals. Dr. Smalley is collaborating with Pfizer to genotype samples collected for her NIMH grant MH5277. Neither she nor Pfizer is receiving or providing financial compensation for this arrangement.

All other authors report no competing interests. Work is supported by NIMH MH058277 (Smalley) and NINDS NS054124 (Loo). We wish to thank all the families who participated in this research and Jennifer Kitil for her research support.

Correspondence concerning this article should be addressed to: Dr. Susan L. Smalley, UCLA Semel Institute, 760 Westwood Plaza, Los Angeles, CA 90095; e-mail: ssmalley@mednet.ucla.edu



Lisa Flook

Mindful Awareness Research Center, Jane and Terry Semel Institute for Neuroscience and Human Behavior, University of California, Los Angeles



Steven Reise

Department of Psychology, University of California, Los Angeles

Attention deficit hyperactivity disorder (ADHD) is a disorder characterized by attentional difficulties. Mindfulness is a receptive attention to present experience. Both ADHD and mindfulness are associated with attention and personality. This study tests whether individuals with ADHD have lower mindfulness scores than controls and, if true, whether personality contributes to these differences. One hundred and five adults (half with ADHD) were assessed for mindfulness, using the Kentucky Inventory of Mindfulness Skills, and personality, using the Tridimensional Character Inventory. Individuals with ADHD report themselves as less mindful than non-ADHD controls and more novelty-seeking, less self-directed, and more self-transcendent. Mindfulness is negatively associated with ADHD and positively associated with self-directedness and self-transcendence. Analyses of subscales of mindfulness suggest that ADHD is associated most with the "Acting in Awareness" dimension, perhaps because of shared items reflecting attentional variability. The current findings support that a large portion of variability in trait mindfulness can be explained by ADHD status and personality traits of self-directedness and self-transcendence. It further suggests that interventions that increase mindfulness might improve symptoms of ADHD and increase self-directedness and/or self-transcendence. © 2009 Wiley Periodicals, Inc. *J Clin Psychol* 65: 1087–1098, 2009.

Keywords: novelty-seeking; self-directedness; self-transcendence; attention; temperament

Introduction

Attention deficit hyperactivity disorder (ADHD) is a condition characterized by inattention and/or hyperactivity and impulsivity (American Psychiatric Association, 1994) that affects some 10% of children and adolescents and 4% of adults (Faraone & Biederman, 2005; Skounti, Philalithis, & Galanakis, 2007). ADHD is thought to represent an extreme on a population continuum of variability with strong genetic influence (Faraone et al., 2005; Smalley, 2008). Genetic and neurobiological studies are underway to yield greater understanding of

gene-to-brain-to-behavior pathways (Smalley, 2008). Although cognitive processes of attention are implicated in ADHD (Loo et al., 2007; Roth & Saykin, 2004), personality differences may also prove important in understanding the genetics, neurobiology, and behavioral differences in this condition (Anckarsater et al., 2006; Cho et al., 2008; Lynn et al., 2005; Tillman et al., 2003).

Mindfulness is a relatively recent construct in Western psychology with an over 2500-year history in Eastern traditions, predominantly Buddhism (Brown, Ryan, & Creswell, 2007). It is defined as a receptive *attention* to present experience and is a construct that has both state and trait qualities (Brown et al., 2007). By trait qualities, we mean differences that are relatively stable across time, an example might be eye color. By state qualities, we mean differences that can be induced through practice or training and that do not remain over time; an example might be colored contact lenses that are used to modify eye color. Bishop et al. (2004) described mindfulness as “self-regulation of attention so that it is maintained on immediate experience” with “an orientation that is characterized by curiosity, openness and acceptance” (p. 3). Given the primary role of attention in mindfulness and the deficits of attention in ADHD, the question of their overlap is of interest (Zylowska, Smalley, & Schwartz, 2008). Perhaps an understanding of their overlap would shed light on biological and psychological aspects of mindfulness (given the large body of research on these facets of ADHD) as well as suggest new methods of treatment in ADHD.

