

## Effectiveness of mindfulness parent training on parenting stress and children's ADHD-related behaviors: A systematic review and meta-analysis

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### Abstract

**Background/Objective:** Literature shows that there is a circular relationship between children's ADHD-related behaviors and parenting stress. This systematic review and meta-analysis aimed to understand if mindfulness parent trainings have benefits for both parenting stress and the problem behaviors in children with ADHD. **Methods:** Five databases, CINAHL, Embase, PsycINFO, PubMed, and Web of Science, were searched. Within-group effects at post-treatment and follow-up assessment, and between-group effects at post-treatment were analyzed. Effect sizes (Hedges'  $g$ ) were also calculated. **Results:** Ten studies (5 RCTs and 5 non-RCTs) met the selection criteria and were selected for systematic review, and nine of them were included for meta-analysis. Among these 10 studies, five studies involved mindfulness training for both parents and children, while the other five studies involved mindfulness training for parents only. Within-group effects at post-treatment were small-to-large for all outcomes. Hedges'  $g$  ranged between  $-0.17$  [95% CI ( $-0.98, 0.64$ )] and  $4.70$  [95% CI ( $3.59, 5.81$ )] for parenting stress;  $0.17$  [95% CI ( $-0.03, 0.37$ )] and  $4.03$  [95% CI ( $2.97, 5.09$ )] for children's problem behaviors; and  $0.20$  [95% CI ( $-0.10, 0.50$ )] and  $2.98$  [95% CI ( $2.16, 3.80$ )] for children's ADHD symptoms. Between-group comparisons showed mindfulness parent training was superior to other active controls on all outcomes. **Conclusion:** Findings suggest that mindfulness parent training may be beneficial for parenting stress and children's ADHD-related behaviors, and due to the small number of studies reviewed, cautions should be taken when interpreting the results.

### Keywords

Mindfulness parent training, ADHD, parenting stress, problem behaviors, children

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Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder which affects 5.3%–7.2% children worldwide (Polanczyk et al., 2007; Thomas et al., 2015). Children with ADHD are characterized by inattention and/or hyperactivity-impulsivity symptoms (American Psychiatric Association, 2013). These two core features of ADHD can cause problem behaviors and subsequently lead to negative impacts on children's academic performance (Visser et al., 2020) and social relationship (Kofler et al., 2011), as well as their later occupational functioning (Halmoy et al., 2009).

Literature shows that ADHD is strongly associated with other disorders such as conduct disorder (CD) and

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oppositional defiant disorder (ODD) (Hurtig et al., 2007). Reale and colleagues (2017) found that in a group of children with ADHD ( $n = 653$ ), 66 % of them had at least one comorbid mental disorder. A recent review also reported that children with ADHD are at a high risk of externalizing behaviors (Tistarelli et al., 2020). Studies also found that children with ADHD and comorbid disorders had more ADHD symptoms than those with ADHD alone (Hurtig et al., 2007), which caused more disruptive/challenging behaviors and poorer social and learning skills in their daily living (Harpin, 2005).

Problem behaviors exhibited by children with ADHD such as challenging behaviors may cause hostility towards parents, leading to parenting stress. A line of research found that parents of children with ADHD reported a higher parental distress and experienced more dysfunctional parent-child interaction than parents of children with other disorders such as specific learning disabilities and language disorder (Craig et al., 2016; Modesto-Lowe et al., 2014; Wiener et al., 2016). Besides, a positive association has been established between children's ADHD symptoms and parenting stress, the more ADHD symptoms that children have the higher stress level that the parents will experience (Bonifacci et al., 2019). Furthermore, maternal stress level was found to be a significant predictor for children's later ADHD symptoms severity (Evans et al., 2020). Taken together, it suggests that the relationship between children's ADHD symptoms and parenting stress appears to be circular, parenting stress will lead to children's problem behaviors which in turn will increase parental stress.

Children's ADHD symptoms and parenting stress are closely related. ADHD also frequently co-exists with other disorders, causing more symptoms. Thus, parents of children with ADHD and comorbid disorders are likely to be more stressful than parents of children with ADHD only. In fact, a study found that maternal stress was positively associated with comorbid conduct disorder (CD) and externalizing behaviors in boys with ADHD (Evans et al., 2020). Another study also reported that the stress level of parents of children with ADHD and comorbid oppositional defiant disorder (ODD) was higher than that of parents of children with ADHD only (Li et al., 2016).

Parents will use different strategies to cope with their own stress caused by parenting issues. Adaptive coping strategies have been reported to be associated with reduction in parental stress (Dounnik et al., 2017). A systematic review reported that parents of children with ADHD used more maladaptive coping skills such as avoidance-focused coping strategies to master or tolerate their parenting stress than parents of typically developing (TD) children. They also used more indirect means than parents of TD children to manage their children's behavioral problems (Craig et al., 2020). Parents of children with ADHD not only facing high parenting stress due to children's ADHD symptoms, but they

also lack effective skills to manage their children's ADHD-related problem behaviors. In view of these two unfavorable conditions found in parents of children with ADHD, interventions that can interrupt the circular relationship between children's ADHD-related problem behaviors and parenting stress, to help parents to relieve their parenting stress in order to reduce their children's ADHD-related problems behaviors which in turn will decrease parenting stress, are warranted.

Mindfulness refers to paying attention and being aware of the experience of the present moment (Kabat-Zinn, 2003). Mindfulness training is a self-regulatory method for strengthening our attentional processes, and it is a common approach for treating anxiety, depression, and stress in different populations (Atia & Sallam, 2020; Ghawadra et al., 2020). Mindfulness trainings for children with ADHD usually focus on children's ADHD symptoms and related problem behaviors, outcomes related to parenting stress are limited. A systematic review indicated that mindfulness-based interventions had positive effects on inattention problems in children/adolescents with ADHD (Lee et al., 2017). Felver and collaborators (2017) also found that a mindful family stress reduction training for parents and their children could improve the attention of both parents and children. Smalley and colleagues (2009) reported that the knowledge on mindfulness is negatively associated with ADHD symptoms in adults with ADHD. All these findings suggest that mindfulness-based training for individuals with ADHD may have benefits for their ADHD symptoms.

Trainings for parents of children with ADHD usually aim to increase parents' knowledge and understanding of ADHD and to improve their behavioral management skills. Parents may also learn self-management skills for relieving parenting stress (Zwi et al., 2011). Parent trainings have been reported to be related positively with the reductions in children's ADHD-related behaviors and parental stress (Zwi et al., 2011).

Among the various kinds of parent trainings, mindfulness parent training becomes popular in recent years. Mindfulness parent training integrates mindfulness training into a parent-focused intervention, and the major goal is to enhance parent-child relationship through improving parent's self-awareness, mindfulness, and intentionality in parenting (Altmaier & Maloney, 2007). A review showed that mindfulness training for mothers with depression could reduce parental stress as well as increase the prosocial behaviors of their typically developing children (Sawyer Cohen, & Semple, 2010). A recent systematic review has investigated the effectiveness of mindfulness-based interventions in parents and their children with ADHD. Results supported that mindfulness-based interventions had benefits for parental stress and children's problem behaviors (Tercelli & Ferreira, 2019). In this review, either mindfulness training for children only or mindfulness training for both children and parents were

involved in the included studies, and no studies involved mindfulness training for parent only. Although mindfulness training for both children and parent can be considered as a kind of mindfulness parent training, it is difficult to know if the training effects were due to the additive benefits of both children training and parents training or it was the unique effect from children training or from parent training. If it can tease apart the benefits of the two kinds of mindfulness parent trainings (i.e., training for both parents and children and training for parents only), it can help us better understand the circular relationship between parental stress and children's ADHD-related problem behaviors. It can also inform practitioners if mindfulness training for parents only is good enough to reduce both parenting stress and children's problem behaviors. As a result, it can allow us to have a better allocation of resources for interventions provided for children with ADHD and their parents.

To the authors' knowledge, research that only includes the effects of mindfulness parent training (i.e., training for parents and children and training for parents only) on children with ADHD and their parents has not been synthesized in a previous systematic review and/or meta-analysis. Thus, the purpose of this systematic review and meta-analysis is:

- (i) To investigate if mindfulness parent training contributes to positive outcomes on parenting stress and children's ADHD-related behaviors; and
- (ii) To analyze the effect sizes of mindfulness parent training on parenting stress and children's ADHD-related behaviors.

## Methods

### Search Strategy

A literature search, using a PICO (population/participant, intervention/indicator, comparator/control, outcome) framework was conducted. Five databases which include CINAHL, Embase, PsycINFO, PubMed, and Web of Science were searched systematically. The keywords attention deficit hyperactivity disorder OR ADHD OR attention problems OR hyperactivity OR impulsivity AND mindfulness parent training OR mindfulness-based parent training OR mindfulness stress reduction training for parents AND parenting stress OR parental stress AND ADHD symptoms OR ADHD behaviors OR externalizing behaviors OR problem behaviors were used to conduct the search. All references were presented in a list to assist the reviewers to perform study selection. Every study was initially identified by title and abstract according to the inclusion criteria, and duplicates were removed.

### Inclusion and Exclusion Criteria

In order to be included in this review and meta-analysis, studies had to: (1) include children with ADHD aged 5–18 years; (2) include a mindfulness-based training for parents or a mindfulness-based training for both parents and children; (3) include an active and/or a passive control condition; (4) include measures of parenting stress, and/or ADHD symptomatology, and/or problem behaviors or externalizing behaviors as outcomes; and (5) be published in English between 2010 and 2020. Reasons for exclusion entailed: (1) reviews, meta-analysis, dissertations, book chapters, and study protocols; (2) studies involving different intervention approaches (e.g., behavioral management skills training; cognitive behavioral therapy); (3) studies focused on different neurodevelopmental disorders (e.g., learning difficulties, Autism Spectrum Disorder); (4) studies including different age ranges (e.g., adults); and (5) studies that only focused on mindfulness training for children but not parents. Studies were not excluded if children presented comorbid diagnoses. After screening each study by title and abstract, the full texts were analyzed and included if they fulfilled the stipulated criteria.

### Data Extraction

Data obtained from each study encompassed study design, participant characteristics, interventions, outcome measures, and main findings. Effect sizes (Hedges'  $g$ ) were computed based on mean, standard deviation (SD), and sample size provided in each included study.

### Methodological Quality Assessment

The Physiotherapy Evidence Database Scale (PEDro; [de Morton, 2009](#)) was used to evaluate the methodological quality of the included randomized controlled trials (RCTs). Each study was assessed by two reviewers (X.P. and P.C.) independently in order to avoid bias. If inconsistent ratings between reviewers for the same study existed, discrepancies were resolved by discussion between the two reviewers. The PEDro consists of 11 items and a point will be given to an item if the criterion of that item is met. Item 1 does not carry a point, the total score of the PEDro is the sum of the points of Items 2 to 11 and the maximum score is 10. Literature suggests that studies have the total score more than 5 are considered as have adequate methodological quality ([Bruce et al., 2014](#)). In this review, the PEDro total score between 9 and 10 is considered as excellent, score between 6 and 8 is considered as good, score between 4 and 5 is considered as fair, score less than 4 is considered as poor ([Foley et al., 2003](#)).

