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A Multilevel Meta-Analysis on the Effect of Mindfulness-Based Interventions in Reducing Externalizing Problem Behavior in Adolescents

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Increasingly more research is showing that stress has an influence on the development and maintenance of externalizing problem behavior in adolescents. Stress, for example, causes more impulsivity and limits emotion regulation. Mindfulness focuses on stress reduction and therefore appears to be a (supportive) treatment option with added value for adolescents with externalizing problem behavior. A multilevel meta-analysis (14 studies and 48 effect sizes) was conducted to gain more insight into the effectiveness of this treatment form in reducing externalizing problem behavior. It specifically considered whether the involvement of parents or other combined forms of treatment influenced the effect. The results showed that mindfulness-based interventions are effective in reducing externalizing problem behavior in adolescents, with a large effect size ($d = 0.99$). The effect was found to be even greater ($d = 1.14$) after correction for selection bias. The moderator analysis revealed that none of the variables examined had an impact on the effect of mindfulness-based interventions. The results of the moderator analysis should be interpreted with caution. Due to the fact that parents were not involved intensely enough, were barely motivated, and no follow-up data are known about the effectiveness.

Keywords: multilevel meta-analysis, mindfulness, adolescent, externalizing problem behavior, parent involvement

Externalizing problem behavior is highly prevalent in adolescents (Dalzell & Cavanagh, 2021; Stevens et al., 2018). This mainly concerns defiant behavior such as frequent lying and/or stealing, physical and verbal aggression, and/or delinquency (Stevens et al., 2018; Vassallo et al., 2016). Externalizing behavioral problems are core predictors of adult psychopathology (Reef et al., 2009) and lead to high societal costs (Cohen & Piquero, 2015); therefore, offering (early) effective intervention is of great importance. While various treatment interventions on externalizing problem behavior exist, for instance, parental training, systemic or family intervention, social skill training, aggressive regulation therapy, or school-based programs, few have proven effective (Smedler et al., 2015; Tanner-Smith et al., 2018).

Stress is known to influence the emergence and maintenance of externalizing problem behavior (Callaghan & Tottenham, 2016; Sprague et al., 2011; Tielbeek et al., 2018). Therefore, treatments aimed at reducing externalizing problem behavior in adolescents should focus on stress reduction (Franco et al., 2016; Lee & DiGiuseppe, 2018). Mindfulness includes the reduction of stress and appears to be suitable as a (supportive) form of treatment for adolescents with externalizing problem behavior (Li et al., 2019). Gaining insight into the actual effectiveness of this form of treatment in reducing the externalization of problem behavior is, therefore, important.

Recently, there is a growing body of studies examining the effects of mindfulness-based interventions for adolescents with externalizing problem behavior, leading to the opportunity to integrate existing knowledge on this form of treatment by means of a meta-analysis. So, this study focuses on the effectiveness of mindfulness-based interventions on reducing externalizing problem behavior in adolescents. In addition, this investigation specifically examines whether parental involvement (parental support or systemic or family therapy) or mindfulness combined with another form of treatment are more effective than treatment solely with mindfulness (Bonta & Andrews, 2017; Henggeler & Sheidow, 2012; Lange, 2018).

Impact of Stress

Epidemiological studies have demonstrated that chronic stress in children and adolescents is associated with adverse brain development and forms a major risk factor for a wide range of psychopathologies, including externalizing problem behavior (Anda et al., 2006; Cicchetti & Toth, 2005; Shields & Cicchetti, 1998; Tielbeek et al., 2018). Many adolescents with externalizing problem behavior suffer from stress due to a troubled history, including traumatic experiences due to mistreatment and/or sexual abuse (Tielbeek et al., 2018; Van Grinsven & Holdorp, 2015), but also less severe experiences, such as perceiving problems in different areas of life, which can lead to stress reactions that disrupt an adolescent's internal balance (Fink, 2016). When stress reactions persist over time, for

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example, due to a lack of internal balance, they can lead to chronic stress, which can harm mental and physical health (McEwen, 2017; Zaalberg et al., 2020).

Several studies revealed that chronic stress is detrimental to the development of the adolescent's brain (Blair, 2010; Girotti et al., 2018). Chronic stress can result in structural changes in the prefrontal cortex, which plays a role in controlling behavior, disrupting the development of executive functioning, including the level of impulse control and working memory (Girotti et al., 2018). Chronic stress can also have a negative impact on emotion regulation and impulse control in adolescents (Tull et al., 2015) and reduce their learnability (Murray-Close et al., 2014). Increased stress levels and disruption of the development of executive functions may increase agitation or arousal in adolescents and inhibit their ability to calm themselves. A decline in executive functioning is related to externalizing problem behavior (Morley, 2018), including aggressive and delinquent behavior (Hillege et al., 2019). Impaired emotion regulation and impulse control also have a clear-cut relation with the development and maintenance of externalizing problem behavior (Hillege et al., 2019).