Mindfulness practice involves concentrated attention but is explicitly described by an open monitoring of attention (Lutz, Slagter, Dunne, & Davidson, 2008). With mindfulness, there is an initial focus on breath that builds concentrated attention with a broadening of the focus of attention toward a steady monitoring of “whatever arises” from sensory, mental, or emotional states. Studies of attentional changes with mindfulness training support that the practice can fairly rapidly lead to changes in conflict attention (Tang et al., 2007). Conflict attention is a type of attention important in self-regulation (Posner & Rothbart, 1998). It involves inhibition of “conflictual” automatic responses to focus on less automatic targets, as measured by tasks such as the Stroop (Stroop, 1935) or the Attentional Network Task (ANT; Fan, McCandliss, Sommer, Raz, & Posner, 2002). The ANT task is a computerized measure of attention that detects alerting, orienting, and conflict attention (Fan et al.) and has been used in studies of both ADHD (Loo et al., 2007) and mindfulness (Jha, Krompinger, & Baime, 2007; Tang et al., 2007). Results from such work support a decrease in conflict attention in ADHD (Loo et al., 2007) and an increase in conflict attention with mindfulness training (Tang et al., 2007). The prefrontal cortex is involved in conflict attention (Posner & Rothbart, 1998), and brain imaging studies of both ADHD and mindfulness suggest prefrontal cortical structure involvement as well (Davidson et al., 2003; Giedd, Blumenthal, Molloy, & Castellanos, 2001; Holzel et al., 2007; Lazar et al., 2005).

A second construct of potential overlap in ADHD and mindfulness is that of personality. Personality may be conceptualized as comprising temperament and character according to Cloninger (2004), where temperament describes differences in biological response patterns to external stimuli, and character describes subject-object relationships, such as the “self” relationship to self, others, and the universe at large. Although there are varying conceptual frameworks of personality, such as the Five Factor model (e.g., Heine & Buchtel, 2009; McAdams, 1992) and tools of measurement, three temperament constructs are fairly consistent across most frameworks. These can be described as the biological response patterns of approach to novel stimuli (novelty-seeking), avoidance of harmful stimuli (harm-avoidance),

and constraint (effortful control), which have unique neurobiological underpinnings (Whittle, Allen, Lubman, & Yucel, 2006). Under the Cloninger conceptualization of personality (2004), three character traits develop with age amidst the varying temperament constructs to form personality. Character describes subject-object relationships of self-to-self (self-directedness), self-to-other (cooperativeness), and self-to-the-universe at large (self-transcendence).

Mindfulness has been shown to correlate with certain measures of personality (Baer et al., 2008; Brown & Ryan, 2003). Significant associations have been reported for trait mindfulness scores and measures of personality based on the Five Factor model (Baer, Smith, & Allen, 2004; Brown & Ryan, 2003). Using tools based on the Five Factor model, a negative association was observed for mindfulness and neuroticism (closely aligned with the dimension of harm avoidance), and positive associations were observed with subscales of mindfulness for openness, agreeableness, extraversion, and conscientiousness (Baer et al., 2004; Brown & Ryan, 2003). To our knowledge, there are no reports of mindfulness and the character scales measured by the Tridimensional Character Inventory (TCI; Cloninger, Przybeck, Svrakic, & Wetzel, 1994), but constructs measured by the character scales (cooperativeness, self-directedness, self-transcendence) may share features with agreeableness, conscientiousness, and openness. The character scales also overlap with constructs described by Hayes (1984) and ones that may benefit from other mindfulness-related practices, such as Acceptance and Commitment Therapy (Hayes, Strosahl, & Wilson, 1999; Powers, Vörding, & Emmelkamp, 2009).

Studies of personality in ADHD also support group differences in personality (Anckarsater et al., 2006; Cho et al., 2008; Lufi & Parish-Plass, 1995; Lynn et al., 2005; Martel & Nigg, 2006; Tillman et al., 2003). Individuals with ADHD are more novelty-seeking (Anckarsater et al.; Cho et al., 2008; Lynn et al., 2005; Tillman et al., 2003), more harm-avoidant (HA), and less constrained (effortful control) than non-ADHD controls (Lufi & Parish-Plass, 1995; Martel & Nigg, 2006). Character traits show differences as well with ADHD individuals showing elevated scores on self-transcendence (Anckarsater et al., 2006; Cho et al., 2008; Lynn et al., 2005) and lower scores on self-directedness and cooperativeness (Anckarsater et al., 2006; Cho et al., 2008; Tillman et al., 2003).

How personality differences specifically influence the development of ADHD is as yet unknown; however, the potential association of mindfulness and ADHD could be due to attention or personality or both. The purpose of the present study is to investigate the association of *trait* mindfulness with ADHD and to examine the degree to which personality differences might contribute to such an association. We hypothesize that ADHD and mindfulness will be negatively correlated because of the role of attention in each (*increasing* conflict attention with greater mindfulness; *decreasing* conflict attention associated with ADHD). Second, we hypothesize that the character traits of self-transcendence, self-directedness, and cooperativeness will contribute to mindfulness and ADHD. Third, we hypothesize that the temperament traits will contribute individually to ADHD (novelty-seeking) and mindfulness (harm-avoidance) but not both.