The Methodological Index for Non-randomized Studies (MINORS) ([Slim et al., 2003](#)) was used to assess the

methodological quality of the included non-randomized trials (non-RCTs). Two reviewers (P.C. and K.N.) evaluated each study independently in order to avoid bias, disagreements were resolved by discussion between the reviewers. The MINORS consists of 12 items, the first 8 items are for both non-comparative and comparative trials, while the last 4 items are additional criteria for comparative studies only. An item is scored 0 if no information is reported in the study, a score of 1 is given if related information is reported but not adequate, and a score of 2 is given if information is adequately reported in the study. The maximum total score for non-comparative studies is 16, and that for comparative studies is 24. A comparative study is considered to be of high quality if the total MINORS score was  $\geq 17$  and low quality if the total score was  $< 17$  (Slim et al., 2003).

### Risk of Bias Assessment

In order to assess the risk of bias of the included studies, the Cochrane risk-of-bias tool for randomized trials (ROB 2; Sterne et al., 2019) was used to assess the risk of bias in randomized controlled trials (RCT) and the Cochrane Risk of Bias in Non-randomized Studies - of Interventions (ROBINS-I; Sterne et al., 2016) was used for non-randomized controlled trials (non-RCT). The ROB 2 assesses five domains of bias: (1) bias due to randomization, (2) bias due to deviations from intended intervention, (3) bias due to missing data, (4) bias due to outcome measurement, and (5) bias due to selection of reported result. The ROBINS-I assesses seven types of bias: (1) bias due to confounding, (2) bias due to selection of participants, (3) bias in classification of interventions, (4) bias due to deviation from intended intervention, (5) bias due to missing data, (6) bias in measurement of outcomes, and (7) bias in selection of the reported result. A judgment about the risk of bias is made based on the answers of the questions. Judgment can be "Low" or "High" risk of bias, or "Some concerns" for ROB 2, and for ROBINS-I the judgment can be "Low," "Moderate," "Serious," "Critical" risk of bias, or "No information" (Higgins et al., 2011; Sterne et al., 2016). Risk of bias was independently assessed by two reviewers (X.P. and K.N.) and disagreements were resolved through discussion.

### Meta-analysis and Publication Bias

A meta-analysis (MA) of the effects of mindfulness parent training on parenting stress and children's ADHD-related behaviors was conducted using the Comprehensive Meta-Analysis 3.0 program (CMA, Version 3.0; Borenstein et al., 2014). The effect sizes (Hedges'  $g$ ) for three types of comparisons on the measures of parenting stress, children's problem behaviors, and children's ADHD symptoms of each trial were calculated: (a) Within-group effect sizes which were based on the Pre- and Post-treatment comparison

of the Intervention Group; (b) Long-term Within-group effect sizes which were based on the Pre-treatment and Follow-up comparison of the Intervention Group and; (c) Between-group effect sizes which were based on the between-group differences from Pre-treatment to Post-treatment. The strength of the effect size is considered as small if Hedges'  $g$  is 0.2; medium if Hedges'  $g$  is 0.5; and large if Hedges'  $g$  is 0.8 (Cohen, 1988). The random-effects model was used for meta-analysis if significant heterogeneity was detected, otherwise, the fixed-effect model was conducted. If tests of heterogeneity and publication bias were not able to be done due to a limited number of studies ( $n \leq 2$ ), the random-effects meta-analysis was conducted because it would be unlikely that both studies would have similar participants and interventions which would lead to the same treatment effects (Borenstein, Hedges, Higgins, & Rothstein, 2014).

Regarding heterogeneity among studies, the  $I^2$  index and its  $p$ -value were computed and reported.  $p$ -value  $< 0.05$  was considered as significance. Publication bias was also evaluated through funnel plot and the Egger's test. Symmetry of the funnel plot was examined visually, asymmetrical funnel plot indicated publication bias.  $p$ -value  $< 0.1$  (2-tailed) in the Egger's test indicated significant publication bias.

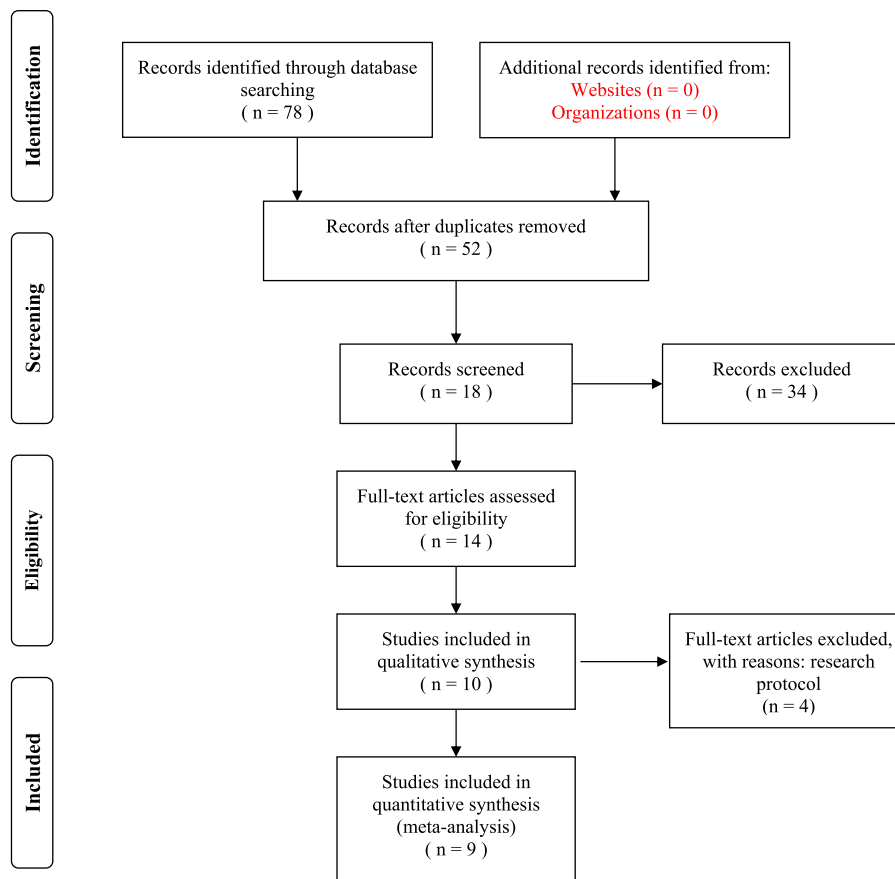
## Results

### Trial Flow

A total of 78 studies were identified from the five databases searched in this systematic review and meta-analysis. After 26 duplicated studies were removed, the remaining studies ( $n = 52$ ) were screened by titles and abstracts. After screening, 18 studies were left and full-text was available for 14 studies. After removing four research protocols, in total 10 studies met the selection criteria for systematic review and nine studies were included in meta-analysis due to data was not available for calculating effect size in one study (Van der Oord et al., 2012). Figure 1 shows the PRISMA flow diagram which illustrates the selection process.

### Characteristics of Studies

The 10 selected studies included 372 parents and 319 children. Among them, five studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Gershly et al., 2017; Lo et al., 2020; Mah et al., 2020) were randomized controlled trials (RCTs), while the other five studies (Anderson and Guthery, 2015; Haydicky et al., 2015; Van der Oord et al., 2012; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) were non-randomized controlled trials (non-RCTs). Four studies (Behbahani et al., 2018; Haydicky et al., 2015; van de Weijer-Bergsma et al., 2012; Van der Oord et al., 2012) had a follow-up assessment, the follow-up period varied from 6 to 8 weeks. Five studies (Anderson and Guthery, 2015;



**Figure 1.** PRISMA flow diagram to show the study selection process.

Bakhshayesh et al., 2015; Behbahani et al., 2018; Gershy et al., 2017; Mah et al., 2020) provided mindfulness training for parents only [MT(P)], while the other five studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Van der Oord et al., 2012; Zhang et al., 2017) provided parallel mindfulness training for parents and children [MT(P+C)]. For intervention intensity and duration, six studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Haydicky et al., 2015; van de Weijer-Bergsma et al., 2012; Van der Oord et al., 2012; Zhang et al., 2017) involved eight 90-min weekly sessions; one study (Anderson and Guthery, 2015) mentioned that the participants were required to read a book on mindfulness daily for 8 weeks; one study (Gershy et al., 2017) involved 90-min weekly sessions across 10–12 weeks; one study (Lo et al., 2020) involved six 90-min weekly sessions, and one study (Mah et al., 2020) involved 120-min long weekly sessions for 12 weeks (Table 1).

Regarding the control conditions, three studies (Bakhshayesh et al., 2015; Gershy et al., 2017; Mah et al., 2020) compared mindfulness training for parents [MT(P)] to an active control. In these three studies, one study (Bakhshayesh et al., 2015) compared mindfulness training for parents [MT(P)] to mindfulness training for children

only [MT(C)], another study (Gershy et al., 2017) compared mindfulness non-violence resistance parent training (MNVR) to traditional non-violence resistance parent training (NVR), and the third study (Mah et al., 2020) compared mindfulness behavioral parent training (MBPT) to standard behavioral parent training (SBPT). Three studies (Behbahani et al., 2018; Lo et al., 2020; Van der Oord et al., 2012) compared mindfulness parent training to a non-active control. Among these three studies, two studies (Lo et al., 2020; Van der Oord et al., 2012) compared [MT(P+C)] to a waitlist control, and one study (Behbahani et al., 2018) compared [MT(P)] to a control received no treatment. Four studies (Anderson and Guthery, 2015; Haydicky et al., 2015; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) had no control group (Table 1).

### Outcome Measures

This review targeted at three primary outcomes namely parenting stress, children's problem behaviors, and children's ADHD symptoms. All studies measured parenting stress and three different questionnaires were used to assess

Table 1. Characteristics of Reviewed Studies.

