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Overview of Reviews

The Cochrane Library and Non-Pharmacological Treatments for Attention Deficit Hyperactivity Disorder in Children and Adolescents: An Overview of Reviews

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Background: Attention deficit hyperactivity disorder (ADHD) is a chronic behavioural disorder that affects 5–8% of children. It is characterized by age-inappropriate levels of inattention, hyperactivity and impulsivity that cause functional impairment in multiple settings. The most common treatment of ADHD involves prescription of stimulant medications, which often cause undesirable side effects and pose unknown long-term health risks. Therefore, alternative treatment options for ADHD are becoming increasingly popular and need to be further investigated.

Objectives: This overview of reviews aims to synthesize evidence from the *Cochrane Database of Systematic Reviews* (CDSR) on the efficacy and safety of non-pharmacologic treatments to improve symptoms of ADHD in children and adolescents.

Methods: Issue 12, 2010 of the CDSR was searched using the terms "attention deficit hyperactivity disorder", "hyperkinetic disorder" and "ADHD" restricted to the title, abstract or keywords, and all systematic reviews examining non-pharmacologic treatments for ADHD in children and adolescents were identified. Data were extracted, complied into tables and synthesized using qualitative and quantitative methods.

Main Results: Three systematic reviews (containing ten trials and 594 participants) were identified for inclusion in this overview. Children assigned to Hatha yoga versus a non-specific physical activity control condition showed significantly less symptoms of inattention when measured using both parent ratings (MD: −0.73; 95% CI: −1.25, −0.21) and child-completed tests (MD: −4.01; 95% CI: −6.23, −1.79). There was no significant benefit of homeopathy compared to homeopathy placebo in decreasing symptoms of ADHD. There was also no significant difference between family therapy and standard treatment for parent and teacher ratings of inattention and hyperactivity/impulsivity; however, when overall symptoms were judged by a blinded third party observer in the classroom setting, standard treatment was significantly more effective (MD: 0.11; 95% CI: 0.05, 0.17). There was no significant difference between meditation therapy compared to both drug therapy and standard treatment without drugs for decreasing symptoms of inattention, hyperactivity, impulsivity, distractibility or overall symptoms.

Authors' Conclusions: The three Cochrane reviews suffered from a lack of high-quality, adequately powered randomized controlled trials using standardized tools to measure clinically important outcomes over adequate periods of time. Therefore, the trials included in this overview are not sufficient to provide evidence of no positive benefit of treatment, nor are they sufficient to recommend the use Hatha yoga, family therapy, meditation therapy or homeopathy for the treatment of ADHD in children and adolescents.

Editors' Note: *Overviews of reviews, compiling evidence from multiple Cochrane reviews into one accessible and usable document, are a regular feature of this journal. Our aim for each overview is to focus on the treatment question, 'which treatment should I use for this condition?', and to highlight the Cochrane reviews and their results in doing so. It is our hope that the overview will serve as a 'friendly front end' to the Cochrane Library, allowing the reader a quick overview (and an exhaustive list) of Cochrane reviews relevant to the clinical decision at hand.*

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Plain Language Summary

Attention deficit hyperactivity disorder (ADHD) is a very common disorder that affects 5–8% of children and teenagers, and is diagnosed more often in boys. Children with ADHD normally have trouble concentrating, finishing tasks, remembering everyday items and listening when people talk to them. They are often fidgety, restless and noisy, and they have trouble sitting still and being quiet. Also, they often say things without thinking and interrupt other people a lot. Children with ADHD usually have this disorder for many years, so it is important that they get proper treatment. A lot of children take medication called stimulants, but these pills can sometimes cause problems. Instead of taking pills, other treatments like family therapy, meditation therapy or homeopathy are sometimes recommended by doctors, but at the moment there is not enough research to know if these treatments work.

Background

Description of the condition

Attention deficit hyperactivity disorder (ADHD), also known as Hyperkinetic Disorder (1), is the most common behavioural disorder in children and one of the most common chronic conditions of childhood (2). The three core symptoms of ADHD are inattention, hyperactivity and impulsivity (3;4). For a diagnosis to be given, symptoms must be present for at least six months, cause considerable functional impairment in two or more settings (i.e. school and home), and have started before the age of seven (1;5). The two most commonly used diagnostic classification systems are the Diagnostic and Statistical Manual of Mental Disorders (DSM) and the International Classification of Diseases and Related Health Problems (ICD) (1;5). The DSM is more inclusive than the ICD (6) and recognizes three subtypes of ADHD: predominantly inattentive, predominantly hyperactive/impulsive, and combined. On the other hand, the ICD only diagnoses the disorder when inattention, hyperactivity and impulsivity are all present. Figure 1 shows a breakdown of the symptoms of ADHD as well as the number and type of symptoms required for DSM and ICD diagnoses.

There is variability in reported prevalence of ADHD due to differences in diagnostic tools, assessment settings and patient characteristics, as well as changes in diagnostic criteria over time (7). Most prevalence estimates range from 4–13% (2;8–10), with some estimates as low as 2% and as high as 18% (6;11). A systematic review on the worldwide prevalence of childhood ADHD reported an overall prevalence of 5.3% (12), and there is generally consensus that the prevalence ranges between 5–8% (13). ADHD is two to nine times more common in boys (14–17), with the exception of the 'inattentive' subtype, which is more commonly diagnosed in girls (18).