Methods

Participants

The sample comprises 105 parents ascertained through at least 2 affected ADHD children as part of an ongoing genetic study of ADHD (Smalley et al., 2000).

The sample represents an independent set of parents from those included in our previous analysis of ADHD and personality (Lynn et al., 2005). About half of the participants ($n = 51$, 49%) met a lifetime diagnosis of ADHD, and the rates of other psychiatric disorders were comparable to the larger sample of participants (McGough et al., 2005) with lifetime rates of mood disorders (46%), two or more anxiety disorders (19%), and a history of conduct/oppositional disorder or antisocial personality (15%) present.

Measures and Analytic Methods

After providing a description of the study, written informed consent approved by the UCLA Institutional Review Board was obtained. In addition to completing questionnaires, the participants underwent direct assessment for ADHD and other DSM-IV Axis I diagnoses using the SADS-LAR (Fyer, Mannuzza, Klein, & Endicott, 1995), supplemented with the KSADS-PL (Kaufman et al., 1997) to assess childhood disruptive disorders (Smalley et al., 2000). A best-estimate procedure is used to determine consensus diagnosis taking into account self and spouse report (DuPaul, Power, Anastopolous, & Reid, 1998) and clinical interview data. A lifetime diagnosis of ADHD is given if the subject meets full DSM-IV criteria for ADHD in childhood or adulthood with age of onset by 7 years (Definite) or if they fall one symptom short of diagnosis but meet the impairment and age of onset criteria (Probable diagnosis; McGough et al., 2005). A subset of 71 participants were administered parts of the WAIS-R (Wechsler, 1981), allowing for estimation of IQ for descriptive purpose; time limitations restricted IQ testing on all participants.

The sample comprises 105 participants (56 women, 49 men) drawn from 61 families. Fifty-one participants (49%) met a lifetime diagnosis of ADHD. The sample has an average age of 43.1 years ($SD = 5.8$), and 77% are Caucasian, 5% African-American, 10% Latino, 4% Asian, and 4% of "other" origin. The majority of participants had 4-year college degrees or higher (56%), 21% had some college, and 23% had high school or less education. The average IQ is 114.1 (standard deviation 16.1). There were no differences in ethnicity, age, education, socio-economic status, or estimated IQ between those with and those without ADHD; only education differed with fewer individuals with ADHD having had some college or college degrees (data not shown).

The Kentucky Inventory of Mindfulness Scale (KIMS; Baer et al., 2004) was added approximately 3 years ago to the battery of self-report questionnaires that participants complete and that includes the Tridimensional Character Inventory (TCI; Cloninger et al., 1994). The KIMS scale is a 39-item questionnaire that yields a composite score of mindfulness and four subscales of mindfulness: (a) observing, as reflected by items such as "I notice when my moods begin to change"; (b) describing, as reflected by items such as "I'm good at finding words to describe my feelings"; (c) acting in awareness, as reflected by items such as "When I do things, my mind wanders off and I'm easily distracted"; and (d) accepting without judgment, as reflected by items such as "I tell myself that I shouldn't be feeling the way I'm feeling." Some KIMS items are reverse scored so that on all subscales, a higher score reflects greater mindfulness. The KIMS has been shown to have high internal consistency (alpha coefficients of .83-.91) and strong correlations with both emotional intelligence ($r = .61$) and personality as assessed by the NEO-PI (Baer et al., 2008).

The TCI is a widely used scale for the assessment of personality (Cloninger et al., 1994). Temperament scales on the TCI include novelty-seeking (NS), harm avoidance (HA), reward dependence (RD), and persistence (P), while character scales include self-directedness (SD), self-transcendence (ST), and cooperativeness (C). The temperament scales of the TCI are correlated with other temperament scales and reflect what Whittle and colleagues (Whittle et al., 2006) described as three temperament dimensions: negative affectivity, positive affectivity, and constraint. Furthermore, the temperament traits correspond nicely to other personality inventories of temperament (Leibing, Jamrozinski, Vormfelde, Stahl, & Doering, 2008). The character traits described in the TCI model are not generally measured by other temperament scales and had been considered more “learned” than biological (Cloninger et al.). However, twin, molecular genetic, and neurobiological studies of the character traits support genetic and biological influences for character as well as temperament (Cloninger, 2004). The three scales are thought to measure subject-object relationships: self to self (SD) by items such as “My behavior is strongly guided by certain goals that I have set for myself”; self to others (C) by items such as “I often consider another’s person’s feelings as much as my own”; and self to the universe (ST) by items such as “Sometimes I have felt like I was part of something with no limits or boundaries in time and space.” How character and temperament, as measured by the TCI map onto other models of personality, has been a topic of recent debate (Cloninger, 2008; Farmer & Goldberg, 2008a,b).