Mindfulness and Externalizing Problem Behavior

Mindfulness was developed in the late 1970s as a treatment to learn to cope with stress and physical and psychological suffering (Kabat-Zinn, 1990). It is based on Eastern meditation techniques, adapted to the Western context (Kabat-Zinn et al., 1985). For adolescents with behavioral problems, mindfulness mainly involves focusing attention and engaging in relaxation exercises. Additionally, adolescents are encouraged to recognize and acknowledge their thoughts and emotions, paying attention to them without judgment. They are taught to focus their attention on alternative stimuli, which decreases the impact of negative emotions and thoughts.

It is known that mindfulness-based interventions primarily lead to the reduction of stress (Shankland et al., 2021; Zhang et al., 2020). This finding has also been demonstrated in adolescents with behavioral problems (Bouw et al., 2017; Chan et al., 2018). By reducing stress and learning to focus one's attention through mindfulness, impulsivity can be better controlled (Heeren & Philippot, 2011; Zare et al., 2016). Mindfulness also helps adolescents in recognizing and acknowledging their emotions; allowing them to regulate themselves better; and empowering them to have control over their own feelings, behavior, and thoughts (Bouw et al., 2017; Shapiro et al., 2006). Improved emotion regulation and reduced stress and impulsivity lead to fewer externalizing behavior problems (Bishop et al., 2004; Miller & Johnston, 2019).

This is also shown in a recent meta-analysis of the effectiveness of mindfulness-based interventions in reducing levels of aggression in children (Tao et al., 2021). As this study only examined aggressive behavior as an outcome measure and involves children with an average age of 9 years, a multilevel meta-analysis of the effectiveness of mindfulness on reducing externalizing problem behavior in adolescents has added value.

Parental Involvement

Research shows that parents of adolescents with externalizing problem behavior often experience a high degree of parental stress (Hayes & Watson, 2013). This relation is bidirectional. The higher the parents' stress, the greater the degree of externalizing problem behaviors in the adolescent, and vice versa (Solem et al., 2011). On the one hand, a number of studies showed that a mindfulness intervention only offered to parents leads to a reduction in behavioral problems in children and adolescents (Bögels et al., 2014; Meppelink et al., 2016). At the other hand, research by Deković et al. (2012) on the mediating effect of parenting skills on their children's externalizing problem behavior shows that parental involvement in the form of systemic or family therapy resulted in an increased sense of competence among parents. This led to an increase in the parents' positive disciplining and a decrease in the externalizing problem behavior in the adolescents. Besides, various studies of therapy based on systemic therapy for youth with externalizing problem behavior did demonstrate the effectiveness of parental involvement by contributing to pattern breaking and generalization of learned skills in adolescents (e.g., Asscher et al., 2014; Carr, 2019; Gutermann et al., 2016; Lange, 2018; van der Pol et al., 2017). It provides better support for young people (Cohen & Mannarino, 2015) and, in many cases, reduces parental stress (Pollio & Deblinger, 2017), provided that the parental involvement has been sufficiently intensive and the adolescent benefits from it (Hoogsteder et al., 2020). Parental involvement (improving skills and/or offering mindfulness) in mindfulness treatment is expected to influence the reduction of externalizing problem behaviors in adolescents.

Multimodal Treatment

Multimodal treatment (providing a combination of individual, group and/or systemic therapy, and/or another method at the same time) generally works better in children and adolescents with behavioral problems than only adhering to one specific treatment (Granski et al., 2020). Hofmann et al. (2012) demonstrated through their meta-analysis that combining treatments generally yields larger effect sizes. Other studies that focused on the effects of psychotherapy with pharmacotherapy (if appropriate), with optional systemic therapy, showed that a combined form of treatment did have added value (Masi et al., 2016; Taylor et al., 2018).

These findings can be explained by the Risk-Needs-Responsivity (RNR) model of Bonta and Andrews (2017). In order to treat externalizing problem behavior effectively, the dynamic (i.e., changeable) risk factors that increase the risk for delinquent behavior, a form of externalizing problem behavior, must be reduced (Bonta & Andrews, 2017). This often means that multimodal treatment is necessary, as few treatments aim at reducing all critical risk factors. Second, the RNR model emphasizes the importance of (specific) responsivity, tailoring an intervention to the learning style, motivation, abilities, and strengths of the person in order to maximize his or her ability to learn from it. Since delinquent behavior is a form of externalizing problem behavior, we suppose that the dynamic risk factors for delinquent behavior at least partially influence externalizing problem behavior and second that the responsivity principle can be generalized to externalizing problem behavior as well.