Attention deficit hyperactivity disorder has significant associated functional problems and co-morbidity.

DSM-IV-TR	ICD-10
For a diagnosis to be given, at least six of the following symptoms of **inattention** and/or six of the following symptoms of **hyperactivity**/**impulsivity** must be present:	For a diagnosis to be given, at least six of the following symptoms of **inattention**, three of the following symptoms of **hyperactivity** and one of the following symptoms of **impulsivity** must be present:
Inattention	
1. Often fails to give close attention to details or makes careless mistakes in schoolwork, work or other activities	
2. Often has difficulty sustaining attention in tasks or play activities	
3. Often does not seem to listen when spoken to directly	
4. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace	
5. Often has difficulty organizing tasks and activities	
6. Often avoids, dislikes or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)	
7. Often loses things necessary for tasks or activities (i.e. toys, school assignments, pencils, books, or tools)	
8. Is often easily distracted by extraneous stimuli	
9. Is often forgetful in daily activities	
Hyperactivity	
1. Often fidgets hands and feet or squirms in seat	
2. Often leaves seat in classroom or in other situations in which remaining seated is expected	
3. Often runs or climbs excessively in situations in which it is inappropriate (in adolescents, may be limited to subjective feelings of restlessness)	
4. Often has difficulty playing or engaging in leisure activities quietly	
5. Is often 'on the go' or acts as if 'driven by a motor'	
6. Often talks excessively (DSM only)	
Impulsivity	
1. Often blurts out answers before questions have been completed	
2. Often has difficulty awaiting turn	
3. Often interrupts or intrudes on others (i.e. butts into conversations or games)	
4. Often talks excessively (ICD only)	

The above information has been modified from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision, and the International Classification of Diseases and Related Health Problems, Tenth Edition.

Figure 1. DSM-IV-TR and ICD-10 diagnostic criteria for attention deficit hyperactivity disorder

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Children with ADHD often display antisocial behaviour, difficulty establishing and maintaining friendships, school underachievement, and low self-esteem (2;6;19). In adolescence, these difficulties extend to substance abuse, crime involvement and unemployment (6;7). Furthermore, up to 67% of children with ADHD have one or more co-morbid disorders such as oppositional defiant disorder (35%), conduct disorder (26–43%), anxiety disorders (26%), mood disorders (18%) and developmental disorders (25–60%), all of which are associated with poorer social, emotional and psychological outcomes (19–23).

Known biological risk factors for development of ADHD include intrauterine growth restriction, low birth weight, prematurity, fetal hypoxia, and brain injury (6;7;24). Environmental factors such as early environmental deprivation, lead exposure, zinc deficiency and maternal smoking and/or alcohol consumption also increase likelihood of developing the disorder (7;25–28). ADHD is a chronic illness that continues to affect 60–80% of children into adulthood; therefore, symptoms require ongoing monitoring and effective treatment (29–31).

Why it is important to do this overview

Current pharmacological treatments for attention deficit hyperactivity disorder have caused much controversy in recent years (32). Standard treatment of ADHD often involves prescription of stimulant medications such as methylphenidates (i.e. Ritalin) or amphetamines (i.e. Adderall) (33). In the 1990s, the number of stimulant prescriptions prescribed for childhood ADHD rose in various parts of the world, including the United States (34), United Kingdom (35), Canada (36), Australia (37), Netherlands (38), Spain (39), Israel (40) and Iceland (41). In many of these areas, such as the United States, stimulants were the most commonly prescribed psychotropic medication in children (34;42). Stimulants have been shown to effectively decrease the short-term symptoms of inattention, hyperactivity, and impulsivity; however, 25–35% of children with ADHD do not respond to stimulant medications (43;44), and many of those who do respond experience adverse effects such as insomnia, decreased appetite, irritability, abdominal pain, and the development of tics (7;42). Further, stimulants do not have lasting benefits after cessation of treatment (45). Recently, there have also been concerns about the long-term effects of stimulants on heart rate, blood pressure, childhood growth rate and incidence of sudden cardiac death (46;47). The potential for long-term adverse effects remains unknown, because most studies have not included long-term follow-ups or have been underpowered to detect statistically significant effects (48–50).

Due to the high prevalence and chronic nature of ADHD, along with the controversy surrounding stimulant use in children, it is important to empirically examine other potential treatment options for children with ADHD. In recent years, non-pharmacological treatments for ADHD have been increasing in popularity as communities become aware of the potential dangers of stimulant use in children (51): between 50–68% of children with ADHD have tried one or more non-pharmacological therapies (52;53), and parents of children with ADHD tend to prefer non-pharmacological therapies for their children (54). Therefore, this overview examines evidence on the efficacy and safety of three non-pharmacological treatments for the management of ADHD in children: family therapy, homeopathy, and meditation therapy (55–57). These treatments have been compared to drug therapies, non-drug therapies and control conditions, and they have been studied using a variety of parent questionnaires, teacher questionnaires and child-completed psychological tests.