All data were entered into SAS data sets using a double-entry verification procedure. Descriptive statistics, *t* tests, and regression analyses were run in SAS version 9.1 (SAS, 2004). Factor and component analyses were conducted in SPSS version 15.0 (SPSS, 2006). Several extraction methods (i.e., principal components, principal axis) were explored and multivariate solutions were rotated using Varimax to obtain orthogonal factors and Promax to obtain oblique or correlated factors.

Results

As shown in Table 1, participants with ADHD score lower on the composite measure of mindfulness and three of the four subscales, describing, acting in awareness, and accepting without judgment, compared with non-ADHD participants (see Table 1). On the Observing subscale, no group differences are evident, and, in fact, the mean score for the ADHD participants is slightly higher (36.22) than non-ADHD controls (34.65). On the TCI scales, participants with ADHD report themselves as more novelty-seeking and self-transcendent than non-ADHD participants, replicating the findings found in a previous study on an independent set of participants (Lynn et al., 2005). In addition, ADHD participants score lower on Self-Directedness than controls, a finding not present in our earlier study (Lynn et al., 2005) but that replicates others (Anckarsater et al., 2006; Cho et al., 2008).

Our hypotheses required inclusion of NS, HA, and the three character scales (ST, SD, and C) from the TCI. In addition, demographic variables (age, sex, ethnicity, and education) were included as covariates. We tested the relationship of ADHD with mindfulness by using hierarchical regression analysis entering demographic variables in step 1, followed by ADHD in step 2, and the five TCI scales in step 3. This methodology allows us to assess the percent variance in mindfulness scores accounted by each set of variables and to compare the relative change between steps. Various diagnostics were conducted to verify that the assumptions of hierarchical regression were not violated. Specifically, none of the variables in the full model

Table 1
TCI and KIMS Scores by Lifetime ADHD Diagnosis

Variable	Lifetime ADHD Status		DF	<i>t</i> statistic ^a	Effect Size ^b
	Yes Mean (SD)	No Mean (SD)			
<i>KIMS scales</i>					
Mindfulness score (KIMS sum)	117.71 (14.70)	129.67 (12.59)	103	4.49**	0.89
Observing	36.22 (7.58)	34.65 (8.67)	103	-0.98	-0.19
Describing	26.10 (6.81)	29.20 (6.03)	103	2.48*	0.49
Acting in awareness	26.24 (5.49)	32.89 (4.42)	103	6.86*	1.35
Accept without judgment	29.16 (6.47)	32.93 (5.76)	103	3.16*	0.62
<i>TCI scales</i>					
Harm avoidance	9.27 (5.69)	8.48 (4.42)	103	-0.80	-0.16
Persistence	3.39 (1.58)	3.20 (1.47)	103	-0.63	-0.12
Novelty-seeking	10.90 (3.96)	7.19 (4.29)	103	-4.61*	-0.91
Reward dependence	10.10 (3.12)	10.43 (3.03)	103	0.55	0.11
Cooperative	20.33 (4.18)	21.57 (3.93)	103	1.57	0.31
^a Self-directed	16.77 (6.31)	20.07 (4.12)	85.3	3.16*	0.62
Self-transcendence	7.14 (3.39)	5.00 (3.40)	103	-3.22*	-0.64

TCI indicates Tridimensional Character Inventory; KIMS, Kentucky Inventory of Mindfulness Scale; ADHD, attention deficit hyperactivity disorder; *SD*, standard deviation. * $p < .01$.

^aVariables with unequal variances, Satterwaite *t* test used.

^bCohen's *d*.

exceeded a variance inflation factor of 2, the Shapiro-Wilk *W* test for normality and quantile-quantile plot confirmed normality of the residuals, absence of heteroscedasticity was confirmed by examining a residual plot, and a linear relationship between the main effects and the outcome were verified through scatter plots.

As shown in Table 2, demographic variables account for little of the variance in mindfulness (7%), and, in contrast, ADHD is strongly associated with mindfulness (presence of ADHD = lower mindfulness), increasing the variance accounted for from 7% to 23%. As can be seen in step 3, individual differences in trait mindfulness are also influenced by personality as reflected by an increase in percent variance from 23% (step 2) to 51% (step 3). Overall, 51% of the variability in mindfulness could be accounted for by differences in demographics (education), ADHD, and specific facets of personality; the three most influential variables (as indexed by the magnitude of standardized betas) are ADHD, *SD*, and *ST*.