The Present Study

The present multilevel meta-analysis examines the effect of mindfulness-based interventions targeting externalizing problem behavior in adolescents, testing possible moderators (adolescent,

intervention, methodological, and publication characteristics). Several adolescent characteristics could affect the results (e.g., Newman et al., 2014). For this reason, we analyzed age, gender, the percentage of adolescents with a migrant background, and whether there was a mild intellectual disability. As intervention characteristics we specifically examine whether parental involvement or other combined forms of treatment are more effective than mindfulness as a single treatment. Mindfulness is expected to have an impact on reducing externalizing problem behavior in adolescents. Many adolescents with externalizing problem behavior suffer from chronic stress due to a troubled history, including traumatic experiences. Chronic stress can disrupt the development of executive functioning, including the level of impulse control. Research shows that a decline in executive functioning is related to externalizing problem behavior, and that stress also negatively influences executive functioning processing (Bouw et al., 2017; Morley, 2018; Zare et al., 2016). Furthermore, we expected that parental involvement would improve treatment effectivity (Gutermann et al., 2016). Additionally, we expected that mindfulness-based interventions are more effective when also offered in combination with another treatment targeting other domains that reinforce problem behavior often using cognitive behavioral therapy and/or skill training.

Method

Inclusion Criteria and Search Strategy

The present multilevel meta-analysis used the following selection criteria: (a) The adolescent was offered mindfulness-based treatment. This means that mindfulness has been part of the treatment, whether or not in combination with parental involvement and/or another intervention individually or in group often based on cognitive behavioral therapy and/or learning adequate skills; (b) the average age of the research group was between 12 and 24 years; (c) the description of the research group shows that these were adolescents exhibiting externalizing behavioral problems (such as aggression, transgressive behavior, and/or criminal behavior); (d) there was an outcome measure that measured some form of externalizing problem with a baseline and final measurement; (e) there was a control group (quasi-experimental or randomized controlled trial [RCT]). A lower limit with regard to the year of publication was not used in the search, as research into mindfulness combined with externalizing problem behavior is still relatively new.

The following digital databases were searched: Ovid (including Education Resources Information Center, Medline, and PsycINFO) and Google Scholar. The following search terms were used in various combinations: mindfulness, external*, aggress*, delinq*, conduct problems, CD, oppositional defiant disorder, antisocial, ADHD, psychopath*, adolesc*, youth*, juvenile*, teenager, adolescent*, minor, experiment*, control, effect*, RCT, random*, comparison. The total number of results from these search terms resulted in 202 studies. These 202 studies were subsequently screened in full; this resulted in nine studies that met the inclusion criteria. Finally, reference sections of relevant meta-analyses and reviews were inspected to include as many studies as possible. This rendered another seven studies that met the inclusion criteria. Authors were also contacted to ask for missing information if necessary to determine whether an article could be selected. After review, a total of 14 studies from 2008 to 2021 were included in the meta-analysis. Figure 1 depicts the screening and selection process (done with three researchers) of the studies in this multilevel meta-analysis.

Coding

It was examined if, whether or not, the involvement of parents or other combined forms of treatment affects how mindfulness impacts the prevalence of externalized problem behaviors. In addition, other possible moderating factors (such as participant demographics, program content, methodological, and publication characteristics) were taken into account. The following intervention characteristics were coded as moderators: treatment setting (outpatient/residential), duration of treatment (in weeks), intensity of treatment (average number of hours per week and the total number of sessions), combined treatment (another intervention individually or in group often based on cognitive behavioral therapy and/or skill training: yes/no), and parental involvement (parental support or systemic or family therapy: yes/no). We wanted to see if there was a moderating effect with regard to different forms of externalizing problem behavior. We have grouped it into three categories, namely aggression, recidivism, and other externalizing problem behavior. The following adolescent characteristics were coded as moderators: the average age of the adolescents, gender (percentage of boys), ethnicity, the percentage of adolescents with a migrant background, whether there was a mild intellectual disability (yes/no), and the percentage of dropouts.