Description of the interventions

While pharmacological interventions only target specific symptoms of ADHD (i.e. inattention, hyperactivity and impulsivity), non-pharmacological interventions attempt to provide comprehensive treatment that addresses the global constellation of symptoms in each child (6). *Family therapy* focuses on the various interpersonal relationships within families and aims to produce changes in the overall structure and functioning of the family. The main goals of family therapy are to help family members proactively manage problem behaviours, cope with the distress caused by the disorder, and avoid practices that exacerbate symptoms (58). Family therapy also teaches parents how to use behaviour change techniques and can help increase feelings of parental competence.

Homeopathy is based on the assumption that anything capable of causing an illness or disorder in a healthy individual should also be able to treat the illness or disorder when it occurs (59). Prescription of homeopathic medicine is based on an overall "symptom complex" that takes all co-morbid symptoms and disorders into account when forming each person's individualized treatment plan (60). Then, after initiation of treatment, the medicines, dilutions, dosages and repetition schedules are modified in response to changes in the patient's condition.

Lastly, *meditation therapy* consists of attentional practices designed to increase attention, calmness and contentment (61). There are two forms of meditation therapy: concentrative meditation involves sustained attention directed towards an object, whereas mindfulness meditation involves detached awareness of everything that enters the mind (62). Meditation therapy can be integrated into other treatment plans; for example, Hatha yoga is considered a dynamic form of concentrative meditation that involves a combination of posture, meditation and breathing exercises (63;64).

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Objectives

This overview of reviews synthesizes the most current evidence in the *Cochrane Database of Systematic Reviews* (CDSR) on the efficacy and safety of non-pharmacologic treatments compared to drug therapies, non-drug therapies and control conditions in order to improve both cognitive and behavioural symptoms of attention deficit hyperactivity disorder in children and adolescents.

Methods

Criteria for considering reviews for inclusion

Reviews were included in this overview providing they were published in the *Cochrane Database of Systematic Reviews* and examined a non-pharmacologic intervention for the treatment of ADHD in children and adolescents.

Search methods for identification of reviews

Issue 12, 2010 of the CDSR was searched using the terms "attention deficit hyperactivity disorder", "hyperkinetic disorder," and "ADHD" restricted to the title, abstract or keywords. This resulted in six reviews and ten protocols. We then consulted the Cochrane Developmental, Psychosocial and Learning Problems Group to ensure that we did not miss any relevant reviews.

Data collection and analysis

For this overview, one reviewer (MF) extracted the following information from each of the included reviews: inclusion criteria (including population, intervention, comparisons, and outcomes), methodological quality assessments and numeric results. A second person subsequently verified the accuracy of numeric results. All included reviews used fixed effects modelling due to lack of meta-analyses and/or lack of significant heterogeneity of trials, therefore this overview also used fixed effects modelling in order to maintain consistency with reviews[1]. All available outcomes from all reviews were included in this overview.

All data contained in the three included reviews was continuous; therefore, all data in this overview was summarized using either mean differences (MD) or standardized mean differences (SMD), both with 95% confidence intervals. MD was used for all outcomes except those where more than one trial contributed to the outcome. SMD was used for outcomes which contained data from more than one trial, because expressing the effects as standardized values allowed results from the different measurement scales used in each trial to be combined (66). MD and SMD results were interpreted as statistically significant if the 95% confidence interval did not touch zero. Statistical heterogeneity among the trials contributing to the outcome, measured using I^2 values, was reported for all pooled effect estimates. An I^2 value close to 0% indicates minimal or no heterogeneity of trials, whereas an I^2 of 50% or greater represents substantial heterogeneity (66).

Results

Results of the search

The search strategy returned five potential reviews and ten protocols. One protocol (67) was excluded because it examined a different disorder, and two reviews (68;69) and five protocols (70–74) were excluded because they examined pharmacological treatments for ADHD. The last four protocols (75–78) examined non-pharmacological treatments for ADHD in children (acupuncture, parent training interventions, polyunsaturated fatty acids and social skills training), but were excluded because the protocols were not yet available in full review format. Therefore, three reviews (with a total of ten trials and 594 participants) met the inclusion criteria for this overview (55–57). Each included review examined a different intervention: family therapy (FT), homeopathy (Hom) and meditation therapy (MT). Table 1 presents the study characteristics of the included reviews.

Description of included reviews

The three included reviews were published in 2009 and 2010. One review (FT) contained two trials, and the other two reviews (Hom, MT) contained four trials each. Most trials included in the reviews were parallel randomized control trials (RCTs), but one review (MT) included two cross-over RCTs (79;80)[2]. The number of participants ranged from 83 (MT) to 322 (FT) for a total of 594 participants included in the three reviews.

Search methods

The search strategies used to identify potentially relevant trials were comparable in all reviews. All reviews searched CENTRAL, CINAHL, MEDLINE, PsycINFO and subject-relevant journals, and they all contacted authors and/or experts. Two reviews (Hom, MT) also searched EMBASE, ERIC and LILACS. Other search methods included searching reference lists (FT, MT), clinical trial databases (Hom, MT) and relevant abstracts (FT, Hom).

[1] One outcome in the homeopathy review (parent rating of hyperactivity) was presented using random effects modelling; Review Manager 5.0 (65) was used to change the effect size to fixed effects modelling, which did not change the significance of the outcome. The original effect size, presented using random effects modelling, was SMD: −0.22; 95% CI: −1.06, 0.63.

[2] Only data from the first phase of the studies (prior to cross-over) was included in this overview in order to eliminate the possibility of carry-over effects.