In an ad hoc analysis, we explored the same set of variables shown in step 3 with each of the four KIMS subscales to determine if any one scale was differentially affected by ADHD. In those analyses, it was clear that ADHD was significantly associated with the subscale "acting in awareness" (standardized beta = $-.48$, $p < .01$) and not with the other three scales (accepting, describing, and observing had standardized betas of $-.07$, $-.21$, and $-.14$, respectively; all were non-significant in the model). To further explore the relationship of ADHD and the "acting in awareness" scale, we applied component analysis to the 18 ADHD symptom items and the 10 "acting in awareness" items after scaling them to similar 0, 1, and 2 response categories (by collapsing the two categories "never" and "rarely true" on the KIMS into one group). The first five eigenvalues (9.3, 2.6, 1.7, 1.5, and 1.2) suggested the presence of a relatively large general factor, but a single component extraction revealed that the ADHD items loaded more highly on the factor while the

Table 2

Summary of hierarchical regression analysis of mindfulness score (KIMS sum) on ADHD and selected personality variables ($n = 105$)

Variable	B	SE B	β	R^2 (adj R^2)
Step 1				0.07 (.03)
Age	0.58	0.27	0.23*	
Sex	0.78	3.06	0.03	
Ethnicity	-0.63	3.67	-0.02	
Some college education	-6.79	4.52	-0.19	
College or higher education	-2.81	3.83	-0.09	
Step 2				0.23 (.19)
Age	0.56	0.25	0.22*	
Sex	0.88	2.79	0.03	
Ethnicity	-3.35	3.41	-0.10	
Some college education	-3.05	4.21	-0.08	
College or higher education	-4.94	3.53	-0.17	
ADHD status	-12.71	2.80	-0.43**	
Step 3				0.51 (.46)
Age	0.08	0.23	0.03	
Sex	0.23	2.56	0.01	
Ethnicity	-4.35	2.86	-0.12	
Some college education	-4.66	3.58	-0.13	
College or higher education	-7.22	3.00	-0.24*	
ADHD status	-11.61	-2.69	-0.39**	
Self-directedness	0.85	0.27	0.32**	
Self-transcendence	1.26	0.35	0.30**	
Novelty-seeking	-0.09	-0.31	-0.03	
Harm avoidance	-0.60	-0.25	-0.20*	
Cooperativeness	0.33	0.30	0.09	

KIMS, Kentucky Inventory of Mindfulness Scale; ADHD, attention deficit hyperactivity disorder; SE, ; B. Note. R^2 (adjusted R^2) = 0.07 (0.03) for step 1; ΔR^2 (adjusted R^2) = 0.16** (0.16) for step 2; ΔR^2 (adjusted R^2) = 0.28** (0.27) for step 3. An F-test was used to test for significance of difference in R^2 values. * $p < 0.05$, ** $p < 0.01$.

KIMS subscale items had low loadings. Using a two-component solution with a Promax rotation, the 18 ADHD items loaded on a first factor, while six KIMS items loaded on a second factor. Four KIMS items (items 3—I am easily distracted, 11—I drive on autopilot, 15—When reading, I focus all my attention on what I'm reading (reverse scored), and 23—I don't pay attention to what I'm doing) cross-loaded on both factors. The correlation among the Promax rotated components is 0.33. These results suggest that the two questionnaires measure two correlated constructs with their overlap largely reflected by a subset of items that measure attention.

Discussion

The findings support the hypothesis that individuals with ADHD have lower trait mindfulness than non-ADHD adults. Using regression analyses, approximately half of the variability in trait mindfulness can be accounted for by demographic differences, ADHD status, and personality dimensions of SD, ST, HA, NS, and C. The most significant variables in the model are ADHD, SD, and ST. The overlap of ADHD and mindfulness is largely ascribed to the mindfulness subscale, acting in awareness, suggesting that much of the association is due to attention. Because conflict attention has been shown to change in response to mindfulness training

(Tang et al., 2007) and to be lower in ADHD on average (Loo et al., 2007), the finding of an association of ADHD and mindfulness, specifically due to items of attention, suggests that mindfulness training might be a viable means of boosting attention in ADHD.