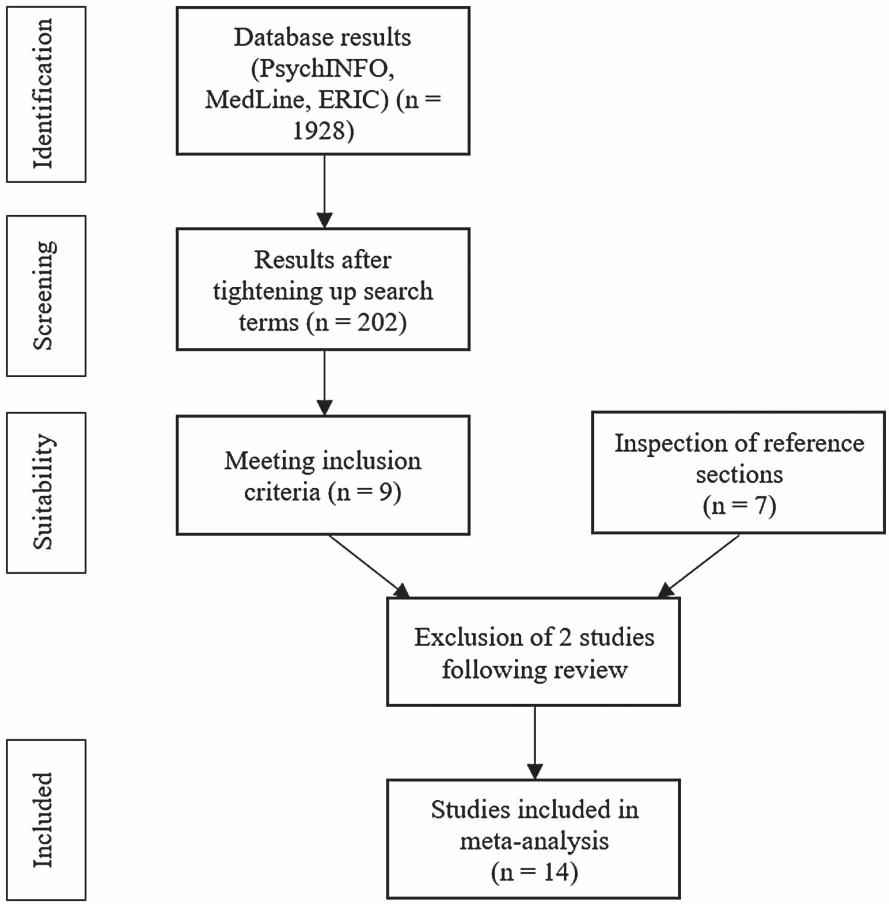
With regard to methodological factors, also known as the study characteristics, the following moderators were coded: independence of the authors(s) (yes/no), type of control group (treatment as usual [TAU]) or no treatment (we also added a waiting list control group to this category, as only one study used this type of control group), whether or not the program integrity and level had been reported (insufficient/moderate/good), type of research design (RCT or quasi-experimental), type of informant (adolescent, parent, therapist or teacher), whether the results of the dropouts had been included (intention-to-treat/completers), and whether there had been a follow-up assessment. If relevant data were missing, the authors were asked for information by email. Finally, the year of publication and the impact factor (over the last 5 years) of the article and publishing journal were coded for the publication characteristics.

All moderators were entered into a database using SPSS; the studies were also coded in SPSS. Initially, two authors both coded seven studies under the supervision of two experienced researchers. Weekly online meetings for any questions, coordination and changes were held, if necessary. To determine interrater reliability, trainee researchers coded four of the other's studies. This resulted in double coding of eight of the 14 studies. The interrater agreement ranged from 95% to 100%; the remainder was subject to a consensus on coding. The included studies with their associated characteristics can be found in Appendix.

Data Analysis

A multilevel approach that made it possible to use multiple effect sizes from a study, if included, was used. Three types of variance were modeled (Houben et al., 2015; Wibbelink & Assink, 2015) in order to provide an accurate picture of the effect size of this meta-analysis (Guyatt et al., 2006). Level 1 concerns the variance of the observed effect sizes around the population effect size. Level 2 is the

Figure 1
Search Strategy



Note. ERIC = Education Resources Information Center.

variance within the population effect sizes of the same study. Level 3 is the variance between the population effect sizes of all studies. All calculations were performed in R using the syntax of Assink and Wibbelink (2016). To determine whether there was heterogeneity within studies (Level 2) and between studies (Level 3), two log likelihood-ratio tests were carried out (Hox, 2010). If a significant amount of variance was present at Level 2 or 3, heterogeneity could be assumed. In that case, moderator analysis should be performed to investigate which factors could explain this heterogeneity (Assink & Wibbelink, 2016). To perform the moderator analyses, the categorical variables were transformed into dummy variables, and continuous variables were centered on their average.

Cohen's d was used to calculate the effect sizes per outcome measure using the formula of Lipsey and Wilson (2001). The effect sizes were calculated for pre-, post-, and follow-up measurements. Subsequently, the postmeasurement effect sizes were subtracted from the premeasurement effect sizes. Whenever the measures for calculating Cohen's d could not be coded directly from the study, they were converted. Cohen (1992) uses the following interpretation of effect sizes: $d = .20$ (small effect), $d = .50$ (medium effect), and $d = .80$ (large effect).

A funnel plot was created to investigate whether there might be missing data due to publication bias (Sterne et al., 2011). Publication bias occurs when researchers are selective in publishing data, for example, by only reporting positive results, and can thus distort the estimate of the effect of a treatment (Egger et al., 1997). A funnel plot compares the effect sizes (on the x-axis) against the standard measurement errors (y-axis). If bias is present, the funnel plot is asymmetric and the Egger's test is significant. A left-skewed funnel plot indicates publication bias, whereas a right-skewed funnel plot indicates other forms of selection bias. When this occurs, a trim-and-fill procedure is performed to assess the severity of the bias (Duval & Tweedie, 2000). During this procedure, missing effect sizes are filled (trim-and-fill method) with estimated values. The result is a new total effect size that takes bias into account (Peters et al., 2007).

Results

Overall Effect

A total of 835 participants were included in this multilevel meta-analysis (experimental group $N_{exp} = 445$, control group $N_{ctrl} = 390$). As one study used the same participants for both the experimental and control groups (using a waiting list), the total sample is slightly larger ($N_{to} = 848$). For 82.63%, the total research

group consisted of boys, and the average age of the total sample was 16.83 (SD = 1.81).