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Table I. Characteristics of included reviews

Review title Authors Last assessed as up-to-date	Number of studies Sample size (range)	Population	Definition of disorder	Intervention	Comparisons	Outcomes for which data are reported
Family therapy for attention-deficit disorder or attention-deficit/hyperactivity disorder in children and adolescents Bjornstad GJ, Montgomery P April 2004	2 322 (32–290)	Children aged 7–10 years old.	ADHD or ADD (using DSM-III or DSV-IV criteria), or HKD (using ICD-9 or ICD-10 criteria). Diagnoses could also be made using other validated instruments. Co-morbid diagnoses were included.	Family therapy including at least one parent and the child.	Medication placebo or standard treatment with or without drugs.	Parent and/or teacher ratings of inattention, hyperactivity/impulsivity and overall symptoms, as well as blinded classroom observations of overall symptoms.
Homeopathy for attention deficit/hyperactivity disorder or hyperkinetic disorder Heirs M, Dean ME February 2006	4 189 (20–83)	Children aged 7–15 years old.	ADHD (using DSM-IV criteria) or HKD (using ICD-10 criteria). Co-morbid diagnoses were included.	Homeopathic medicine.	Homeopathy placebo.	Parent ratings, teacher ratings and/or child test scores of hyperactivity, inattention, impulsivity, conduct problems, emotional liability, anxiety, overall symptoms and adverse effects.
Meditation therapies for attention-deficit/hyperactivity disorder (ADHD) Krisanaprakornkit T, Ngamjarus C, Witoonchart C, Piyavhatkul N April 2010	4 83 (16–24)	Children aged 6–13 years old.	ADHD or HKD (diagnosed using 'established criteria' such as the DSM-III, DSM-IV or ICD-10).	Meditation therapy either on its own or as the main intervention in a multi-component therapy (i.e. Hatha yoga).	Drug therapy, standard treatment without drugs or control conditions.	Parent ratings, teacher ratings and/or child test scores of inattention, hyperactivity, impulsivity, distractibility, locus of control and overall symptoms.

ADD: attention deficit disorder; ADHD: attention deficit hyperactivity disorder; DSM-III: Diagnostic and Statistical Manual of Mental Disorders, Third Edition; DSM-IV: Diagnostic and Statistical Manual of Mental of Mental Disorders, Fourth Edition; HKD: hyperkinetic disorder; ICD-9: International Statistical Classification of Diseases and Related Health Problems, Ninth Edition; ICD-10: International Statistical Classification of Diseases and Related Health Problems, Tenth Edition.

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Participants

The children and adolescents included in all reviews had fairly similar ages and diagnoses. All participants ranged from 6–15 years and were diagnosed with attention deficit hyperactivity disorder or hyperkinetic disorder. Nine trials diagnosed the disorders using the DSM-III, DSM-IV or ICD-10, and one trial (81) recruited children with "previously diagnosed ADHD" but did not confirm the diagnosis prior to entry. Three of the ten trials included in this overview were restricted to boys only (79;82;83), and the other seven trials included boys and girls. Two reviews (FT, Hom) included children with co-morbid diagnoses (i.e. conduct disorder, oppositional defiant disorder).

Interventions

The included reviews examined a total of six interventions. All three reviews compared an active treatment to a control condition (either placebo or exercise control), and two of the reviews (FT, MT) also compared an active treatment to another active treatment. Specifically, the reviews examined the following six interventions, with one of the meditation trials (83) contributing to two comparisons:

- Homeopathy versus homeopathy placebo (4 trials)
- Family therapy versus medication placebo (participants in the 'medication placebo' group received a placebo instead of a stimulant medication) (1 trial)
- Family therapy versus standard therapy with or without drugs ('standard therapy' was defined as access to any drug or non-drug treatment offered through community mental health resources such as the primary clinician) (1 trial)
- Meditation therapy versus drug therapy (2 trials)
- Meditation therapy versus standard therapy without drugs ('standard therapy without drugs' consisted of milieu, individual, group and/or family therapy) (1 trial)
- Hatha yoga versus non-specific physical activity ('non-specific physical activity' was a control condition consisting of various running, agility, concentration and ball games) (2 trials).

The intervention periods for nine of the trials lasted between one and five months, with one trial on family therapy (84) lasting longer (fourteen months). Three homeopathy trials (85–87) had follow-up periods ranging from 2–4.5 months, one trial on family therapy (88) had a follow-up period of nine months, and the last six trials did not follow up with children after the cessation of treatment.

Outcome measures

The three included reviews reported outcome data for ten symptoms of ADHD: inattention, hyperactivity, impulsivity, hyperactivity/impulsivity, conduct issues, emotional liability, anxiety, distractibility, locus of control and overall symptoms. Data was collected using a total of twenty different parent questionnaires, teacher questionnaires and child-completed psychometric tests. Table 2 presents a summary of the outcome data collected by each trial, as well as the tools used within each trial to collect the data.