Study	Study design	Participant characteristics				Treatment			
		Intervention group		Control group		Intervention group			
		Parent	Child	Parent	Child	Treatment received	Treatment protocol	Treatment received	Treatment protocol
Anderson and Guthery, 2015	Pre- and post-treatment comparison	Mothers n = 7	N/A	No control group	No control group	Reading the book "Everyday Blessings: The Inner Work of Mindful Parenting" on their own pace	8 weeks reading the book "Everyday Blessing: The Inner Work of Mindful Parenting" on their own pace	No control group	No control group
Bakhshayesh et al., 2015	RCT	Mothers n = 12	Boys n = 12	CG (1) Mothers n = 12	CG (1) Boys n = 12	Parent mindfulness training	Group training; 90 minutes/session; in total 8 sessions	CG (1) Mindfulness training for children	Same as intervention group
Bebbahani et al., 2018	RCT with an 8-week follow-up	Mothers n = 26	Age range = 6–12 years Child n = 26 Age range = 7–12 years All were on stimulant medication	CG (2) Mothers n = 12	CG (2) Boys n = 12	Parent mindfulness training based on the Kabat-Zinn protocol	90 min/session; 1 session/week; for 8 weeks	CG (2) Mindfulness training for parents and children	Parent N/A
Gershly et al., 2017	RCT	Fathers n = 19	Age range = 6–15 years	Fathers n = 19	Age range = 6–15 years	Mindfulness-enhance parent training (non-violence resistance + mindfulness parent training; NVRM)	Non-violent resistance (NVR) parent training; 90 min/session; for 10–12 weeks; and A 90-min mindfulness session at the third week	NVR parent training	90 min/session; 1 session/week for 10–12 weeks
Haydicky et al., 2015	Pre- and post-treatment comparison and; Pre-treatment and 6-week follow-up comparison	Parents n = 17	Child n = 18  Mean age (SD) = 15.5 (1.58)  11 (61%) children were taking medication for ADHD	No control group	No control group	Parallel Mindfulness Training for Parents and Children based on the Mindfulness-based Cognitive Therapy (MBCT) and the Mindfulness-based Stress Reduction (MBSR) training the MYmind program	Parallel training; 90 min/session; for 8 sessions; A joint parent-child session at the 6th week post-treatment	No control group	No control group

(continued)

Table 1. (continued)

Study	Study design	Participant characteristics				Treatment			
		Intervention group		Control group		Intervention group	Control group		
		Parent	Child	Parent	Child	Treatment received	Treatment protocol		
Lo et al., 2020	RCT with a wait-list control group	n = 50	n = 50	n = 50	n = 50	Parent training of the Family-based Mindfulness Intervention (FBMI) program	Parent Group training: 90 min/session; 1 session/week; for 6 weeks; 4 <sup>th</sup> -6 <sup>th</sup> sessions were parent-child joint sessions	Underwent the same FBMI program after the treatment groups	Same as the intervention group
Mothers in both groups = 96%	Age range = 5-7 years	Mothers in both groups = 96%	Age range = 5-7 years	Child Children training of the FBMI program which was followed the Mindfulness Matters Program	Child Group training: 60 min/sessions; in total 8 sessions				
Mah et al., 2020	RCT	n = 34	n = 34	n = 29	n = 29	Parent Mindfulness-enhanced Behavioral Parent Training (MBPT)	Parent 120 min/session; 1 session/week; for 12 weeks	Parent Standard Behavioral Parent Training (SBPT)	Parent 120 min/session; 1 session/week; for 12 weeks
van der Oord et al., 2012	Quasi-experimental design with a wait-list control group and	n = 11	n = 11 mean age = 9.67 (1.33) Four children were on medication	n = 11	n = 11	Parallel mindfulness training for Parents and Children based on the Mindfulness-based Cognitive Therapy (MBCT) and Mindfulness-based Stress Reduction (MBSR) Training	90 min/session; 1 session/week; for 8 weeks; 3 joint parent-child sessions	Received the same parallel parent and child mindful training after the post-test of the intervention group	Not received any treatment during the waiting period except children were on stimulant medication. Parallel parent and child training. Same as intervention group
An 8-week follow-up									

(continued)

Table 1. (continued)

Study	Study design	Participant characteristics				Treatment			
		Intervention group		Control group		Intervention group		Control group	
		Parent	Child	Parent	Child	Treatment received	Treatment protocol	Treatment received	Treatment protocol
van de Weijer- Bergsma et al., 2012	Pre- and post-treatment comparison and; Pre-treatment and 8-week follow-up comparison	n = 19	n = 10	No control group	No control group	Parallel Mindfulness Training for Parents and Children	90 min/session; 1 session/week; for 8 weeks; a joint parent-child session at the 8th week post-treatment	No control group	No control group
Mothers n = 10; Fathers n = 9	Age range = 11–15 years One child was on medication								
Zhang et al., 2017	Pre- and post-treatment comparison	n = 11 Mother n = 7 Father n = 9	n = 11 Mean age = 9.5(1.4) Ten children were on medication	No control group	No control group	Parallel mindfulness training for Parents and Children based on the Mindfulness-based Cognitive Therapy (MBCT) and Mindfulness-based Stress Reduction (MBSR) Training the MYmind Program	90 min/session; 1 session/week; for 8 weeks	No control group	No control group

Note. RCT = randomized controlled trial; CG = control group; N/A = not applicable; NVRM = combined nonviolent resistance parent training and mindfulness-based skills training; NVR = nonviolent resistance parent training; FBMI = family-based mindfulness intervention; MBPT = mindfulness-enhanced behavioral parent training; SBPT = standard behavioral parent training; MBCT = mindfulness-based cognitive therapy; MBSR = mindfulness-based stress reduction training.



parents' self-report stress due to parenting. The Parental Stress Index- Short Form (PSI-SF) was used in eight studies (Anderson and Guthery, 2015; Bakhshayesh et al., 2015; Behbahani et al., 2018; Lo et al., 2020; Mah et al., 2020; van de Weijer-Bergsma et al., 2012; Van der Oord et al., 2012; Zhang et al., 2017). The Difficulty in Emotion Regulation Scale (DERS) was used in one study (Gershly et al., 2017), and the Stress Index for Parents of Adolescents on Parenting Stress (SIPA) was used in one study (Haydicky et al., 2015).

For measuring children's problem behaviors such as externalizing (e.g., oppositional behaviors, aggression) and internalizing (e.g., depression, anxiety) behaviors, the parent-report version of six different questionnaires were used in eight studies. The Revised Conners' Parent Rating Scale-Short Form (CPRS-R-S) was used in one study (Bakhshayesh et al., 2015), the Conners 3 was used in one study (Haydicky et al., 2015), the Revised Child Anxiety and Depression Scale (RCADS) was used in one study (Haydicky et al., 2015), the Disruptive Behavior Disorder Rating Scale (DBDRS) was used in one study (Van der Oord et al., 2012), the Child Behavioral Checklist (CBCL) was used in three studies (Gershly et al., 2017; Lo et al., 2020; van de Weijer-Bergsma et al., 2012), and the Eyberg Child Behavior Inventory (ECBI) was used in one study (Zhang et al., 2017). The teacher-report version of the CBCL (van de Weijer-Bergsma et al., 2012) and the DBDRS (Van der Oord et al., 2012) was used in one study respectively. The youth-report version of the Conners 3 (Haydicky et al., 2015) and the CBCL (van de Weijer-Bergsma et al., 2012) was used in one study, respectively.

Eight studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Haydicky et al., 2015; Lo et al., 2020; Mah et al., 2020; Van der Oord et al., 2012; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) have measured children's ADHD symptoms, including inattention and hyperactivity-impulsivity symptoms. Six questionnaires and two performance-based tests were used in these eight studies. The ADHD Rating Scale (ADHD-RS) was used in two studies (Bakhshayesh et al., 2015; Mah et al., 2020), the Swan, Nolan, and Pelham Parent Rating Scale, 4 edition (SNAP-IV) was used in one study (Behbahani et al., 2018), the Conners 3 was used in one study (Haydicky et al., 2015), the Strengths and Weaknesses of ADHD Symptoms and Normal Behaviors Rating Scales (SWAN) was used in one study (Lo et al., 2020), the CBCL was used in one study (van de Weijer-Bergsma et al., 2012), the DBDRS was used in one study (Van der Oord et al., 2012). For these six questionnaires, the parent-rating version were used in seven studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Haydicky et al., 2015; Lo et al., 2020; Mah et al., 2020; Van der Oord et al., 2012; van de Weijer-Bergsma et al., 2012). The teacher-rating version of the CBCL (Van der Oord et al., 2012) and the DBDRS (van de Weijer-Bergsma et al., 2012) were used in one study respectively, and the youth-report

version of the Conners 3 (Haydicky et al., 2015) and the CBCL (van de Weijer-Bergsma et al., 2012) were used in one study respectively. For performance-based tests, the Test of Everyday Attention for Children (TEA-Ch) and the Continuous Performance Task (CPT) were used in one study (Zhang et al., 2017).

### Methodological Quality Assessment

The PEDRo Scale was used to assess the methodological quality of RCTs. Among the five included RCTs (Bakhshayesh et al., 2015; Behbahani et al., 2018; Gershly et al., 2017; Lo et al., 2020; Mah et al., 2020), the PEDRO total score ranged between 4 and 7, indicating the methodological quality was fair-to-good. Among these five studies, three studies (Behbahani et al., 2018; Gershly et al., 2017; Lo et al., 2020) had the PEDRO total score ranged between 6 and 7, suggesting a good quality, and two studies (Bakhshayesh et al., 2015; Mah et al., 2020) had the PEDRO total score ranged from 4 to 5, suggesting a fair quality.

The MINORS was used to evaluate the methodological quality of non-RCTs. The MINORS total score of the five included non-RCTs ranged between 7 and 10, suggesting a low quality. Among these five non-RCTs, three studies (Haydicky et al., 2015; Van der Oord et al., 2012; van de Weijer-Bergsma et al., 2012) had a total score of 10 and two studies (Anderson and Guthery, 2015; Zhang et al., 2017) had a total score of 7.