The use of mindfulness-based interventions led to a significant reduction in externalizing problem behavior (the total of all outcome measures) in adolescents (d = 0.99, 95% CI [0.65, 1.32], $p < .001$; see Table 1). The effect size can be categorized as large (Cohen, 1992). This means that, as expected, mindfulness-based interventions have a positive effect on reducing externalizing problem behavior in adolescents. This effect is regardless the focus of the intervention, such as reducing aggression or anger, other forms of externalizing problem behavior, or recidivism.

Publication and Selection Bias

There was no publication bias, as no effect values were missing on the left side of the funnel plot (see Figure 2). The funnel plot did show, however, that there was selection bias, as 12 missing effect values were found on the right side of the funnel plot, and these influenced the overall effect (empty dots). Selection bias suggests that a part of the target group has not been included. To correct for this selection bias, the missing effect sizes were filled with estimated values. This correction led to an increase in the effect size (d = 1.14, 95% CI [0.78, 1.50], $p < .001$).

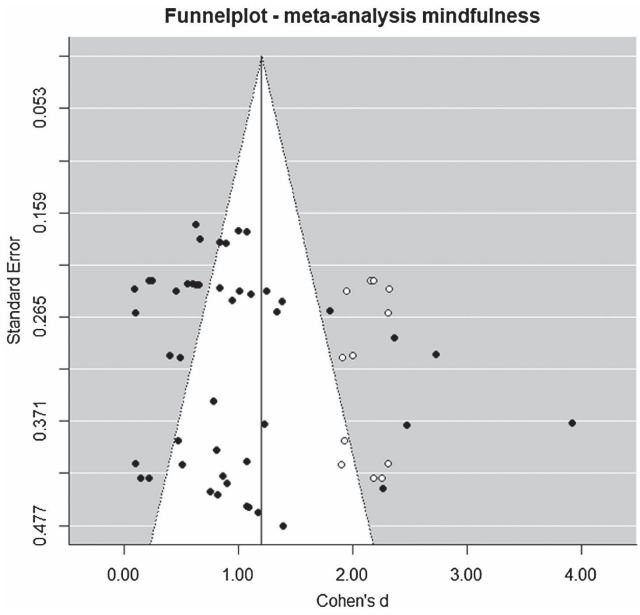
The results of the likelihood-ratio test showed significant variance of the effect sizes within studies (Level 2), $\chi^2(1) = 47.298$, $p < .001$, and between studies (Level 3), $\chi^2(1) = 6.969$, $p < .008$, which justify the use of moderator analyses to explain within- and between-study heterogeneity.

Moderator Analyses

Table 2 presents the results of the moderator analyses on the relationship between mindfulness and the reduction of externalizing problem behavior in adolescents. Contrary to expectations, combined treatment (d = 1.00) or noncombined treatment (d = 0.96) have an equal effect in reducing externalizing problem behavior. The treatment setting (residential vs. outpatient) and the duration and intensity of the treatment did not moderate the outcome effect as well. Concerning adolescent characteristics, age and gender of the participants did not have a significant impact on the effectiveness of the treatment. This means that boys and girls, and younger and older adolescents, were equally receptive to the intervention. With regard to the methodological characteristics, none of the included moderators had an influence on the effectiveness of the intervention. For example, type of control group (no treatment or TAU), type of informant (adolescent, parent, or therapist/teacher), and whether the dropouts were included. As for the publication characteristics, the year of publication and the impact factor of the journal in which the study had been published also did not have a moderating effect on intervention effectiveness.

Figure 2

Mindfulness Meta-Analysis Funnel Plot



Finally, insufficient information was available regarding the degree of integrity of the program, the migration background of the participants, and whether the participants had a mild intellectual disability, making it impossible to calculate the moderator effects for these variables.

Discussion

This meta-analysis (14 studies and 48 effect sizes) investigated whether mindfulness-based interventions are effective in reducing externalizing problem behavior in adolescents. Second, it took into account the possible moderating variables in terms of intervention, participant, methodological, and publication characteristics. It specifically considered whether the involvement of parents (parental support or systemic or family therapy) or other combined forms of treatment (such as another intervention individually or in group often based on cognitive behavioral therapy and/or learning adequate skills) influenced the effect. The results showed that mindfulness-based interventions are effective in reducing externalizing problem behavior in adolescents, with a large effect size (d = 0.99). The effect was found to be even greater (d = 1.14) after correction for selection bias. The moderator analysis revealed that none of the variables examined had an impact on the effect of mindfulness-based interventions.

Table 1

Overall Effect of Mindfulness-Based Interventions on Externalizing Problem Behavior

Overall effect	k	#*ES*	M_d	95% CI	p	σ^2_{Level2}	σ^2_{Level3}	% var. Level 1	% var. Level 2	% var. Level 3
Overall effect	14	48	0.99	[0.65, 1.32]	$p < .001$	0.230 ($p < .001$)	0.245 ($p < .01$)	13.22	42.00	44.78

Note. k = number of independent studies; #*ES* = number of effect sizes; M_d = average effect size Cohen's d; CI = confidence interval; σ^2_{Level2} = variance within studies; σ^2_{Level3} = variance between studies; % var = percentage of variance.

