Is combined CBT therapy more effective than drug therapy alone for ADHD in children? A meta-analysis

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Based on published research on the combined cognitive behavioral therapy (CBT) versus drug therapy alone in children with attention deficit/hyperactivity disorder (ADHD), we systematically reviewed and analyzed the efficacy of two treatment methods in children with ADHD. The literature as at the end of 10 July 2017 in multiple databases was systematically searched. Standardized mean differences (SMD) and 95% confidence intervals (CIs) were calculated. The results indicated that combined CBT therapy was efficacious in reducing symptoms of ADHD (SMD -0.48 , 95% CI -0.80 to -0.17). The executive function scores were not improved more in the combined CBT (SMD -0.34 ; 95% CI -0.71 to 0.03). This study suggests that combined CBT seems more efficacious in some domains affecting children with ADHD, but further evaluation is needed.

Keywords: ADHD; CBT; review; treatment.

Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5), attention deficit/hyperactivity disorder (ADHD) is characterized by the development of inappropriate levels of inattention and/or hyperactivity, and has a negative impact on the behavioral inhibition, selective attention and other executive functions which cannot be better explained by another condition.¹ The prevalence of ADHD ranged from about 3% to 9%.²

ADHD is a chronic disease, so both medications and psychological interventions were used to treat this disorder. Stimulant medications were effective for approximately 70–80% of ADHD patients.³ They can relieve the symptoms of ADHD, but there is less evidence that medications can normalize the function.⁴ The previous study has shown that combination with psychological treatment can reduce the dose of medications.⁵ All these treatment methods including drug treatment and psychological intervention were usually recommended for children.⁶ However, a survey has shown that

the parents were more satisfied when receiving psychosocial intervention than to receive drug therapy alone.⁷ Specially, cognitive behavioral therapy (CBT) was the most common psychosocial intervention for children with mental disorders. CBT is a good approach to managing a variety of disorders, including cognitive and behavioral intervention components. CBT is based on the premise that the combination of thought, emotion, and behavior is interrelated, and that dealing with one of the three parts also modifies other elements. Most CBT interventions take action on cognitive activities that regulate the individual's response to the environment.⁸

CBT model of children with ADHD posits that many of the consequences of symptoms of ADHD are maintained or exacerbated by a lack of adequate psychosocial coping skills. By providing compensatory executive functioning training to children, the treatment is designed to prevent the emergence of some of the impairments that can arise as a result of undertreated ADHD. The cognitive technologies used in

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CBT for children included core modules on psychoeducation and organizing/planning, distractibility identification, and cognitive restructuring, as well as optional modules on reducing procrastination, improving communication skills, and improving anger/frustration management.

Within the past years, there have been meta-analysis published on the efficacy of CBT for managing adult with ADHD,^{9,10} and showed comparable effect sizes for adult with ADHD. The CBT interventions in the adult ADHD population are focused on skill-building and teaching specific skills.¹⁰ Although there is undoubtedly a cognitive component to the adult ADHD CBT interventions, all existing adult ADHD CBT interventions appear more heavily skewed toward teaching cognitive techniques. Given that the adult ADHD interventions appear to be effective and the adult interventions comprise more cognitive features than behavioral features, but for the children, the CBT interventions comprise more behavioral features than cognitive features.

The previous research had shown that the combined CBT treatment used lower dose of medication than the medication group, while showing more improvement to treatment.⁵ To date, there has been no meta-analysis to examine the effects of combined CBT versus drug therapy alone on ADHD for children. More and more trials evaluated the efficacy of combined CBT in this population. However, there are different opinions about whether combined CBT treatment was more superior than drug therapy alone. We conducted a systematic review to address this question and summarize the current findings about the effects of CBT for children with ADHD on symptoms and functioning.

Methods and Materials

Inclusion and exclusion criteria

The participants of interest were aged < 18 and were diagnosed with ADHD (any subtype) according to either DSM-5

Figure 1. Flowchart of study selection.

or ICD-10 criteria. Studies involving common comorbid disorders were included (e.g., oppositional defiant disorder, generalized anxiety disorder, major depressive disorder, etc.) if only rare comorbid disorders (e.g., fragile X syndrome) were excluded. The intervention of interest was combined CBT therapy, which should be compared to drug therapy alone. The dose of medication in all included studies was the same in both combined CBT therapy and drug alone. The following were our outcomes of interest: symptoms of ADHD, executive function. We excluded studies in which psychological treatments were not CBT, only study protocol, no control group or ineligible statistical information.