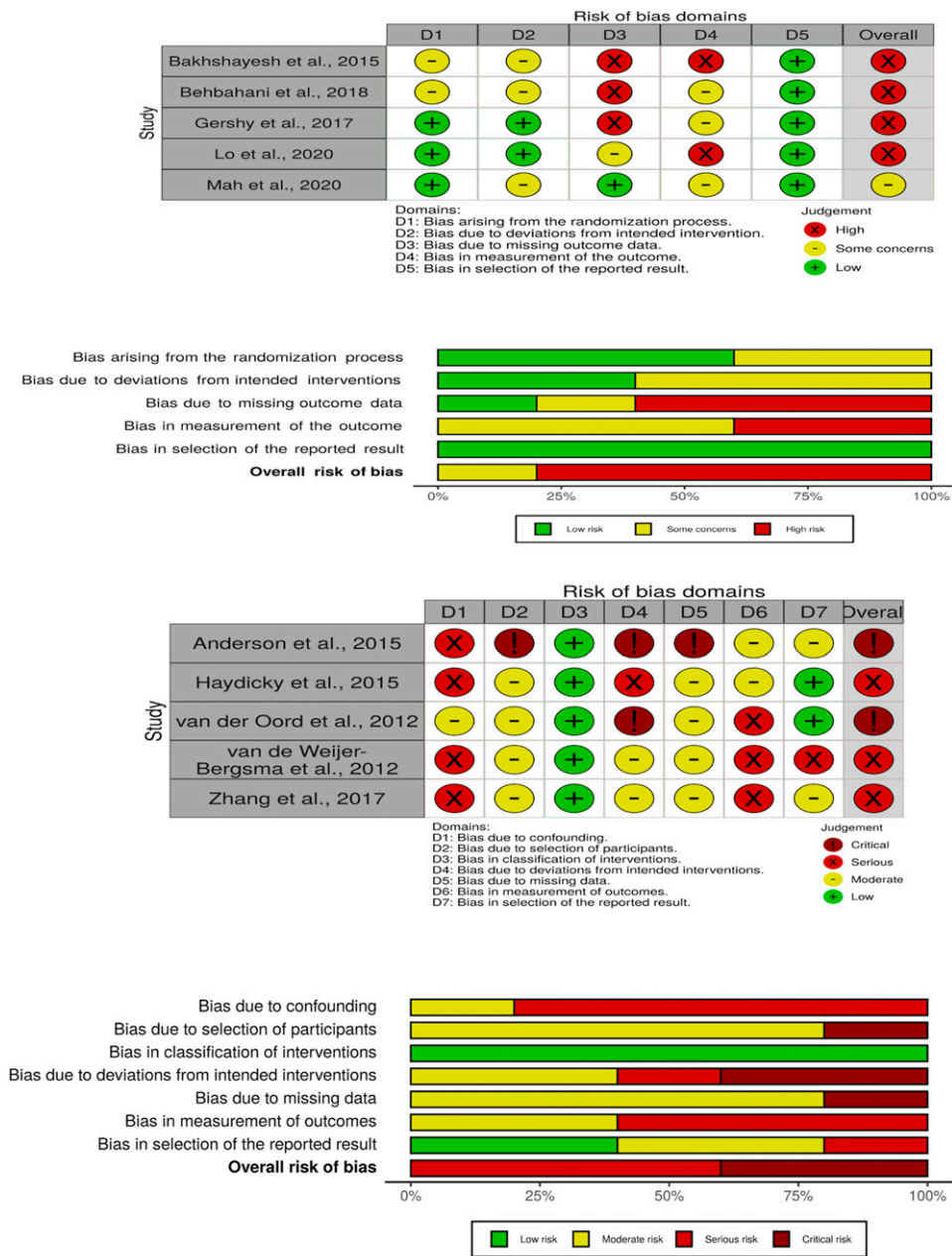
### Risk of Bias Assessment

The Risk of Bias assessment based on the ROB 2 showed that among the 5 reviewed RCTs, four studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Gershly et al., 2017; Lo et al., 2020) had an overall high risk, and one study (Mah et al., 2020) had some concerns (Figure 2). For non-RCTs, the ROBIN-I showed that three studies (Haydicky et al., 2015; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) had an overall serious risk of bias and two studies (Anderson and Guthery, 2015; Van der Oord et al., 2012) had critical risk of bias (Figure 2).

### Effects of Intervention

For each analysis, heterogeneity among studies was examined,  $I^2$  index and its  $p$ -value were reported. Publication bias was evaluated through funnel plot and Egger's test. Effect size (Hedges'  $g$ ) for each study included for meta-analysis (MA) was estimated using random-effects model if significant heterogeneity was detected. Otherwise, fixed-effect model was conducted.

*Pre- Versus Post-Treatment Within-Group Effects.* To evaluate the within-group effects of mindfulness parent training at post-treatment, the effect sizes (Hedges'  $g$ ) were computed

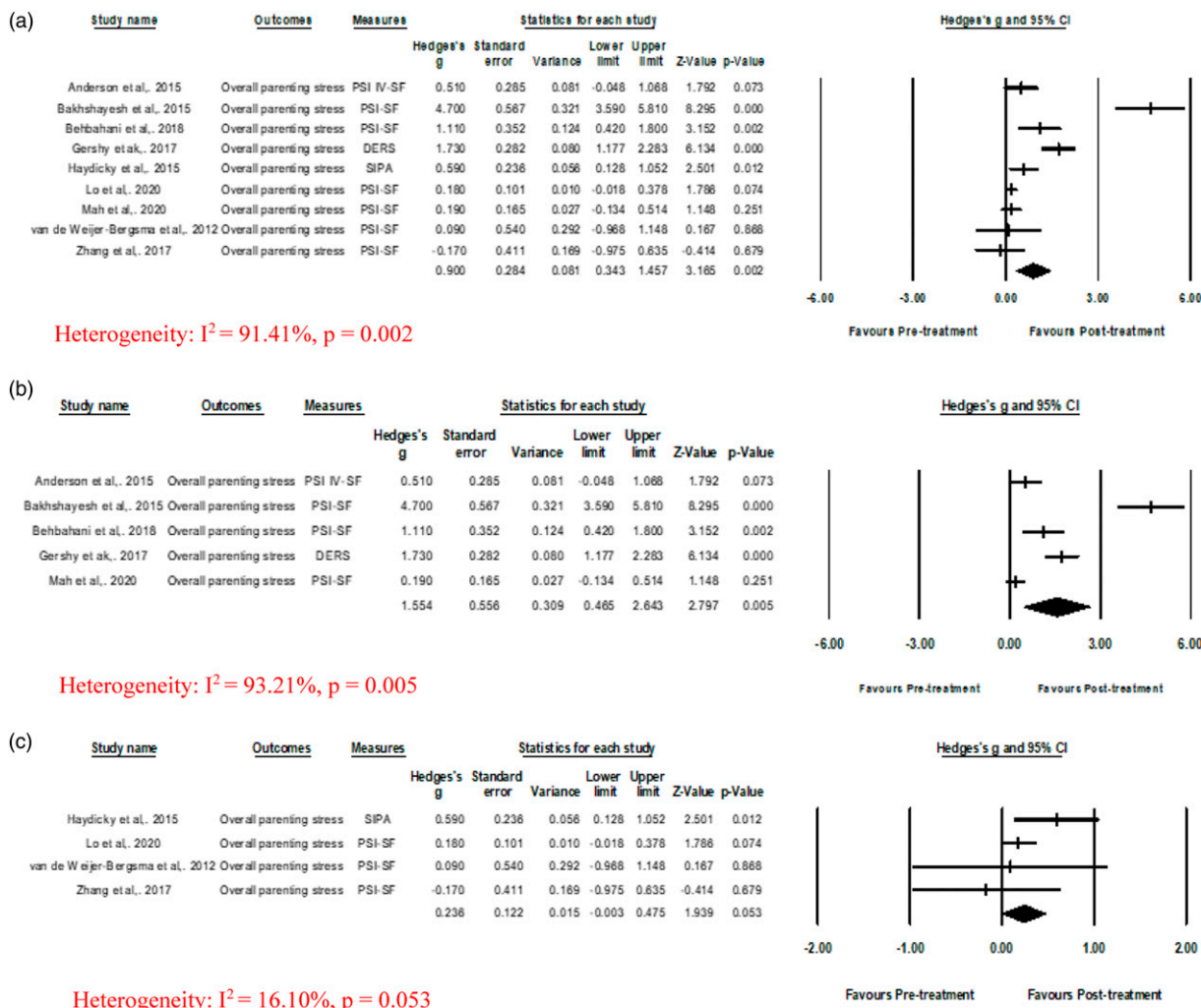


**Figure 2.** Risk of bias assessment for randomized controlled trials (top panel) using the ROB 2 and non-randomized controlled trials (bottom panel) using the ROBINS-I.

based on the mean (SD) and sample size of the Intervention group at pre- and post-treatment of each study.

*Within-Group Effects on Parenting Stress at Post-Treatment.* In total, nine studies have reported the within-group effects of mindfulness parent training (MPT) on parenting stress at post-treatment. Test of heterogeneity showed significant variation in treatment effects among studies,  $I^2 = 91.41\%$ ,  $p = 0.002$  (Figure 3(a)). Figure 6(a) showed the funnel plot for the within-group effects on parenting stress at post-treatment, through visual

examination, asymmetrical plot was noted with majority of the studies fell on the left side of the funnel. Egger’s test showed evidence for publication bias, intercept = 3.67 [95% CI (-0.81, 8.15)],  $p = 0.094$  (2-tailed). Results of random-effects meta-analysis showed that the within-group effects on parenting stress at post-treatment ranged between -0.17 [95% CI (-0.98, 0.64)] and 4.70 [95% CI (3.59, 5.81)]. Among these nine studies, one study reported an increase in parenting stress at post-treatment, the effect size (Hedges’ g) was -0.17 [95% CI (-0.98, 0.64)] (Zhang et al., 2017).



**Figure 3.** Random-effects analyses on the within-group effects of mindfulness parent training (top panel), mindfulness training for parents (middle panel), and mindfulness training for parents and children (bottom panel) on parenting stress at post-treatment. (a) Random-effects analysis on the within-group effect of mindfulness parent training on parenting stress at post-treatment. (b) Random-effects analysis on the within-group effect of mindfulness training for parents [MT(P)] on parenting stress at post-treatment. (c) Random-effects analysis on the within-group effect of mindfulness training for parents and children [MT(P+C)] on parenting stress at post-treatment.

Eight studies (Anderson and Guthery, 2015; Bakhshayesh et al., 2015; Behbahani et al., 2018; Gershly et al., 2017; Haydicky et al., 2015; Lo et al., 2020; Mah et al., 2020; van de Weijer-Bergsma et al., 2012) reported a decrease in parenting stress at post-treatment. The effect size (Hedges' g) ranged from 0.09 [95% CI (-0.97, 1.15)] (van de Weijer-Bergsma et al., 2012) to 4.70 [95% CI (3.59, 5.81)] (Bakhshayesh et al., 2015), indicating mindfulness parent training had a small-to-large effect on parenting stress. In these eight studies, three studies (Lo et al., 2020; Mah et al., 2020; van de Weijer-Bergsma et al., 2012) reported a small effect size, two studies (Anderson and Guthery, 2015; Haydicky et al., 2015) reported a medium effect size, and three studies (Bakhshayesh et al., 2015; Behbahani et al.,

2018; Gershly et al., 2017) reported a large effect size (Figure 3(a)).