Aside from attentional variability, ADHD and mindfulness are associated with personality. The current study replicates a previously reported association of NS with ADHD (Lynn et al., 2005), but we find no association of NS with mindfulness. Conversely, in the present study, we found no association of HA with ADHD but observed a negative association of HA with mindfulness. Both ADHD and mindfulness are associated with SD and ST in the present study. In contrast to our expectation, we found little support that cooperativeness is associated with mindfulness in the present study.

Self-directedness is a construct that has great importance in psychological health and well-being. Several decades of research have clearly demonstrated a strong association of positive mental health and high scores on SD (Cloninger, 2004). All personality disorders and many Axis I diagnoses are associated with low scores on SD (Cloninger, 2004). These data suggest that *any intervention that improves SD* may have a marked influence on treatment success for most, if not all, psychiatric disorders. The current data support the hypothesis that mindfulness and SD are strongly associated, but the present data cannot determine causality. Future studies investigating mindfulness training on SD may help shed light on the impact it can have on the self-to-self relationship.

Self-transcendence is a character trait associated with an experience of being part of something greater than oneself, a relationship of self to the universe at large. Individuals low on ST are described as self-oriented, materialistic, irritable, controlling, serious; individuals that score high on ST are described as being judicious, idealistic, transpersonal, faithful, and spiritual. The ST construct reflects a non-religious yet spiritual dimension of personality. The positive role of elevated ST in coping with aging, illness, or end stage of life is well documented (Cloninger, 2004, 2006). The positive correlation of ST with mindfulness may reflect the necessity to “step out of oneself,” to adopt a meta-cognitive stance in mindfulness and the relationship of ST to such meta-cognition. The previous (Lynn et al., 2005) and current report of individuals with ADHD scoring higher on ST might suggest that they would be more “mindful” in contrast to the current findings. In our analysis of subscales of the KIMS, we found that the association of ADHD was largely with the “acting in awareness” and not the other scales. In fact, the Observing subscale of the KIMS (one most associated with ST) was the only subscale in which individuals with ADHD scored equal to non-ADHD individuals. Further work is needed to better understand why ST is elevated in ADHD (we speculate that an over-reliance on right hemisphere processing is a mechanism), but the findings suggest that it might prove to be a useful feature for learning or maintaining a mindfulness practice. An elevated ST in ADHD might make adopting a meta-cognitive stance easier (despite the attentional difficulties) and that might foster greater success when compared with other forms of behavioral intervention. ST is another aspect of character that may increase because of mindfulness training, and when complemented by elevated SD, is known to be associated with well-being. Further research on mindfulness training and these two constructs of character are needed.

In summary, the current study suggests that individuals with ADHD are lower on trait mindfulness. Changes in trait mindfulness are evident in pre- to post-intervention studies of mindfulness training (Carmody, Baer, Lykins, & Olendzki, 2009),

suggesting that mindfulness training may be a useful complementary tool for improving ADHD. In a small feasibility study, we found support for this hypothesis (Zylowska et al., 2008). Controlled trials are needed to test this hypothesis, and incorporation of both attentional measures (behavior and cognitive) and personality assessments are needed. The trait measures of mindfulness are also associated with two personality dimensions, self-directedness and self-transcendence, suggesting that training may also affect these two constructs, both of which are important for overall well-being. Future work is needed to elucidate causal relationships between ADHD, mindfulness, and character development.

References

- American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders DSM-IV-TR* (4th ed.). Washington, DC: American Psychiatric Association.
- Anckarsater, H., Stahlberg, O., Larson, T., Hakansson, C., Jutblad, S.B., Niklasson, L., et al. (2006). The impact of ADHD and autism spectrum disorders on temperament, character, and personality development. *American Journal of Psychiatry*, 163(7), 1239–1244.
- Baer, R.A., Smith, G.T., & Allen, K.B. (2004). Assessment of mindfulness by self-report: The Kentucky inventory of mindfulness skills. *Assessment*, 11(3), 191–206.
- Baer, R.A., Smith, G.T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., et al. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment*, 15(3), 329–342.
- Bishop, S.R., Lau, M., Shapiro, S., Carlson, L., Anderson, N.D., Carmody, J., et al. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice*, 11(3), 230–241.
- Brown, K.W., & Ryan, R.M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), 822–848.
- Brown, K.W., Ryan, R.M., & Creswell, J.D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry*, 18(4), 211–237.
- Carmody, J., Baer, R.A., Lykins, E.L.B., & Olendzki, N. (2009). An empirical study of the mechanisms of mindfulness in a mindfulness-based stress reduction program. *Journal of Clinical Psychology*.
- Cho, S.C., Hwang, J.W., Lyoo, I.K., Yoo, H.J., Kin, B.N., & Kim, J.W. (2008). Patterns of temperament and character in a clinical sample of Korean children with attention-deficit hyperactivity disorder. *Psychiatry and Clinical Neurosciences*, 62(2), 160–166.
- Cloninger, C.R. (2004). *Feeling good: The science of well-being*. New York: Oxford University Press.
- Cloninger, C.R. (2006). The science of well-being: An integrated approach to mental health and its disorders. *World Psychiatry*, 5(2), 71–76.
- Cloninger, C.R. (2008). The psychobiological theory of temperament and character: Comment on Farmer and Goldberg (2008). *Psychological Assessment*, 20(3), 292–299; discussion 300–294.
- Cloninger, C.R. (1994). *The temperament and character inventory (TCI): A guide to its development and use* (1st ed.). St. Louis, MO: Center for Psychobiology of Personality, Washington University.
- Davidson, R.J., Kabat-Zinn, J., Schumacher, J., Rosenkranz, M., Muller, D., Santorelli, S.F., et al. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosom Med*, 65(4), 564–570.
- DuPaul, J.G., Power, T.J., Anastopolous, A.D., & Reid, R. (1998). *ADHD rating scale IV: Checklists, norms, and clinical interpretation*. New York, NY: Guilford.