The assessment of risk of bias formed the basis for assessment of the overall quality of the evidence. Moreover, each individual outcome was also assessed for inconsistency, indirectness, imprecision, and publication bias, according to the GRADE principles.¹¹

A systematic literature search was performed in the following databases: Pubmed, Embase, PsycInfo, web of science, Sinomed. We used the following search terms: ADHD, Attention deficit disorder with hyperactivity, Attention deficit disorder*, Hyperkinetic disorder*, Cognitive-behavior*, Cognitive behavior* therap*, Cognitive behavior* treatment*, Cognitive behavior* intervention*, Cognitive behavior* group*, Cognitive behavior* train*, child*, adolescent*, young pe*, youth*, teen*. Studies published in English and Chinese were included. Duplicates were removed, and titles and abstracts were screened by researchers. Potentially eligible studies were collected in full text, and assessment of eligibility was then performed by researchers. After completion of full-text reading and final inclusion of eligible studies, researcher assessed the study quality and extracted the data (Fig. 1).

Data extraction and statistical analysis

The meta-analysis was performed using Review Manager software developed by The Cochrane Collaboration.¹² Data

extraction was done independently by two authors (Q. Ding, M. Li, with disagreements resolved by D. Zhu). Most proximal and probably blinded analysis was performed for the interested domains including ADHD symptoms and executive function. When an outcome was long-term follow-up, we used the final data to follow the efficacy of the treatment. Blinded assessments were made by individuals who were blind to allocation. In trials if more than one measurement was available, the blinded measurement was preferred.¹³ For ADHD symptom, we used the total score, only in the study by Coelho *et al.*,¹⁴ the CBCL attention/hyperactivity problems score was used. For executive function, in the study by Coelho *et al.*¹⁴ we used IVA-CPT omissions score, in the study by Yang *et al.*¹⁵ NCT omissions score was used (Table 1). Random effects in our meta-analysis were performed because we anticipated that the criteria for included participants and the specific contents and duration of the intervention would vary between trials. We planned *a priori* to assess effect sizes measured on scales (continuous outcomes) using the standardized mean differences (SMD) with 95% confidence interval (95% CI). Moreover, we assessed the heterogeneity between studies using I^2 statistics.

Results

Selection of studies

Our search ended on 10 July 2017. After screening titles and abstracts, full-text papers were assessed for eligibility. Finally, five primary studies fulfilled our inclusion criteria. The characteristics of the included studies were provided in Table 1.

Forest plots and estimates of heterogeneity were only shown for outcomes reported by the included studies. The meta-analysis showed a statistically and clinically significant effect of the combined CBT therapy which was more efficacious in reducing symptoms of ADHD (SDM -0.48 , 95%

Table 1. Descriptive summary of the included studies.

Reference	Study design	Subjects			Combined interventions				Outcome measurement according to dependent variable	
		Age	Exp. (n)	Cont. (n)	Type	Length (min)	Sessions	Duration (weeks)	ADHD symptom	Executive function
16	N/RCT	7–13	15	15	methylphenidate + CBT	N/R	N/R	N/R	CSI-4	N/R
14	N/RCT	7–14	30	30	methylphenidate + CBT	90	28	N/R	CBCL	IVA-CPT
13	RCT	14–18	24	22	medication + CBT	N/R	12	17.31	ADHD severity ratings	N/R
17	RCT	10.3 ± 1.6	31	30	atomoxetine + CBT	50	8	8	The symptom inventory scale of ADHD	N/R
15	RCT	N/R	29	31	methylphenidate + CBT	60	12	12	PSQ	NCT

Notes: Exp (n) = Experiment (number); Cont. (n) = Control (number); RCT = Randomized controlled trials; N/RCT = Non-randomized controlled trials; CBT = Cognitive behavior therapy; N/R = Not reported; CSI = Child symptom inventory; CBCL = Child behavior checklist; IVA-CPT = Integrated visual and auditory continuous performance test; PSQ = Conners parents symptom questionnaire; NCT = Number cancel test.

Figure 2. Comparative effect of combined therapy versus drug therapy on ADHD symptoms.

Figure 3. Comparative effect of combined therapy versus drug therapy on executive function.