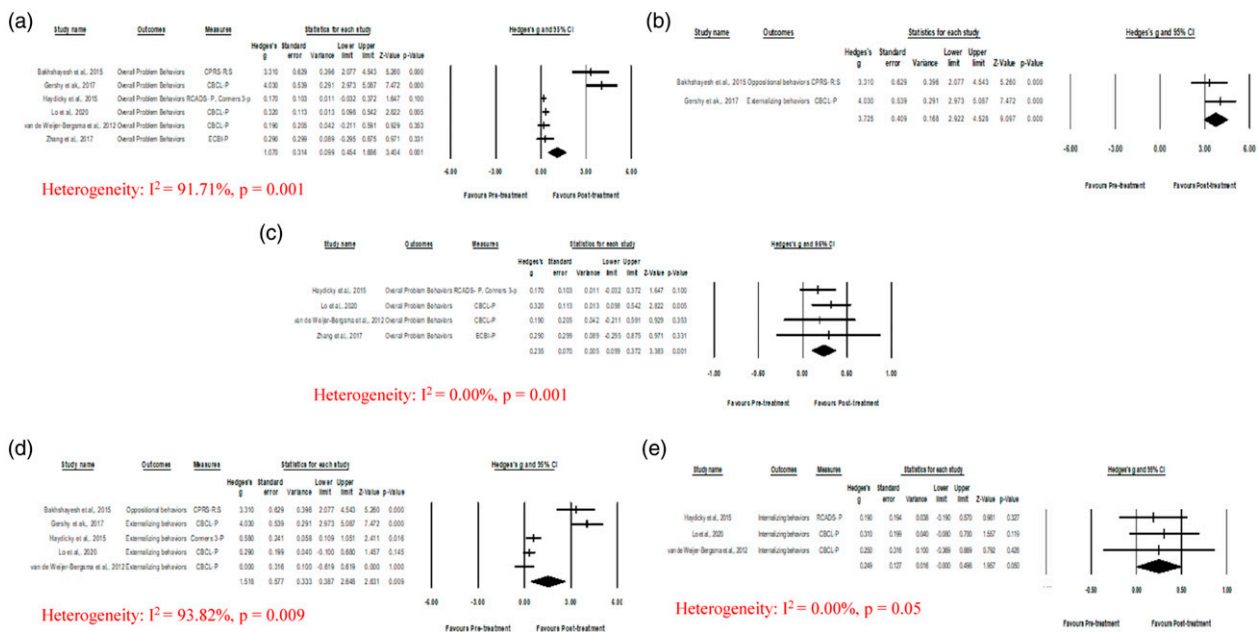
*Within-Group Effects of Mindfulness Training for Parents [MT(P)] and Mindfulness Training for Parents and Children [MT(P+C)] on Parenting Stress at Post-Treatment.* To further evaluate the effects of mindfulness parent training (MPT) on parenting stress, the within-group effect of the two types of MPT (i.e., mindfulness training for parents only [MT(P)] and parallel mindfulness training for parents and children [MT(P+C)]) were evaluated separately. There were five studies (Anderson and Guthery, 2015; Bakhshayesh et al., 2015; Behbahani et al., 2018; Gershly et al., 2017; Mah et al., 2020) involved mindfulness training for parents only [MT(P)]. Test of heterogeneity showed significant

variation in treatment effects among studies,  $I^2 = 93.21\%$ ,  $p = 0.005$  (Figure 3(b)). Asymmetrical funnel plot with majority of the studies fell on the left side of the plot was noted. Egger's test indicated significant publication bias, intercept = 9.14 [95% CI (0.08, 18.21)],  $p = 0.049$  (2-tailed). Results of random-effects meta-analysis showed that the within-group effect of [MT(P)] on parenting stress ranged between 0.19 [95% CI (-0.13, 0.51)] (Mah et al., 2020) and 4.70 [95% CI (3.59, 5.81)] (Bakhshayesh et al., 2015), indicating [MT(P)] had a small-to-large effect on parenting stress. Among these five studies, one study (Mah et al., 2020) reported a small effect, one study (Anderson and Guthery, 2015) reported a medium effect, and three studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Gershy et al., 2017) reported a large effect (Figure 3(b)).

Four studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) involved mindfulness training for both parents and children [MT(P+C)]. Result of test of heterogeneity was non-significant,  $I^2 = 16.10\%$ ,  $p = 0.053$  (Figure 3(c)). Symmetrical funnel plot with studies fell on both sides of the plot was noted. Egger's test indicated that publication bias was non-significant, intercept = -0.009 [95% CI (-5.07, 5.05)],  $p = 0.995$  (2-tailed). Results of fixed-effect meta-analysis

showed that the within-group effect of [MT(P+C)] based on the four included studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) ranged between -0.17 [95% CI (-0.98, 0.64)] (Zhang et al., 2017) and 0.59 [95% CI (0.13, 1.05)] (Haydicky et al., 2015), indicating [MT(P+C)] had a small-to-medium effect on parenting stress. In these four studies, two studies (Lo et al., 2020; van de Weijer-Bergsma et al., 2012) reported a small effect and one study (Haydicky et al., 2015) reported a medium effect which were in favor of post-treatment, while one study (Zhang et al., 2017) reported a small effect which was in favor of pre-treatment (Figure 3(c)).

*Within-Group Effects on Children's Problem Behaviors at Post-Treatment.* Six studies (Bakhshayesh et al., 2015; Gershy et al., 2017; Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) reported the within-group effects on children's problem behaviors and all of them found a reduction in children's problem behaviors at post-treatment. Result of test of heterogeneity was significant,  $I^2 = 91.71\%$ ,  $p = 0.001$  (Figure 4(a)). Figure 6(b) showed the funnel plot for the within-group effects on children's problem behaviors at post-treatment, through visual examination, asymmetrical



**Figure 4.** Random-effects analysis on the within-group effects of mindfulness parent training on children's problem behaviors at post-treatment. (a) Random-effects analysis on the within-group effect of mindfulness parent training on children's problem behaviors at post-treatment. (b) Random-effects analysis on the within-group effect of mindfulness training for parents [MT(P)] on children's problem behaviors at post-treatment. (c) Random-effects analysis on the within-group effect of mindfulness training for parents and children [MT(P+C)] on children's problem behaviors at post-treatment. (d) Random-effects analysis on the within-group effect of mindfulness parent training on children's externalizing behaviors at post-treatment. (e) Random-effects analysis on the within-group effect of mindfulness parent training on children's internalizing behaviors at post-treatment.

plot was noted with most of the studies fell on the left side of the funnel. Egger's test indicated that publication bias was significant, intercept = 5.27 [95% CI (0.01, 10.54)],  $p = 0.049$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) ranged from 0.17 [95% CI (-0.03, 0.37)] (Haydicky et al., 2015) to 4.03 [95% CI (2.97, 5.09)] (Gershby et al., 2017), indicating mindfulness parent training had a small-to-large effect on children's problem behaviors. In these six studies, four studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) reported a small effect, and two studies (Bakhshayesh et al., 2015; Gershby et al., 2017) reported a large effect (Figure 4(a)).

*Within-Group Effects of Mindfulness Training for Parents [MT(P)] and Mindfulness Training for Parents and Children [MT(P+C)] on Children's Problem Behaviors at Post-Treatment.* To further evaluate the effects of mindfulness parent training (MPT), the within-group effects of the two types of MPT (i.e., mindfulness training for parents [MT(P)] and parallel mindfulness training for parents and children [MT(P+C)]) were reviewed separately. There were only two studies (Bakhshayesh et al., 2015; Gershby et al., 2017) involve [MT(P)]. Due to the limited number of studies reviewed, heterogeneity and publication bias were not analyzed. Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) of [MT(P)] based on the two included studies was 3.31 [95% CI (2.08, 4.54)] (Bakhshayesh et al., 2015) and 4.03 [95% CI (2.97, 5.09)] (Gershby et al., 2017), both studies reported a large effect (Figure 4(b)).

Four studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) involved [MT(P+C)]. Result of test of heterogeneity was significant,  $I^2 = 0.00\%$ ,  $p = 0.001$  (Figure 4(c)). Symmetrical funnel plot with studies evenly distributed on both sides of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = 0.14 [95% CI (-4.06, 4.34)],  $p = 0.897$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) of [MT(P+C)] based on the four included studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) ranged from 0.17 [95% CI (-0.03, 0.37)] (Haydicky et al., 2015) to 0.32 [95% CI (0.10, 0.54)] (Lo et al., 2020), all studies reported a small effect (Figure 4(c)).

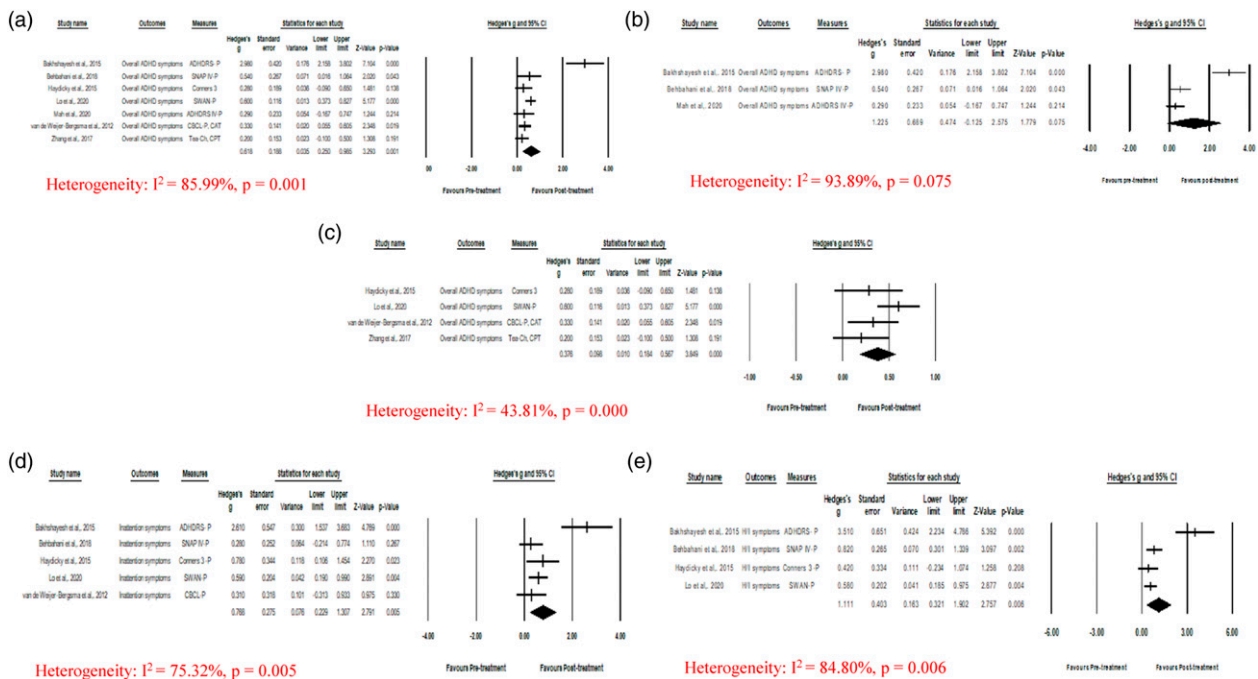
*Within-Group Effects on Children's Externalizing and Internalizing Behaviors at Post-Treatment.* The effects of mindfulness parent training on children's problem behaviors were further assessed in terms of externalizing and internalizing behaviors. Four studies (Bakhshayesh et al., 2015; Gershby et al., 2017; Haydicky et al., 2015; Lo et al., 2020) reported a decrease in parent-rated externalizing behaviors at post-treatment. Result of test of heterogeneity was significant,  $I^2 = 93.82\%$ ,  $p = 0.009$  (Figure 4(d)). Asymmetrical funnel plot with more studies fell on the left

side of the plot was noted. Egger's test indicated evidence for publication bias, intercept = 8.03 [95% CI (-0.82, 16.88)],  $p = 0.063$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) ranged from 0.29 [95% CI (-0.10, 0.68)] (Lo et al., 2020) to 4.03 [95% CI (2.97, 5.09)] (Gershby et al., 2017), indicating MPT had a small-to-large effect on children's externalizing behaviors. In these four studies, one study (Lo et al., 2020) reported a small effect, one study (Haydicky et al., 2015) reported a medium effect, and two studies (Bakhshayesh et al., 2015; Gershby et al., 2017) reported a large effect (Figure 4(d)).