- Fan, J., McCandliss, B.D., Sommer, T., Raz, A., & Posner, M.I. (2002). Testing the efficiency and independence of attentional networks. *Journal of Cognitive Neuroscience*, 14(3), 340–347.
- Faraone, S.V., & Biederman, J. (2005). What is the prevalence of adult ADHD? Results of a population screen of 966 adults. *Journal of Attention Disorders*, 9(2), 384–391.
- Faraone, S.V., Perlis, R.H., Doyle, A.E., Smoller, J.W., Goralnick, J.J., Holmgren, M.A., et al. (2005). Molecular genetics of attention-deficit/hyperactivity disorder. *Biological Psychiatry*, 57(11), 1313–1323.
- Farmer, R.F., & Goldberg, L.R. (2008a). Brain modules, personality layers, planes of being, spiral structures, and the equally implausible distinction between TCI-R “temperament” and “character” scales: Reply to Cloninger (2008). *Psychological Assessment*, 20(3), 300–304.
- Farmer, R.F., & Goldberg, L.R. (2008b). A psychometric evaluation of the revised temperament and character inventory (TCI-R) and the TCI-140. *Psychological Assessment*, 20(3), 281–291.
- Fyer, A.J., Mannuzza, S.M., Klein, D., & Endicott, J. (1995). Schedule for affected disorders and schizophrenia—1985, Updated for DSM-IV (SADS LA-IV). New York, New York State Psychiatric Institute: Anxiety Family Genetics Unit.
- Giedd, J.N., Blumenthal, J., Molloy, E., & Castellanos, F.X. (2001). Brain imaging of attention deficit/hyperactivity disorder. *Annals of the New York Academy of Sciences*, 931, 33–49.
- Hayes, S.C. (1984). Making sense of spirituality. *Behaviorism*, 12, 99–110.
- Hayes, S.C., Strosahl, K., & Wilson, K.G. (1999). Acceptance and commitment therapy: An experiential approach to behavior change. New York: Guilford Press.
- Heine, S.J., & Buchtel, E.E. (2009). Personality: The universal and the culturally specific. *Annual Review of Psychology*, 60, 369–394.
- Holzel, B.K., Ott, U., Hempel, H., Hackl, A., Wolf, K., Stark, R., et al. (2007). Differential engagement of anterior cingulate and adjacent medial frontal cortex in adept meditators and non-meditators. *Neuroscience Letters*, 421(1), 16–21.
- Jha, A.P., Krompinger, J., & Baime, M.J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective, & Behavioral Neuroscience*, 7(2), 109–119.
- Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., et al. (1997). Schedule for affective disorders and schizophrenia for school-age children—present and lifetime version (K-SADS-PL): Initial reliability and validity data. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36(7), 980–988.
- Lazar, S.W., Kerr, C.E., Wasserman, R.H., Gray, J.R., Greve, D.N., Treadway, M.T., et al. (2005). Meditation experience is associated with increased cortical thickness. *Neuroreport*, 16(17), 1893–1897.
- Leibing, E., Jamrozinski, K., Vormfelde, S.V., Stahl, J., & Doering, S. (2008). Dimensions of personality—relationship between DSM-IV personality disorder symptoms, the five-factor model, and the biosocial model of personality. *Journal of Personality Disorders*, 22(1), 101–108.
- Loo, S.K., Humphrey, L.A., Tapio, T., Moilanen, I.K., McGough, J.J., McCracken, J.T., et al. (2007). Executive functioning among Finnish adolescents with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 46(12), 1594–1604.
- Lufi, D., & Parish-Plass, J. (1995). Personality assessment of children with attention deficit hyperactivity disorder. *Journal of Clinical Psychology*, 51(1), 94–99.
- Lutz, A., Slagter, H.A., Dunne, J.D., & Davidson, R.J. (2008). Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences*, 12(4), 163–169.