Table 2
Effects of Moderator Analyses of Mindfulness-Based Interventions on Externalizing Problem Behavior

Moderator variable	*k*	#*ES*	B_0/d	t_0	B_1	t_1	$F(df_1, df_2)$
Intervention properties							
Outcome measures							$F(2, 45) = 0.56$
Aggression	10	27	1.01	4.79 ($p < .001$)			
Other externalizing problem behavior	9	13	0.97	4.28 ($p < .001$)	−0.04	−0.90	
Recidivism	2	8	0.71	2.57 ($p < .01$)	0.27	1.06	
Setting							$F(1, 46) = 0.49$
Outpatient	6	14	1.16	3.83 ($p < .001$)			
Residential	8	34	0.90	4.24 ($p < .001$)	0.26	0.70	
Treatment intensity							
Duration	13	44	1.02	5.33 ($p <.001$)	0.01	0.79	$F(1, 42) = 0.62$
Intensity	13	44	0.98	4.84 ($p <.001$)	0.00	−0.12	$F(1, 42) = 0.01$
Combined treatment							$F(1, 46) = 0.02$
Yes	7	29	1.00	4.32 ($p < .001$)			
No	7	19	0.96	3.72 ($p < .001$)	0.04	0.13	
Parental involvement							$F(1, 46) = 0.47$
Yes	7	28	1.09	4.75 ($p < .001$)			
No	7	20	0.86	3.47 ($p < .001$)	0.23	0.69	
Adolescent properties							
Age	12	38	1.03	5.05 ($p < .001$)	0.05	0.55	$F(1, 36) = 0.30$
Sex (% boys)	14	48	0.97	5.70 ($p < .001$)	−0.01	−1.26	$F(1, 46) = 1.60$
Methodological properties							
Independence							$F(1, 46) = 1.41$
Yes	10	36	0.86	4.52 ($p < .001$)			
No	4	12	1.27	4.39 ($p < .001$)	−0.41	−1.19	
Control group type							$F(1, 46) = 0.18$
No treatment	6	18	1.08	3.89 ($p < .01$)			
TAU	8	30	0.93	4.13 ($p < .01$)	0.15	0.42	
PI indication							$F(1, 46) = 0.77$
No	7	18	0.82	3.24 ($p < .01$)			
Yes	7	30	1.11	5.03 ($p < .01$)	−0.29	−0.88	
Type of research design							$F(1, 46) = 1.52$
RCT	7	19	1.18	5.24 ($p < .001$)			
Quasi-experimental	7	29	0.80	3.53 ($p < .001$)	0.39	1.23	
Informant							$F(2, 45) = 0.22$
Adolescent	9	23	1.08	4.69 ($p < .001$)			
Parent	6	10	0.86	2.73 ($p < .01$)	0.09	0.28	
Therapist or teacher	8	27	0.96	4.31 ($p < .001$)	0.12	0.47	
Inclusion of dropouts							$F(1, 46) = 043$
Yes	8	29	0.87	3.48 ($p < .01$)			
No (completer)	6	19	1.09	4.71 ($p < .001$)	−0.22	−0.65	
Publication properties							
Year of publication	14	48	0.98	5.67 ($p < .001$)	−0.07	−1.55	$F(1, 46) = 2.41$
Impact factor	11	37	0.83	8.57 ($p < .001$)	0.06	0.58	$F(1, 35) = 0.34$

Note. *k* = amount of independent studies; #*ES* = amount of effect sizes; B_0/d = intercept/mean effect size; t_0 = *t* value for mean *d*; B_1 = regression coefficient difference with reference group; t_1 = *t* value for regression coefficient; $F(df_1, df_2)$ = omnibus test; TAU = treatment as usual; PI = program integrity; RCT = randomized controlled trial.

It is known that mindfulness-based interventions primarily lead to the reduction of stress (Shankland et al., 2021; Zhang et al., 2020). It is plausible, therefore, that reducing stress is key for adolescents with externalizing problem behavior, as long-term stress can result in disrupted executive functioning, leading to poorer emotion regulation and impulse control (Tull et al., 2015). Impaired emotion regulation and impulse control, in turn, have a clear-cut relation with the development and maintenance of externalizing problem behavior (Hillege et al., 2019). In other words, mindfulness-based interventions are very likely to have significant added value in reducing stress, because this ultimately leads to the reduction of externalizing problem behavior in adolescents.

The funnel plot demonstrated the presence of a selection bias in the present meta-analysis, suggesting that part of the target group was not included during the selection process (Sterne et al., 2011). A possible explanation for the selection bias is exclusion due to a missing baseline and/or final measurement. It is also possible that some studies investigated externalizing problem behaviors as a factor, but did not explicitly mention or recognize this term.

Despite the use of a valid inclusion and exclusion criteria, there are always several factors such as participant demographics, intervention

content, methodological, and publication characteristics that lead to heterogeneity. The use of moderator analyzes to explain within- and between-study heterogeneity showed that despite the different characteristics that cause heterogeneity, there is no specific factor that significantly influenced the effect.