Methodological quality of included reviews

The instruments used to evaluate the methodological quality of trials included in each review were fairly homogenous. Two reviews (FT, Hom) presented information on sequence generation, allocation concealment, blinding and incomplete outcome data (89). Blinding was judged as adequate in 4/6 trials, sequence generation and allocation concealment were each judged as adequate in 3/6 trials and incomplete outcome data was judged as adequate in only 1/6 trials[3]. The third review (MT) used the Cochrane Risk of Bias tool to assess trial quality based on sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting and other sources of bias (i.e. study design or stopping early) (66). Based on these Risk of Bias criteria, all four trials in the review were judged to have a high risk of bias.

Effect of interventions

Parent ratings of ADHD symptoms

Table 3 presents data for parent ratings for eight symptoms of ADHD. Compared to a non-specific physical activity control condition, Hatha yoga was found to significantly decrease symptoms of inattention (MD: −0.73; 95% CI: −1.25, −0.21), but not hyperactivity, impulsivity or overall symptoms. Meditation therapy compared to drug therapy and standard treatment without drugs did not significantly decrease hyperactivity and overall symptoms, and family therapy compared to standard treatment with or without drugs did not affect symptoms of inattention and hyperactivity/impulsivity. Compared to homeopathy placebo, homeopathy did not significantly decrease inattention, hyperactivity, impulsivity, conduct problems, emotional liability, anxiety or overall symptoms.

One trial comparing meditation therapy (mantra meditation), relaxation training (progressive muscle relaxation), and drug therapy (82) did not contribute numeric data to this overview because the trial did not present the number of participants in each group. However, compared to drug therapy, it was reported that both meditation therapy and relaxation training significantly decreased parent reports of impulsivity and overall symptoms.

[3] The family therapy review only provided written descriptions of sequence generation, blinding and incomplete outcome data, so one reviewer (MF) and a research assistant independently scored these dimensions based on the written descriptions in the review, and resolved any disagreements through discussion.

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Table II. Tools used to collect outcome data for all included trials

			Outcomes						
Review	**Trial**	**Type of data**	**Inattention**	**Hyperactivity**	**Impulsivity**	**Conduct issues**	**Emotional liability**	**Overall symptoms**	**Other outcomes**
Family therapy (Bjornstad 2010)	Horn 1991 (88)	Parent rating							
		Teacher rating						CRS	
		Child test							
	Jensen 1999* (84)	Parent rating	SNAP						Hyperactivity/impulsivity: SNAP
		Teacher rating	SNAP						Hyperactivity/impulsivity: SNAP
		Child test							
Homeopathy (Heirs 2009)	Frei 2005 (87)	Parent rating						CGI-P	
		Teacher rating							
		Child test							
	Jacobs 2005 (86)	Parent rating	CPRS-R:S	CPRS-R:S	CPRS-R:S	CPRS-R:S	CPRS-R:S	CGI-P, CPRS-R:S	Adverse effects: SSEC
		Teacher rating			CGI-T		CGI-T	CGI-T	
		Child test	CCPT		CCPT				
	Lamont 1997 (85)	Parent rating		Unpublished 5pt scale					
		Teacher rating							
		Child test							
	Strauss 2000 (81)	Parent rating			CRS	CRS		CRS	Anxiety: CRS
		Teacher rating							
		Child test	CCT						
Meditation therapy (Krisanaprakomkit 2010)	Haffner 2006 (80)	Parent rating	FBB-HKS	FBB-HKS	FBB-HKS			FBB-HKS	
		Teacher rating							
		Child test	DAT						
	Jensen 2004 (79)	Parent rating			CPRS-R:L				
		Teacher rating						CTRS-R:L	
		Child test	TOV						
	Kratter 1983 (82)	Parent rating						PTQ, WWPAS	
		Teacher rating						PTQ, WWPAS	
		Child test	FDT		MFFT				Locus of control: LCS

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Table II. (*Continued*)

Review	Trial	Type of data	Outcomes						
			Inattention	Hyperactivity	Impulsivity	Conduct issues	Emotional liability	Overall symptoms	Other outcomes
	Moretti-Altuna 1987 (83)	Parent rating		WWPAS				PTQ	
		Teacher rating						PTQ	
		Child test	FDT		MFFT				Distractibility: CEFT

CCPT: Conners' Continuous Performance Test (101); CCT: Childrens Checking Task (102); CEFT: Children's Embedded Figures Test (103); CGI-P: Conners' Global Index – Parent scale (104); CGI-T: Conners' Global Index – Teacher scale (104); CPRS-R:L: Conners' Parents Rating Scales – Revised: Long (105;106); CPRS-R:S: Conners' Parents Rating Scales – Revised: Short (105;106); CRS: Conners' Rating Scales (107); CTRS-R:L: Conners' Teachers Rating Scales – Revised: Long (108); DAT: Dortmund Attention Test (109); FBB-HKS: Fremdbeurteilungsbogen fur hyperkinetische Storungen (110;111); FDT: Fruit Distraction Test (112); LCS: Nowicki-Strickland Locus of Control scale (113); MFFT: Matching Familiar Figure Test (114); PTQ: Parent-Teacher Questionnaire (107); SNAP: Swanson, Nolan and Pelham scale (115); SSEC: Stimulant Side Effects Checklist (116); TOV: Test of Variables of Attention (117); WWPAS: Werry-Weiss-Peters Activity Scale (118).

* This trial also used blinded third party observers to collect outcome data on overall symptoms in the classroom setting.