- Lynn, D.E., Lubke, G., Yang, M., McCracken, J.T., McGough, J.J., Ishii, J., et al. (2005). Temperament and character profiles and the dopamine D4 receptor gene in ADHD. *American Journal of Psychiatry*, 162(5), 906–913.
- Martel, M.M., & Nigg, J.T. (2006). Child ADHD and personality/temperament traits of reactive and effortful control, resiliency, and emotionality. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 47(11), 1175–1183.
- McAdams, D.P. (1992). The five-factor model in personality: A critical appraisal. *Journal of Personality*, 60(2), 329–361.
- McGough, J.J., Smalley, S.L., McCracken, J.T., Yang, M., Del’Homme, M., Lynn, D.E., et al. (2005). Psychiatric comorbidity in adult attention deficit hyperactivity disorder: Findings from multiplex families. *American Journal of Psychiatry*, 162(9), 1621–1627.
- Posner, M.I., & Rothbart, M.K. (1998). Attention, self-regulation and consciousness. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, 353(1377), 1915–1927.
- Powers, M.B., Vörding, M., & Emmelkamp, P.M.G. (2009). Acceptance and commitment therapy: A meta-analytic review. *Psychotherapy and Psychosomatics*, 8, 73–80.
- Roth, R.M., & Saykin, A.J. (2004). Executive dysfunction in attention-deficit/hyperactivity disorder: Cognitive and neuroimaging findings. *Psychiatric Clinics of North America*, 27(1), 83–96, ix.
- SAS. (2004). *SAS Procedures Guide for Personal Computers (Version 9.1.3)*. Cary, NC: SAS Institute Inc.
- Skounti, M., Philalithis, A., & Galanakis, E. (2007). Variations in prevalence of attention deficit hyperactivity disorder worldwide. *European Journal of Pediatrics*, 166(2), 117–123.
- Smalley, S.L. (2008). Genetics and the future of ADHD. *Advances in ADHD*, 2(3), 74–78.
- Smalley, S.L., McGough, J.J., Del’Homme, M., NewDelman, J., Gordon, E., Kim, T., et al. (2000). Familial clustering of symptoms and disruptive behaviors in multiplex families with attention-deficit/hyperactivity disorder. *Journal of the American Academy of Child and Adolescent Psychiatry*, 39(9), 1135–1143.
- SPSS, I. (2006). *SPSS for Windows (Version 15.0)*. New York, NY: SPSS.
- Stroop, J.R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, 18(6), 643–662.
- Tang, Y.Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Lu, Q., et al. (2007). Short-term meditation training improves attention and self-regulation. *Proceedings of the National Academy of Sciences of the United States of America*, 104(43), 17152–17156.
- Tillman, R., Geller, B., Craney, J.L., Bolhofner, K., Williams, M., Zimmerman, B., et al. (2003). Temperament and character factors in a prepubertal and early adolescent bipolar disorder phenotype compared to attention deficit hyperactive and normal controls. *Journal of Child and Adolescent Psychopharmacology*, 13(4), 531–543.
- Wechsler, D. (1981). *Wechsler adult intelligence scale-revised*. San Antonio, TX: Psychological Corporation.
- Whittle, S., Allen, N.B., Lubman, D.I., & Yucel, M. (2006). The neurobiological basis of temperament: Towards a better understanding of psychopathology. *Neuroscience and Biobehavioral Reviews*, 30(4), 511–525.
- Zylowska, L., Ackerman, D.L., Yang, M.H., Futrell, J.L., Horton, N.I., Hale, T.S., et al. (2008). Mindfulness meditation training in adults and adolescents with ADHD: A feasibility study. *Journal of Attention Disorders*, 11(6), 737–746.
- Zylowska, L., Smalley, S., & Schwartz, J. (2008). Mindfulness for attention deficit hyperactivity disorder (ADHD). In F. Didonna (Ed.), *Clinical handbook of mindfulness*. New York: Springer.

Copyright of *Journal of Clinical Psychology* is the property of John Wiley & Sons Inc. and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.