Parental Involvement

It is striking that no significant difference in effect was found between treatment with and without parental involvement. After all, several studies have shown that systemic therapy is an effective element in the treatment of externalizing problem behavior in adolescents (Asscher et al., 2014; Lange, 2018). Possible explanations can be the lack of information about the intensity of the parental involvement and/or a lack of motivation. In seven of the 14 studies, parental involvement was detailed, but only three of these studies reported about the intensity of the involvement (how often parents were seen). Parental involvement was quite low in two and high in one of these studies (Swart & Apsche, 2014a, 2014b, 2014c). In the latter, the adolescent, parent(s), and other family members were offered weekly individual and group therapy (including mindfulness) for 8–12 months, depending on the level of cooperation of the family members. To what extent this actually materialized, however, was not reported. Only the seventh study (Bögels et al., 2008) reported the number of sessions parents had missed, also detailing about tardiness and noncompliance to homework (Bögels et al., 2008).

The degree of motivation influences the effectiveness of a treatment; motivation is necessary to actually bring about behavioral change (Bonta & Andrews, 2017). Sufficient and willing parental involvement in the treatment has a positive effect on the adolescent's treatment motivation (Brauers et al., 2016), increasing the effectiveness of the treatment (Wilder, 2014). It is possible that no effect was found in the present meta-analysis as parents may not have been sufficiently involved (intensity was too low) or motivated.

Adolescents' troubled histories that have led to serious insecurity in the parent–child relationship, such as child abuse, may have also influenced the effectiveness of parental involvement during treatment (Weijters et al., 2019). After all, it is known that many adolescents who end up in forensic care have a troubled history (Dierkhising et al., 2013; Van Grinsven & Holdorp, 2015). In two of the seven included studies that involved parent(s) or guardian(s) in treatment, the adolescents reported to have experienced at least one form of child abuse during their childhood (Swart & Apsche, 2014b, 2014c). It can be assumed that this finding can be applied to a great number of studies. Such negative life events are often accompanied by problematic attachment, which strains the parent–child relationship (Rodriguez et al., 2014; Rydell, 2010). Treatment should then initially focus on attachment, processing traumatic experiences and improving relationships; a process that takes considerable time (Lange, 2018). Only when parent–adolescent relationship has improved, there is a greater chance that parental involvement will contribute to the reduction of externalizing behavioral problems. The explanations above indicate that the result concerning the influence of parental involvement should be interpreted with caution.

Multimodal Forms of Treatment

Contrary to expectations, this study found no difference in treatment effect between a combined form of treatment (other than parent involvement) or treatment solely with mindfulness. Looking at the principles of RNR (Bonta & Andrews, 2017), it was expected that combined treatment would be more effective (in the long term) in reducing externalizing problem behavior and the risk of criminal recidivism (Bonta & Andrews, 2017), because of the possibility to focus the treatment on various critical domains or risk factors (e.g., Schippers et al., 2020). A possible explanation for the result of this meta-analysis could be that the included studies mainly examined the effect at the end of treatment, yielding insufficient information on the long-term effects of mindfulness-based interventions. Only the studies by Milani et al. (2013) and Hoogsteder et al. (2020) used a follow-up assessment to measure the effects of the intervention after a longer period of time. Both, incidentally, used a broader form of treatment. It is possible that mindfulness-based interventions mainly show results in the short term and only a long-term effect to a limited extent, especially regarding recidivism of problem behavior and/or delinquent behavior.

Restrictions

A limitation of the study was the low number of studies included in the present meta-analysis ($N = 14$). A limited number of studies may jeopardize the validity of the statistical conclusions, as the number of studies may render insufficient statistical power for detection of an effect. However, the number of included studies was higher than in most meta-analyses, which typically contain less than nine studies (Lau et al., 2006). Moreover, the multilevel approach made it possible to include multiple effect sizes of the same study, which increases the statistical power and possibilities for meaningful moderator analyses. Another limitation of the present study was the lack of information on some variables in the included studies. This made it impossible to investigate certain moderators, specifically the level of program integrity and the presence of a migration background or a mild intellectual disability. Monitoring the integrity of interventions makes it possible to substantiate whether mindfulness or similar exercises have resulted in positive progress (Goense et al., 2016).

Conclusion

This multilevel meta-analysis investigated whether mindfulness-based interventions are effective in reducing externalizing problem behavior in adolescents. Mindfulness is a promising intervention that may help reduce the negative impact of (chronic) stress on mental and physical health (Shankland et al., 2021; Zhang et al., 2020). The use of mindfulness-based interventions is especially relevant when adolescents with externalized behavioral problems experience prolonged stress due to the accumulation of various risk factors (Blair, 2010; McEwen, 2017). Therefore, treatments aimed at reducing externalizing problem behavior in adolescents should focus on stress reduction—far more so than is currently the case (Franco et al., 2016; Lee & DiGiuseppe, 2018). Despite the results of this meta-analysis, numerous studies have demonstrated that parental involvement does matter. Involving parents in treatment is still considered to be very important, provided that the intensity and quality of the relationship between caregiver and child and the level of motivation are sufficient.