Three studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012) reported a decrease in Internalizing behaviors at post-treatment. Result of test of heterogeneity was non-significant,  $I^2 = 0.00\%$ ,  $p = 0.05$  (Figure 4(e)). Symmetrical funnel plot was noted. Egger's test indicated no evidence for publication bias, intercept = 0.08 [95% CI (-15.73, 15.89)],  $p = 0.957$  (2-tailed). Results of fixed-effect meta-analysis showed that the effect size (Hedges'  $g$ ) ranged from 0.19 [95% CI (-0.19, 0.57)] (Haydicky et al., 2015) to 0.31 [95% CI (-0.08, 0.70)] (Lo et al., 2020), all studies reported a small effect (Figure 4(e)).

*Within-Group Effects on Children's ADHD Symptoms at Post-Treatment.* Seven studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Haydicky et al., 2015; Lo et al., 2020; Mah et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) reported the within-group effects on children's ADHD symptoms and all of them found a reduction of parent-rated ADHD symptoms at post-treatment. Test of heterogeneity showed significant variation in the treatment effect among studies,  $I^2 = 85.99\%$ ,  $p = 0.001$  (Figure 5(a)). Figure 6(c) showed the funnel plot for the within-group effects on children's ADHD symptoms at post-treatment, through visual examination, asymmetrical plot was noted with six out of seven studies fell on the left side of the funnel. Egger's test indicated no evidence for publication bias, intercept = 3.86 [95% CI (-3.09, 10.82)],  $p = 0.213$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) ranged from 0.20 [95% CI (-0.10, 0.50)] (Zhang et al., 2017) to 2.98 [95% CI (2.16, 3.80)] (Bakhshayesh et al., 2015), indicating a small-to-large effect of MPT on children's ADHD symptoms. In these seven studies, four studies (Haydicky et al., 2015; Mah et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) reported a small effect, two studies (Behbahani et al., 2018) reported a medium effect, and one study (Bakhshayesh et al., 2015) reported a large effect (Figure 5(a)).

*Within-Group Effects of Mindfulness Training for Parents [MT(P)] and Mindfulness Training for Parents and Children [MT(P+C)] on Children's ADHD Symptoms at Post-Treatment.* To further evaluate the effects of mindfulness parent training (MPT), the within-group effects of



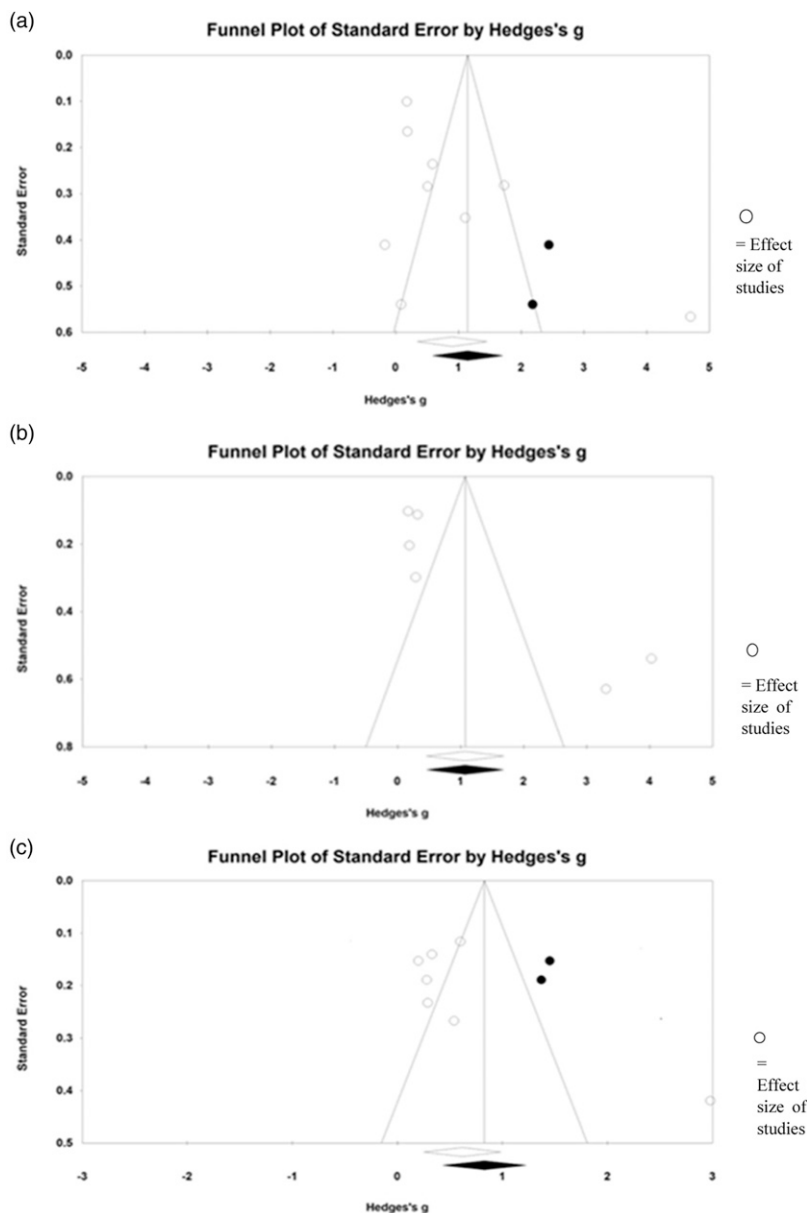
**Figure 5.** Random-effects analyses on the within-group effects on mindfulness parent training on children's ADHD symptoms. (a) Random-effects analysis on the within-group effect of mindfulness parent training on children's ADHD symptoms at post-treatment. (b) Random-effects analysis on the within-group effect of mindfulness training for parents [MT(P)] on children's ADHD symptoms at post-treatment. (c) Random-effects analysis on the within-group effect of mindfulness training for parents and children [MT(P+C)] on children's ADHD symptoms at post-treatment. (d) Random-effects analysis on the within-group effect of mindfulness parent training on children's ADHD inattention symptoms at post-treatment. (e) Random-effects analysis on the within-group effect of mindfulness parent training on children's ADHD hyperactivity/impulsivity symptoms at post-treatment.

the two types of MPT (i.e., mindfulness training for parents [MT(P)] and parallel mindfulness training for parents and children [MT(P+C)]) were reviewed separately. Three studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Mah et al., 2020) involved [MT(P)]. Test of heterogeneity showed no evidence for heterogeneity among studies,  $I^2 = 93.89\%$ ,  $p = 0.075$  (Figure 5(b)). Asymmetrical funnel plot with majority of the studies fell on the left side of the plot was noted. Egger's test indicated evidence for publication bias, intercept = 14.57 [95% CI (-8.91, 38.05)],  $p = 0.080$  (2-tailed). Results of fixed-effect meta-analysis showed that the effect size (Hedges' g) of [MT(P)] based on the three included studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Mah et al., 2020) ranged from 0.29 [95% CI (-0.17, 0.75)] (Mah et al., 2020) to 2.98 [95% CI (2.16, 3.80)] (Bakhshayesh et al., 2015), indicating a small-to-large effect of MT(P) on children's ADHD symptoms. Among these three studies, one study (Mah et al., 2020) reported a small effect, one study (Behbahani et al., 2018) reported a medium effect, and one study (Bakhshayesh et al., 2015) reported a large effect (Figure 5(b)).

Four studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) involved

[MT(P+C)]. Test of heterogeneity showed evidence for heterogeneity among studies,  $I^2 = 43.81\%$ ,  $p = 0.000$  (Figure 5(c)). Asymmetrical funnel plot with majority of the studies fell on the left side of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = -5.41 [95% CI (-17.66, 6.84)],  $p = 0.198$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges' g) of [MT(P+C)] based on the four included studies (Haydicky et al., 2015; Lo et al., 2020; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) ranged from 0.20 [95% CI (-0.10, 0.50)] to 0.60 [95% CI (0.37, 0.83)], indicating a small-to-medium effect of [MT(P+C)] on children's ADHD symptoms. Among these four studies, three studies (Haydicky et al., 2015; van de Weijer-Bergsma et al., 2012; Zhang et al., 2017) reported a small effect, and one study (Lo et al., 2020) reported a medium effect (Figure 5(c)).

*Within-Group Effects on Children's ADHD Inattention and Hyperactivity-Impulsivity Symptoms at Post-Treatment.* To evaluate the effects of mindfulness parent training on the core ADHD symptoms, the within-group effects on Inattention symptoms and Hyperactivity-Impulsivity symptoms were further reviewed separately. Five studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Haydicky et al., 2015;



**Figure 6.** Funnel plots for the within-group effects on parenting stress, children’s problem behaviors and ADHD symptoms at post-treatment. (a) Funnel plot for the within-group effects on parenting stress at post-treatment. (b) Funnel plot for the within-group effects on problem behaviors at post-treatment. (c) Funnel plot for the within-group effects on ADHD symptoms at post-treatment.

Lo et al., 2020; van de Weijer-Bergsma et al., 2012) reported a reduction in parent-rated inattention symptoms. Test of heterogeneity showed no evidence for heterogeneity among studies,  $I^2 = 93.89\%$ ,  $p = 0.075$  (Figure 5(d)). Asymmetrical funnel plot with majority of the studies fell on the left side of the plot was noted. Egger’s test indicated evidence for publication bias, intercept = 14.57 [95% CI (–8.91, 38.05)],  $p = 0.080$  (2-tailed). Results of fixed-effect meta-analysis showed that the effect size (Hedges’ g) ranged from 0.28 [95% CI (–0.21, 0.77)] (Behbahani et al., 2018) to 2.61 [95%

CI (1.54, 3.68)] (Bakhshayesh et al., 2015), indicating a small-to-large effect of mindfulness parent training on children’s ADHD inattention symptoms. Among these five studies, two studies (Behbahani et al., 2018; van de Weijer-Bergsma et al., 2012) reported a small effect, two studies (Haydicky et al., 2015; Lo et al., 2020) reported a medium effect, and one study (Bakhshayesh et al., 2015) reported a large effect (Figure 5(d)).