Teacher ratings of ADHD symptoms

Table 4 presents teacher ratings for five symptoms of ADHD. Meditation therapy compared to drug therapy and standard treatment without drugs did not significantly decrease overall symptoms, and one trial comparing meditation therapy, relaxation training and drug therapy (82) showed no significant improvement in overall symptoms (numeric data not available). There was no benefit of homeopathy over homeopathy placebo for symptoms of impulsivity, emotional liability or overall symptoms.

Family therapy compared to medication placebo showed no significant decrease in overall symptoms, and family therapy compared to standard treatment with or without drugs did not significantly decrease symptoms of inattention and hyperactivity/impulsivity. However, when overall symptoms were judged by a blinded third-party observer in the classroom setting, children receiving standard treatment with or without drugs scored significantly better than those receiving family therapy (MD: 0.11; 95% CI: 0.05, 0.17).

Child test results measuring ADHD symptoms

Table 5 presents the results of child-completed tests measuring three symptoms of ADHD. Children receiving Hatha yoga scored significantly better on a test of inattention than non-specific physical activity controls (MD: −4.01; 95% CI: −6.23, −1.79). Meditation therapy compared to drug therapy and standard treatment without drugs did not significantly decrease symptoms of inattention, impulsivity or distractibility, and a separate trial on meditation (82) found that children receiving meditation versus drug therapy scored significantly better on a test of inattention but scored no different on a test of internal locus of control (numeric data not provided). Lastly, homeopathy versus homeopathy placebo did not significantly reduce symptoms of inattention or impulsivity.

Adverse events

No trials in the family therapy or meditation therapy reviews measured adverse events, and only one trial (86) in the homeopathy review measured adverse events. This trial found no significant difference in adverse events between the homeopathy and homeopathy placebo groups, with no adverse events reported in either group.

Discussion

Summary of main results

This overview of reviews synthesizes the evidence currently in the *Cochrane Database of Systematic Reviews* regarding the efficacy and safety of family therapy, meditation therapy, homeopathy, and Hatha yoga, compared to both active therapies and control conditions, to treat children and adolescents with

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Table III. Parent ratings of ADHD symptoms

Symptom	Comparison	Number of subjects (studies)	Measure of effect (95% CI)
Inattention	Family therapy vs. standard treatment with or without drugs	259 (1)	MD: −0.09 (−0.25, 0.07)
	Homeopathy vs. placebo	43 (1)	MD: 5.08 (−2.45, 12.61)
	Hatha yoga vs. non-specific physical activity‡	**19 (1)**	**MD: −0.73 (−1.25, −0.21)** [a]
Hyperactivity	Homeopathy vs. placebo	86 (2)	SMD: −0.21 (−0.64, 0.22) *
	Hatha yoga vs. non-specific physical activity‡	19 (1)	MD: −0.54 (−1.17, 0.09)
	Meditation therapy vs. standard treatment without drugs‡	17 (1)	MD: −2.75 (−17.55, 12.05)
	Meditation therapy vs. drug therapy‡	15 (1)	MD: −2.83 (−23.81, 18.15)
Impulsivity	Homeopathy vs. placebo	63 (2)	SMD: −0.03 (−0.52, 0.46)†
	Hatha yoga vs. non-specific physical activity‡	19 (1)	MD: −0.13 (−0.83, 0.57)
Hyperactivity/impulsivity	Family therapy vs. standard treatment with or without drugs	259 (1)	MD: −0.11 (−0.29, 0.07)
Conduct issues	Homeopathy vs. placebo	63 (2)	SMD: −0.01 (−0.51, 0.48)†
Emotional liability	Homeopathy vs. placebo	43 (1)	MD: 2.99 (−5.39, 11.37)
Anxiety	Homeopathy vs. placebo	20 (1)	MD: −1.55 (−3.90, 0.80)
Overall symptoms	Homeopathy vs. placebo§	43 (1)	MD: 1.77 (−6.34, 9.88)†
	Hatha yoga vs. non-specific physical activity‡	19 (1)	MD: −0.54 (−1.09, 0.01)
	Meditation therapy vs. standard treatment without drugs‡	17 (1)	MD: −3.22 (−10.84, 4.40)
	Meditation therapy vs. drug therapy‡	15 (1)	MD: −2.39 (−10.61, 5.83)

ADHD: attention deficit hyperactivity disorder; CI: confidence interval; MD: mean difference; SMD: standardized mean difference.

[a] Significantly favours Hatha yoga.

* I^2: 74%;

† I^2: 0%;

‡ The review authors did not calculate effect sizes for these outcomes because they stated that the means were smaller than twice the standard deviations and the data were probably skewed. The overview authors calculated effect sizes based on information presented in the review;

§ One trial used two different tests ("Conners' Global Index – Parent" and "Conners' Parent Rating Scale, Revised, ADHD Index subscale") to calculate this outcome; only the score from the first test was included in this comparison in order to avoid giving extra weight to the trial. Also, a third trial reported an effect size for this outcome but did not provide means, standard deviations or sample sizes, therefore the effect size could not be combined with the rest of the data and is not included in measure of effect.