When performing this meta-analysis, it was noted that no study included stress and executive functioning as an outcome measure. It is recommended to do this in the future with young people with externalizing behavioral problems, then it can be better investigated

whether reducing stress and improving executive functions lead to a reduction of externalizing behavioral problems.

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(*Appendix follows*)

Appendix

Properties of Included Studies

Study	*N*	Age (*M*)	Study and sample properties	Externalizing problem behavior	Intervention type	Setting	Duration (weeks)	Experimental condition	Control condition
Hoogsteder et al. (2014)[a]	91	16.8	Europe, quasi-experimental, intention-to-treat, independent	Recidivism, self-control, anger	MF + other intervention(s) individual and/or group + parental support (seven sessions)	Inpatient	47	Re-ART (*n* = 63)	TAU (*n* = 28)
Hoogsteder et al. (2018)[b]	91	16.8	Europe, quasi-experimental, intention-to-treat, independent	Recidivism, self-control, anger	MF + other intervention(s) individual and/or group + parental support (seven sessions)	Inpatient	47	Re-ART (*n* = 63)	TAU (*n* = 28)
Franco et al. (2016)	27	15.9	Europe, RCT, completer, independent	Aggression, anger	Only mindfulness (based)	Outpatient	10	MBP (*n* = 13)	WL (*n* = 14)
Swart and Apsche (2014a)	143	16	Central America, RCT, completer, dependent	Aggression, anger, general externalizing problem behavior	MF + other intervention(s) individual and/or group	Inpatient	Unknown	MDT (*n* = 72)	CBT (TAU; *n* = 71)
Swart and Apsche (2014b)	122	16	Central America, RCT, completer, dependent	General externalizing problem behavior, anger	MF + other intervention(s) individual and/or group and parental support (eight sessions).	Inpatient	34	FMDT (*n* = 61)	TAU (*n* = 61)
Swart and Apsche (2014c)	84	16	Central America, RCT, completer, dependent	Aggression, anger, general externalizing problem behavior	MF + other intervention(s) individual and/or group + parental support and systemic therapy (32 weeks)	Inpatient	32	MDT (*n* = 42)	CBT (TAU; *n* = 42)
Himelstein et al. (2015)	35	16	Central America, RCT, completer, dependent	Aggression	MF + other intervention(s) individual and/or group	Inpatient	12	MBSR (*n* = 18)	TAU (*n* = 17)
Bögels et al. (2008)	14	14.2	Europe, quasi-experimental, intention-to-treat, independent	General externalizing problem behavior	MF + parental support, parents also received mindfulness (eight sessions)	Outpatient	8	MBCT (*n* = 14)	WT (*n* = 10)

(*Appendix continues*)

Appendix (*continued*)

Study	*N*	Age (*M*)	Study and sample properties	Externalizing problem behavior	Intervention type	Setting	Duration (weeks)	Experimental condition	Control condition
Naseh et al. (2016)	24	Unknown	Asia, RCT, intention-to-treat, independent	General externalizing problem behavior	Only mindfulness (based)	Outpatient	8	*n* = 12	NT (*n* = 12)
Evans-Chase (2013)	59	18	North America, quasi-experimental, completer, independent	Aggression, anger	Only mindfulness (based)	Inpatient	8	*n* = 29	TAU (*n* = 30)
Milani et al. (2013)	22	Unknown	Asia, quasi-experimental, intention-to-treat, independent	Aggression	Only mindfulness (based)	Inpatient	4	MBCT (*n* = 10)	NT (*n* = 12)
Roux and Philippot (2020)	44	16	Europe, quasi-experimental, completer, independent	Oppositional defiant disorder (ODD), general externalizing problem behavior	MF + other intervention(s) individual and/or group	Inpatient	16	MBP (*n* = 22)	TAU (*n* = 22)
Singh et al. (2013)	57	23	North America, RCT, intention-to-treat, independent	Aggression	MF + parental support (duration unknown)	Outpatient	48	MBP (*n* = 17)	WL (*n* = 17)
Hoogsteder et al. (2020)	76	18.8	Europe, quasi-experimental, intention-to-treat, independent	Aggression, risk of violent recidivism, anger, rule-breaking behavior	MF + other intervention(s) individual and/or group + parental support (seven sessions)	Outpatient	48	Re-ART (*n* = 47)	TAU (*n* = 29)

Note. MF = mindfulness; Re-ART = responsive aggression regulation therapy; TAU = treatment as usual; RCT = randomized controlled trial; MBP = mindfulness-based program; WL = waiting list; MDT = mode deactivation therapy; CBT = cognitive behavioral therapy; FMDT = family mode deactivation therapy; MBSR = mindfulness-based stress reduction; MBCT = mindfulness-based cognitive therapy; NT = no treatment.
[a,b]Concerns the same data, but different outcome measures were used.

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