Four studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Haydicky et al., 2015; Lo et al., 2020) reported a

reduction in parent-rated hyperactivity-impulsivity symptoms. Test of heterogeneity showed evidence for heterogeneity among studies,  $I^2 = 75.32\%$ ,  $p = 0.005$  (Figure 5(e)). Symmetrical funnel plot with studies fell on both sides of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = 4.67 [95% CI (-3.19, 12.12)],  $p = 0.160$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) ranged from 0.42 [95% CI (-0.23, 1.07)] (Haydicky et al., 2015) to 3.51 [95% CI (2.23, 4.79)] (Bakhshayesh et al., 2015), indicating a small-to-large effect on child's ADHD hyperactivity-impulsivity symptoms. Among these four studies, one study (Haydicky et al., 2015) reported a small effect, two studies (Behbahani et al., 2018; Lo et al., 2020) reported a medium effect, and one study (Bakhshayesh et al., 2015) reported a large effect (Figure 5(e)).

**Pre-treatment versus Follow-up Within-group Effects.** To evaluate the long-term effects of mindfulness parent training, the effect sizes (Hedges'  $g$ ) were computed based on the comparisons of the mean (SD) and sample size of the Intervention group at pre-treatment and follow-up of each study.

**Within-Group Effects on Parenting Stress at Follow-Up.** Three studies (Behbahani et al., 2018; Haydicky et al., 2015; van de Weijer-Bergsma et al., 2012) reported the effects of mindfulness parent training on parenting stress at follow-up, with the follow-up period varied from 6 to 8 weeks. For heterogeneity,  $I^2 = 11.10\%$ ,  $p = 0.000$ . Asymmetrical funnel plot with two studies fell on the left side of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = -3.38 [95% CI (-12.78, 6.03)],  $p = 0.137$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) ranged from 0.38 [95% CI (-0.72, 1.48)] (van de Weijer-Bergsma et al., 2012) to 1.28 [95% CI (0.71, 1.85)] (Behbahani et al., 2018), suggesting the positive effect of MPT on parenting stress at post-treatment was maintained at follow-up.

**Within-Group Effects on Children's ADHD Inattention Symptoms at Follow-Up.** Three studies (Behbahani et al., 2018; Haydicky et al., 2015; van de Weijer-Bergsma et al., 2012) reported the effects of mindfulness parent training on parent-rated inattention symptoms at follow-up. For heterogeneity,  $I^2 = 77.44\%$ ,  $p = 0.014$ . Asymmetrical funnel plot with all studies fell on the left side of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = 4.94 [95% CI (-6.60, 16.69)],  $p = 0.207$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) ranged from 0.35 [95% CI (-0.17, 0.87)] (Behbahani et al., 2018) to 0.81 [95% CI (0.10, 1.52)] (Haydicky et al., 2015), showing that the positive effect of MPT on children's inattention symptoms at post-treatment was maintained at follow-up.

**Within-Group Effects on Children's Hyperactivity-Impulsivity Symptoms at Follow-Up.** Two studies (2015;

Behbahani et al., 2015; Haydicky et al., 2015) reported the effects of mindfulness parent training on parent-rated hyperactivity-impulsivity symptoms at follow-up. Due to the limited number of studies, heterogeneity and publication bias were not analyzed. Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) was 0.62 [95% CI (-0.08, 1.32)] (Haydicky et al., 2015) and 1.02 [95% CI (0.47, 1.57)] (Behbahani et al., 2018), showing that the positive effect of MPT on children's hyperactivity-impulsivity symptoms at post-treatment was maintained at follow-up.

**Between-group Effects. Between-Group Effects on Parenting Stress at Post-Treatment.** Five studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Gershy et al., 2017; Lo et al., 2020; Mah et al., 2020) reported the between-group effects of mindfulness parent training on parenting stress. For heterogeneity,  $I^2 = 71.88\%$ ,  $p = 0.035$ . Symmetrical funnel plot with studies evenly distributed on both sides of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = 0.67 [95% CI (-2.38, 3.72)],  $p = 0.619$  (2-tailed). Results of random-effects meta-analysis showed that, among these five studies, four studies (Bakhshayesh et al., Behbahani et al., 2018; Gershy et al., 2017; Mah et al., 2020) reported an effect size in favor of mindfulness parent training (MPT), with the Hedges'  $g$  ranged between 0.06 [95% CI (-0.32, 0.44)] (Bakhshayesh et al., 2015) and 0.84 [95% CI (0.54, 1.14)] (Behbahani et al., 2018). One study reported an effect size in favor of the control, the Hedges'  $g$  was -0.04 [95% CI (-0.24, 0.16)] (Lo et al., 2020).

**Between-Group Effects on Parenting Stress When Comparing to a Non-Active Control.** Two studies (Behbahani et al., 2018; Lo et al., 2020) compared mindfulness parent training to a non-active control. Due to limited number of studies, heterogeneity and publication bias were not analyzed. One study (Behbahani et al., 2018) reported an effect size in favor of the MPT and the Hedges'  $g$  was 0.84 [95% CI (0.54, 1.14)], while the other study (Lo et al., 2020) reported an effect size in favor of the waitlist control and the Hedges'  $g$  was -0.04 [95% CI (-0.24, 0.16)].

**Between-Group Effects on Parenting Stress When Comparing to an Active Control.** Three studies (Bakhshayesh et al., 2015; Gershy et al., 2017; Mah et al., 2020) compared mindfulness parent training to an active control. For heterogeneity,  $I^2 = 0.00\%$ ,  $p = 0.129$ . Symmetrical funnel plot with all studies distributed around the central part of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = 0.19 [95% CI (-13.65, 14.04)],  $p = 0.887$  (2-tailed). Results of fixed-effect meta-analysis showed that the effect size (Hedges'  $g$ ) ranged from 0.06 [95% CI (-0.32, 0.44)] (Bakhshayesh et al., 2015) to 0.59 [95% CI (-2.66, 3.84)] (Gershy et al., 2017), in favor of mindfulness parent training. When compared mindfulness



training for parents [MT(P)] to mindfulness training for children [MT(C)], the effect size was 0.06 [95% CI (-0.32, 0.44)] (Bakhshayesh et al., 2015); compared mindfulness behavioral parent training to standard behavioral parent training, the effect size was 0.31 [95% CI (-0.04, 0.66)] (Mah et al., 2020); and compared mindfulness non-violence resistance parent training to non-violence resistance parent training, the effect size was 0.59 [95% CI (-2.66, 3.84)] (Gershby et al., 2017).

*Between-Group Effects on Children's Problem Behaviors.* Three studies (Bakhshayesh et al., 2015; Gershby et al., 2017; Lo et al., 2020) evaluated the between-group effects of mindfulness parent training (MPT) on parent-rated externalizing behaviors. For heterogeneity,  $I^2 = 80.90\%$ ,  $p = 0.034$ . Symmetrical funnel plot with studies evenly distributed on both sides of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = 6.63 [95% CI (-4.35, 17.61)],  $p = 0.150$  (2-tailed). Results of random-effects meta-analysis showed that the effect size ranged between -0.03 [95% CI (-0.42, 0.36)] (Lo et al., 2020) and 1.35 [95% CI (0.66, 2.04)] (Gershby et al., 2017). Among these three studies, two studies (Bakhshayesh et al., 2015; Gershby et al., 2017) reported an effect size (Hedges'  $g$ ) in favor of MPT which were 1.32 [95% CI (0.64, 2.00)] (Bakhshayesh et al., 2015) and 1.35 [95% CI (0.66, 2.04)] (Gershby et al., 2017). One study reported an effect size in favor of the control, the effect sizes (Hedges'  $g$ ) was -0.03 [95% CI (-0.42, 0.36)] (Lo et al., 2020).

*Between-Group Effects on Children's Externalizing Behaviors When Comparing to a Non-Active Control.* One study (Lo et al., 2020) compared MPT to a waitlist control and reported an effect size (Hedges'  $g$ ) of -0.03 [95% CI (-0.42, 0.36)], in favor of the control condition.

*Between-Group Effects on Children's Externalizing Behaviors When Comparing to an Active Control.* Two studies compared mindfulness parent training to an active control. Due to the limited number of studies, heterogeneity and publication bias were not analyzed. Results of random-effects meta-analysis showed that the effect sizes (Hedges'  $g$ ) were 1.32 [95% CI (0.64, 2.00)] (Bakhshayesh et al., 2015) when compared [MT(P)] to [MT(C)] and 1.35 [95% CI (0.66, 2.04)] (Gershby et al., 2017) when compared non-violence resistance + mindfulness parent training to non-violence resistance parent training, both were in favor of mindfulness parent training.

## Between-group Effects on Children's ADHD Symptoms

*Between-Group Effects on Children's ADHD Inattention Symptoms.* Three studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Lo et al., 2020) evaluated the between-group effects on parent-rated inattention symptoms. For heterogeneity,  $I^2 = 38.42\%$ ,  $p = 0.002$ .

Symmetrical funnel plot with studies distributed on both sides of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = 4.01 [95% CI (-2.32, 10.38)],  $p = 0.137$  (2-tailed). Results of random-effects meta-analysis showed that the effect size (Hedges'  $g$ ) of these three studies ranged between 0.20 [95% CI (-0.19, 0.59)] (Lo et al., 2020) and 1.07 [95% CI (0.44, 1.70)] (Bakhshayesh et al., 2015), all comparisons were in favor of mindfulness parent training. Among these three studies, one study (Lo et al., 2020) reported a small effect,  $g = 0.2$  [95% CI (-0.19, 0.59)] when compared to a waitlist control group, another study (Behbahani et al., 2018) also reported a small effect,  $g = 0.41$  [95% CI (-0.09, 0.91)] when compared to a control group with no treatment, the third study (Bakhshayesh et al., 2015) reported a large effect,  $g = 1.07$  [95% CI (0.44, 1.70)] when compared [MT(P)] to [MT(C)].