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Table IV. Teacher ratings of ADHD symptoms

Symptom	Comparison	Number of subjects (studies)	Measure of effect (95% CI)
Inattention	Family therapy vs. standard treatment with or without drugs	247 (1)	MD: −0.01 (−0.21, 0.19)
Impulsivity	Homeopathy vs. placebo	43 (1)	MD: 5.01 (−2.53, 12.55)
Hyperactivity/impulsivity	Family therapy vs. standard treatment with or without drugs	247 (1)	MD: −0.15 (−0.35, 0.05)
Emotional liability	Homeopathy vs. placebo	43 (1)	MD: 3.85 (−1.62, 9.32)
Overall symptoms	**Family therapy vs. standard treatment with or without drugs** *	**216 (1)**	**MD: 0.11 (0.05, 0.17)** [a]
	Homeopathy vs. placebo	43 (1)	MD: 4.72 (−2.11, 11.55)
	Family therapy vs. medication placebo	25 (1)	MD: −1.98 (−6.01, 2.05)
	Meditation therapy vs. standard treatment without drugs	17 (1)	MD: −0.52 (−5.88, 4.84)
	Meditation therapy vs. drug therapy	15 (1)	MD: −2.72 (−8.49, 3.05)

ADHD: attention deficit hyperactivity disorder; CI: confidence interval; MD: mean difference.
[a] Significantly favours standard treatment with or without drugs.
* This was not a teacher rating but instead a blinded classroom observation by someone other than the teacher.

Table V. Child test results measuring ADHD symptoms

Symptom	Comparison	Number of subjects (studies)	Measure of effect (95% CI)
Inattention	Homeopathy vs. placebo	63 (2)	SMD: −0.25 (−0.74, 0.25) *
	Hatha yoga vs. non-specific physical activity†‡	**19 (1)**	**MD: −4.01 (−6.23, −1.79)** [a]
	Meditation therapy vs. standard treatment without drugs†‡	17 (1)	MD: −1.98 (−8.45, 4.49)
	Meditation therapy vs. drug therapy†‡	15 (1)	MD: −3.11 (−9.20, 2.98)
Impulsivity	Homeopathy vs. placebo	43 (1)	MD: −1.04 (−9.47, 7.39)
	Meditation therapy vs. standard treatment without drugs‡	17 (1)	MD: −5.28 (−13.85, 3.29)
	Meditation therapy vs. drug therapy‡	15 (1)	MD: −4.78 (−11.37, 1.81)
Distractibility	Meditation therapy vs. standard treatment without drugs ‡	17 (1)	MD: −8.34 (−107.05, 90.37)
	Meditation therapy vs. drug therapy‡	15 (1)	MD: 9.47 (−115.50, 134.44)

ADHD: attention deficit hyperactivity disorder; CI: confidence interval; MD: mean difference; SMD: standardized mean difference.
[a] Significantly favours Hatha yoga.
* I^2: 0%;
† The outcome of "inattention" was computed from the original outcome of "attention";
‡ The review authors did not calculate effect sizes for these outcomes because they stated that the means were smaller than twice the standard deviations and the data were probably skewed. The overview authors calculated effect sizes based on information presented in the review.

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ADHD. There are currently four additional non-pharmacological protocols in the CDSR that assess acupuncture, parent training interventions, polyunsaturated fatty acids and social skills training (75–78); however, data from these reviews are not yet available.

Currently, data were available for one trial comparing family therapy to standard treatment. Only one outcome, a blinded third party assessment of overall symptoms in the classroom setting which favoured standard treatment, was significant. One trial each compared meditation therapy to drug therapy and standard treatment without drugs and reported no significant differences for any outcomes. None of these three trials were adequately powered to assess equivalence of therapies.

One trial compared family therapy to a medication placebo and the one reported outcome showed no significant difference between interventions. Four trials comparing four different types of homeopathy versus homeopathy placebos found no significant effect of homeopathy. Lastly, one trial which compared Hatha yoga to a non-specific physical activity control condition found that Hatha yoga led to statistically significant decreases in both parent ratings and child test scores of inattention, but no other outcomes were significant. However, this trial was not blinded, had a small sample size, and contained data that was reported as being skewed (i.e. the means were smaller than twice the standard deviations) (90), so replication of results is necessary before the efficacy of Hatha yoga can be established.

Overall, there was a lack of statistically significant differences between comparison interventions, and when data on similar outcomes was obtained from different informants (i.e. parents, teachers and children) there was also inconsistency in the direction of effect. For all interventions assessed in this overview, there was a lack of high-quality, adequately powered randomized controlled trials using standardized tools to measure clinically important outcomes over adequate periods of time. Therefore, there is currently not enough evidence to support the use of family therapy, meditation therapy, homeopathy or Hatha yoga for children with ADHD.

Limitations

The limited findings of this overview are due to a paucity of trials as well as the poor methodological quality of the trials that have been done. Sequence generation, allocation concealment, blinding and incomplete outcome data were each judged as adequate in less than 50% of trials. Sample sizes were also very small, which increases the likelihood of not finding significant results when they do exist and also means that studies were underpowered to assess equivalence with existing evidence-based therapies. Furthermore, most trials did not assess long-term outcomes, and in some cases, trials did not take into account previous evidence about the time to effect of the treatment being examined. For example, previous observational research has reported that it takes six months before noticing the treatment effects of homeopathy in children with ADHD (91), but the longest homeopathy trial was 4.5 months. For all of the interventions included in this overview, more trials of higher quality are required.