CI -0.80 to -0.17 , $I^2 = 37\%$) (Fig. 2). The executive function scores were not improved more in the combined CBT (SMD -0.34 , 95% CI -0.71 to 0.03 , $I^2 = 5\%$) (Fig. 3).

GRADE assessment

The overall quality of the evidence was very low according to our GRADE assessment, as this is determined by the lowest

score for any critical outcome (Table 2). A low quality rating suggests that future research was very likely to have an important impact on the effect estimate. Our confidence in the effect estimates of the five included studies was downgraded for a poor description of the randomization procedure, lack of a description of any allocation concealment inadequate blinding of participants and personnel (Figs. 4 and 5), the small sample size in all studies, the subjectivity inevitably

Table 2. GRADE assessment of the included study.

Quality assessment							No of patients		Effect			
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	ADHD symptom	Control	Relative (95% CI)	Absolute	Quality	Importance
ADHD symptom (better indicated by lower values)												
5	Observational studies	Serious*	No serious inconsistency	No serious indirectness	No serious imprecision	None	129	128	—	SMD 0.48 lower (0.8 to 0.17 lower)	Very low	Important

Note: *Selection bias, performance bias, detection bias, attrition bias and reporting bias.

Figure 4. Risk of bias graph of the included studies.

Figure 5. Risk of bias summary of the included studies.

involved in reporting of outcomes and under unblinded conditions for the evaluator, which challenges the external validity of the results.

Discussion

Five small studies have laid the foundation for our analysis, and our confidence in effect estimates has been rated very low using the GRADE standard.

In the study by Aghaee *et al.*,¹⁶ Coelho *et al.*,¹⁴ Xu *et al.*,¹⁷ both drug therapy and combined CBT were effective in reducing ADHD clinical symptoms, but combined therapy was not capable of displaying more effects than drug therapy on clinical symptoms. But, in the study by Sprich *et al.*¹³ and Yang *et al.*,¹⁵ combined therapy was more effective than drug therapy.

Our meta-analysis results indicated that combined therapy was more effective in reducing ADHD clinical symptoms than drug therapy. Combined therapies have led to different results in various studies, mainly because CBT sessions were performed in a limited number, the participants did not have enough time to completely learn the techniques, and there is no power to dominate the cognitive functions in children due to lack of adequate cognitive growth.

In the study by Coelho *et al.*,¹⁴ drug therapy and combined therapy were effective in increasing executive function, but

Combined therapy was not more effective than drug therapy. But, in the study by Sprich *et al.*,¹³ combined therapy was more effective than drug therapy. Our meta-analysis results indicated that combined therapy was not more effective in increasing executive function for ADHD of children. The previous research had suggested that functional outcomes improved after CBT was maintained at three-month follow-up.¹⁸ But, in the study by Coelho *et al.*,¹⁴ they measured the executive function outcomes directly after treatment. We hypothesized that the executive function would have a delayed response to treatment. After symptom reduction for some period of time, one would later see executive function improvements.

Future Directions for Research

Future studies should apply validated manuals in multi-center random control studies and include treatment fidelity ratings of the applied intervention to replicate findings and increased sample sizes. We hope that future studies will investigate whether or not combined treatment would be similarly effective in children with ADHD who are not on medications or whether treatment gains from combined CBT treatment were dependent on pharmacological treatment.

Studies should seek to avoid too narrow inclusion criteria since patients with ADHD constitute a heterogeneous group with varying types of comorbidities and studies therefore need to establish whether CBT can be used for most patients with ADHD, or whether it is only indicated for a sub-group of individuals. It could also be of value to compare the effect of the formats of CBT delivery, i.e., group, individual or combined therapy, in an RCT design and to study the effect of CBT on neurological and neuropsychological functioning.

Limitations

Our literature search was limited to studies in English and Chinese. Restricting our study to the comparison of combined CBT therapy and drug therapy also restricted the number of studies we could include. In addition, the confidence in our conclusions about the effects of combined CBT therapy was limited by the small sample sizes and risk of bias in the available studies.

Despite our low confidence in the effect estimates, combined CBT therapy may be a better treatment option for children with ADHD. However, larger randomized studies of solid methodological quality were needed in order to establish the exact treatment efficacy on a broader set of outcomes and in a more heterogeneous population of children with ADHD.

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