*Between-Group Effects on Children's ADHD Hyperactivity-Impulsivity Symptoms.* Three studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Lo et al., 2020) evaluated the between-group effects on parent-rated hyperactivity-impulsivity symptoms. For heterogeneity,  $I^2 = 2.14\%$ ,  $p = 0.001$ . Symmetrical funnel plot with studies distributed on both sides of the plot was noted. Egger's test indicated no evidence for publication bias, intercept = 1.54 [95% CI (-2.80, 5.88)],  $p = 0.266$  (2-tailed). In these three studies, one study (Lo et al., 2020) compared MPT to a waitlist control and reported a small effect,  $g = 0.30$  [95% CI (-0.09, 0.69)]; another study (Behbahani et al., 2018) compared MPT to a control with no treatment and reported a medium effect,  $g = 0.74$  [95% CI (0.23, 1.25)]; the third study (Bakhshayesh et al., 2015) compared [MT(P)] to [MT(C)] and reported a large effect,  $g = 1.61$  [95% CI (-0.38, 3.60)].

## Discussion

This systematic review and meta-analysis has included 10 studies on mindfulness parent training (MPT) and evaluated its effects on parenting stress, children's problem behaviors, and children's ADHD symptoms. Results showed that mindfulness parent training (MPT) may have beneficial effects on these three outcomes. Within-group pre- and post-treatment comparisons yielded a small-to-large effect of mindfulness parent training on parenting stress, children's problem behaviors, and children's ADHD symptoms at post-treatment. The positive effects of MPT on parenting stress and children's ADHD symptoms were maintained at follow-up assessment. Subgroup analyses showed that MPT had a small-to-large effect on children's externalizing behaviors, ADHD inattention and hyperactivity-impulsivity symptoms, and a small effect on children's internalizing behaviors. Besides, the effects of mindfulness training for parents [MT(P)] appears to be larger than that of

mindfulness training for parents and children [MT(P+C)] on all three outcomes. Between-group comparisons at post-treatment showed a small-to-medium effect on parenting stress, and a large effect on children's problem behaviors and children's ADHD symptoms when compared to an active control.

The findings of this systematic review and meta-analysis (MA) echo those of previous systematic reviews that mindfulness training had positive effects on reducing inattention symptoms and externalizing behaviors in children with ADHD, and stress in their parents at post-treatment (Tercelli & Ferreira, 2019; Townshend et al., 2016). Moreover, the magnitude of the within-group effects on parenting stress, children's externalizing behaviors, and inattention symptoms at post-treatment found in this MA are comparable to those found in these two previous reviews (Tercelli & Ferreira, 2019; Townshend et al., 2016). Furthermore, this MA and the review conducted by Burgdorf et al. (2019) both found a small between-group effects on parenting stress, with mindfulness parent training induced greater reduction in parenting stress than active control at post-treatment. Taken together, the findings of this systematic review and MA provide preliminary support for the benefits of mindfulness parent training for reducing parenting stress and children's ADHD-related behaviors.

Although the findings in this MA support positive effects of mindfulness parent training in children with ADHD and their parents, elaborations for some findings are required. Among the nine reviewed studies on the within-group effects for parenting stress at post-treatment, one study (Zhang et al., 2017) had a negative Hedge's  $g$   $\{-0.17$  [95% CI  $(-0.98, 0.64)]\}$ , suggesting parents were more stressful after training. This finding is inconsistent with those found in other studies in this review which had a positive Hedge's  $g$ , suggesting a decrease of parenting stress after training. The authors of this study (Zhang et al., 2017) had provided an explanation for the increase in parental stress at post-treatment. The authors mentioned that the post-treatment assessment was conducted in September, the beginning of a new semester. Usually, during this period of time, parents were focused on their children's school adaptation and academic performance and became stressful. Thus, they might give a high rating for their stress level at post-treatment assessment despite they had completed the mindfulness parent training. In addition to this explanation, there is another possible account for the increase in parenting stress after treatment in this study. Literature shows that parents of children with ADHD and comorbidities had higher stress level than parents of children with ADHD only or with other disorders (Li et al., 2016). When examining the characteristics of the study done by Zhang et al. (2017), only 11 parent-child dyads were involved in the mindfulness training for both parents and children. However, comorbidities such as speech disorders, developmental delay,

genetic disease, Tourette's syndrome were found in four children. It is possible that the high percentage (36.4%) of children with ADHD and comorbidities included in this study might lead to a large number of parents who had high parental stress and expected for an intensive training. Yet, the intensity and duration of training in this study were the same to those found in other studies (Bakhshayesh et al., 2015; Behbahani et al., 2018; Haydicky et al., 2015; van de Weijer-Bergsma et al., 2012; Van der Oord et al., 2012), this may cause parents' dissatisfaction with the training and consequently a high rating for parenting stress at post-treatment.

Seemingly, parallel mindfulness training for parents and children [MT(P+C)] should lead to a greater benefit than mindfulness training for parents only [MT(P)] in all outcomes because children also received training. However, subgroup analyses in this MA consistently showed that the effect of [MT(P)] are larger than that of [MT(P+C)] on parenting stress, children's problem behaviors and children's ADHD symptoms at post-treatment. It is possible that the greater training effects from [MT(P)] could be caused by the differences in the aims and content between the two types of training. Mindfulness parent training (MPT) is a parent-focused intervention which aims to enhance parent-child relationship through improving parent's self-awareness, mindfulness, and intentionality in parenting. Management of children's problem behaviors is not a focus of MPT (Altmaier & Maloney, 2007). Studies showed that mindfulness training for parents could enhance their satisfaction with parenting which in turn reduced parenting stress (Sawyer Cohen & Semple, 2010). Less parenting stress could lead to better parent-child interaction and subsequently enhance child's compliance (Singh et al., 2010). Through this chain, a reduction in children's problem behaviors is ensued. In addition to this potential explanation, parents' expectation on children's behavioral changes due to training may also be a possible reason for the larger effect of [MT(P)] than that of [MT(P+C)] found in this MA. In parallel mindfulness training for parents and children [MT(P+C)], training is provided for both parents and children simultaneously. Because children also receive training, parents will pay attention to children's condition and may expect to see some behavioral changes. If the trajectory of children's behavioral changes is not following parents' expectation, it may not change parents' impression on children's behaviors. As a result, parents may not give a lower rating for children's problem behaviors at post-treatment. Collectively, the above-mentioned may provide potential explanations for the finding that [MT(P)] had a larger effect than [MT(P+C)] on parenting stress and children's ADHD-related behaviors. In order to better know the effects of mindfulness parent training on parenting stress and children's problem behaviors and ADHD symptoms, more well-designed RCTs are required to compare [MT(P)] to [MT(P+C)] as well as to address the

issue if [MT(P)] could be used as a stand-alone intervention. It is also noteworthy that all studies included in this MA used parent-rating for measuring children's behavioral changes and parents were not blinded in their children's condition, there may have some bias in their reporting. Thus, it should consider to use more objective measures such as teacher-rating or involve multiple raters to report children's behaviors in future studies.

Between-group comparisons showed that when compared MPT to an active control, the results were in favor of MPT, with the effects were small-to-medium on parenting stress and large on children's externalizing behaviors and ADHD symptoms. Although the findings were in favor of mindfulness parent training, because between-group comparisons were based on a small number of studies ( $n = 3$  for parenting stress,  $n = 2$  for children's externalizing behaviors, and  $n = 1$  for children's ADHD symptoms), the findings could be due to the unique characteristics of the included studies. However, among the small number of between-group comparisons, two analyses compared the mindfulness version to the standard version of the parent training and the results were in favor of mindfulness parent training. These results actually provide a preliminary support for a greater effect of mindfulness-based parent training. To ascertain these results, more well-designed RCTs are required. All in all, due to the small number of studies included in the between-group analyses, cautions should be taken when interpreting the between-group effects.

The methodological quality assessment showed that the RCTs and Non-RCTs included in this MA review had fair-to-good and low quality respectively. In addition, the risk of bias assessment also showed that the RCTs and non-RCTs in this MA were at high and critical risk respectively. The results of these two assessments suggest that the methods used in the included studies had fair design which could influence the outcomes of studies. Therefore, when interpreting the findings of this MA, it is important to consider the methodological quality and risk of bias of all studies in addition to the magnitude of effect sizes.

Although this systematic review and MA provides preliminary evidence that mindfulness parent training may be beneficial for parenting stress and children's ADHD-related behaviors, some limitations need to be addressed in future studies. First, only 10 studies were included in this review, a small number of trials bears a great variability among studies which could contribute to an underestimation or overestimation of the overall effect if a study had a considerable smaller or larger effect than other studies. In fact, the within-group effect on parenting stress at post-treatment in this review showed that one study (Bakhshayesh et al., 2015) had an exceptionally large effect ( $g = 4.7$ ) relative to other studies. If the effect size of all studies were pooled together, the averaged effect size may be overestimation. To avoid providing misleading results,

only the range of the effect sizes across studies was presented and the pooled effect sizes for all analyses were not emphasized in this review. In addition, if there are treatment effects on both positive and negative directions within a small number of included studies, it could be difficult to draw conclusions on the effect of mindfulness parent training. In this review, when compared MPT to a non-active control, one study (Behbahani et al., 2018) reported a positive between-group effect, while the other study (Lo et al., 2020) showed a negative between-group effect on parenting stress at post-treatment. It is inappropriate to use the pooled effect size of both studies to represent the overall effect because they may cancel out the effect of each other. To avoid the above-mentioned issues, more well-designed RCTs are required. Second, publication bias was detected in most of the analyses in this meta-analysis. The consequences of publication bias would be an inflated claim of the treatment benefits or the presence of risk factors related to the published work which could be misleading in clinical practice in many ways such as intervention planning and policy making. However, this meta-analysis was intended to detect if publication bias existed only, the sources of bias were unknown. Thus, when interpreting or generalizing the results of this meta-analysis to other populations, cautions should be taken. Third, although preliminary evidence for the benefits of mindfulness parent training on parenting stress and children's problem behaviors and ADHD symptoms was found in this review, it is still unclear if MPT can be used as a stand-alone intervention and what is the optimal intervention protocol based on the findings. Moreover, literature shows that parenting stress is also influenced by children's ADHD subtype and comorbidities (Li et al., 2016), the treatment effects on children with different ADHD subtypes may be varied. Although it is important to consider children's characteristics such as medication condition, ADHD subtypes and comorbidity, and parent's ADHD symptoms in the analyses, due to the limited number of studies included in this review, subgroup analyses based on these factors were not able to be conducted. More RCTs of high quality should be conducted in the future in order to provide evidence for the beneficial effects of mindfulness parent training.

## Conclusion

This systematic review and meta-analysis provides preliminary evidence that mindfulness parenting training (MPT) may have positive effects on parenting stress and children's problem behaviors and ADHD symptoms. However, due to the fair methodological quality and high level of risk of bias, cautions should be taken when interpreting the results. Besides, this review fails to provide evidence that MPT could be used as a stand-alone intervention. To address this issue, studies should compare mindfulness parent training to other evidence-based parent

trainings in the future. Moreover, because only a limited number of studies were included, it is unknown if MPT has different effects on children with different ADHD subtypes and comorbidities. Future studies should also identify the types of parents and children who may benefit more from mindfulness-based parent training.

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