There were a number of additional non-pharmacological interventions that were not included in this overview because there was no relevant Cochrane review. Therefore, we were unable to assess the efficacy of non-pharmacological interventions such as acupuncture, behaviour therapy, biofeedback, cognitive-behavioural therapy, dietary interventions (i.e. elimination and supplementation diets), environmental manipulation, parent and teacher training interventions, psychoeducation and social skills training.

Another limitation of this overview was the variability in primary outcomes used in trials, as well as the tools used to measure these outcomes (see Table 2). Across reviews and trials there was an absence of standardized, patient-important outcomes measuring changes in ADHD symptoms. Inconsistency of outcomes meant that data from trials often could not be meta-analyzed; therefore, the authors of the systematic reviews were not able to overcome the small sample sizes and low power of individual trials to determine if true differences existed between comparisons. When meta-analysis was possible, the absence of consistent measurement tools (19 different tools were used) limited the clinical applicability of the findings; this is because standardized mean differences needed to be used, which remove the unit of measurement and do not allow clinicians to easily see the expected clinical benefit of the treatment (i.e. the expected change in number of points on test scores). Therefore, in the individual reviews and in this overview, there are few meaningful comparisons and it is difficult to draw conclusions about the effects of treatment that have immediate clinical relevance. In addition, the clinical outcomes used often required reports from parents and teachers who, given the nature of the interventions, may not have been blinded to treatment allocation. Future ADHD trials should use consistent and clinically relevant primary outcomes that can be assessed by blinded observers and are sensitive to changes over time.

The trials in this overview did not take into account the possibility that children with different subtypes of ADHD might respond differently to treatments, or that treatment effectiveness could vary depending on the presence or absence of common co-morbidities such as conduct disorder. For example, it is currently not known whether children diagnosed with inattentive subtype ADHD respond to the same treatments as those diagnosed with hyperactive/impulsive subtype, although it seems likely that children with inattentive subtype may find meditation more difficult and therefore be less responsive to this form of therapy. Since ADHD is a heterogeneous disorder and children

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with co-morbid conditions likely respond to different therapies, future trials should present subgroup analyses of clinically meaningful subtypes to help clinicians and parents make important treatment decisions.

Few trials included in this overview adequately measured adverse effects. This is worrisome because a lack of data does not necessarily mean that the interventions are safe (66). For example, case reports on the treatment of schizophrenia have documented adverse effects of family therapy (92), and a systematic review on homeopathy reported more minor adverse events in patients receiving homeopathy compared to placebo (93). Research has found that adults with pre-existing psychological disorders may experience adverse effects of meditation such as temporary derealisation, depersonalization or onset of psychosis (94–98), and while research has not yet examined the potential adverse effects of meditation in children, it is likely inadvisable for children to sit still for prolonged periods of time with their eyes closed (57). Potential adverse effects of yoga include physical injuries such as back, neck and shoulder injuries (99). The poor measurement and reporting of adverse events in all included trials means that the safety of non-pharmacological treatments for children with ADHD is currently unknown.

A 2008 guideline on the treatment of ADHD conducted rigorous searches for both pharmacological and non-pharmacological interventions and found 49 drug trials containing 7500 participants but only 16 non-drug trials containing 1200 participants (6). The relative lack of rigorous non-pharmacological trials can be partially explained because compared to drug trials, non-pharmacological trials typically receive less funding and are resource-intensive, hard to blind and have difficulty recruiting participants (100). However, non-pharmacological interventions are becoming increasingly popular as communities become more aware of the short and long-term adverse effects of stimulant therapy (51). This increased demand for non-pharmacological therapies must be accompanied by rigorous scientific research assessing their efficacy and safety as superior or equivalent to other proven effective treatments.

Authors' Conclusions

Implications for practice

There is no clear evidence of benefit following the non-pharmacological treatment of ADHD reported in any of the three included Cochrane reviews. When family therapy and meditation therapy were compared to standard treatment, results were inconsistent and the trials were underpowered to assess equivalence with current accepted therapies. When family therapy, homeopathy, and Hatha yoga were compared to placebo or control conditions, results showed no consistent benefit of therapy. Due to important design flaws, no trials included in this overview are sufficient to provide evidence of no positive benefit of treatment; however, there is currently not enough evidence to recommend the use of any of these therapies for the treatment of ADHD in children and adolescents.

Implications for research

Outcomes of systematic reviews assessing the efficacy and safety of other non-pharmacological interventions are eagerly awaited, but these reviews will require sufficient high-quality trials to inform decision-making. Future trials must be of high methodological quality, and the length of treatment and follow-up must be appropriate to the nature of the intervention, its time to effect and its mechanism of action. Discussion and consensus within the ADHD community is needed in order to determine which tools should be used to provide reliable, blinded and valid measurements of clinically useful symptoms that are important to individuals and their families. Also, outcome measures should be used consistently across trials. If this occurs it will allow data synthesis within systematic reviews, which will improve sample size and power for future systematic reviews even if large sample sizes are not achieved for individual trials.

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Contributions of Authors

Both authors contributed to this overview. MF extracted all data and wrote the Background, Methods and Results sections. MF and KW wrote the Discussion section, and KW wrote the Authors' Conclusions section. MF is the primary author of this report. Both authors contributed to editing all sections of the overview and take responsibility for the manuscript.

Declarations of Interest

No declarations of interest are noted.

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