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Retraction

Retracted: Comparative Efficacy and Acceptability of Nonpharmacotherapy in the Treatment of Inattention for ADHD: A Network Meta-Analysis

Complexity

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

In addition, our investigation has also shown that one or more of the following human-subject reporting requirements has not been met in this article: ethical approval by an Institutional Review Board (IRB) committee or equivalent, patient/participant consent to participate, and/or agreement to publish patient/participant details (where relevant).

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] X. Che, C. Jong-Hwan, and X. Shang, "Comparative Efficacy and Acceptability of Nonpharmacotherapy in the Treatment of Inattention for ADHD: A Network Meta-Analysis," *Complexity*, vol. 2021, Article ID 9435262, 14 pages, 2021.

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Review Article

Comparative Efficacy and Acceptability of Nonpharmacotherapy in the Treatment of Inattention for ADHD: A Network Meta-Analysis

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This article is aimed to compare the efficacy and acceptability of exercise intervention with other nonpharmacological therapies in improving attention in ADHD patients and then rank those therapies. *Methods.* Relevant RCT studies from the Cochrane Library, Web of Science, Psycinfo, and PubMed were systematically searched from January 2011 to January 2020. The literature was screened, and the researchers extracted and used Stata16 and WinBugs1.4 independently to analyze the data. *Results.* The improvement of "attention deficit" in ADHD patients was measured in 83 independent studies with 4,998 participants and 14 nonpharmacological therapies. Therapies were ranked as follows, according to the efficacy and acceptability of the cumulative probability area under the curve (SUCRA): (1) meditation and cognitive; (2) sport intervention therapy; (3) vitamin and mineral; (4) cognitive behavioral therapy; (5) computer training; (6) psychological education; (7) working memory training; (8) neurofeedback therapy; (9) polyunsaturated fatty acids; (10) mineral supplements; (11) meditation; (12) vitamin; (13) biofeedback therapy; and (14) school-based training. However, because the effect size of meditation and cognitive therapy was at a marginally significant level (SMD = −1.07, (−2.15, 0.00)), the robustness of the results was far lower than that of sport intervention therapy. Therefore, careful interpretation is needed in practice. *Conclusion.* Considering the efficacy and acceptability of various nonpharmacological therapies, sport intervention has a more stable effect on the improvement of attention deficit. Secondly, meditation and cognitive therapy, cognitive behavioral therapy, and computer training can also be effective complementary tools.

1. Introduction

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder commonly seen in the early childhood, with a global incidence rate of about 1.4–3.0% among children, and most of them are males. Its main symptoms include attention deficit, hyperactivity, impulsivity, and a mixture of the three disorders [1]. Globally, it is estimated that 8–10% [2] of children and 5-6% [3] of adults are affected to varying degrees. Affected by genetic inheritance and prenatal environmental factors, inattention in patients is difficult to be effectively alleviated because the onset period spans from the early childhood to late adolescence (4–17 years old) and continues until adulthood [4].

Therefore, it has a serious negative impact on the early academic development of patients and the socialization process such as work and life in adulthood [5].

The traditional treatment of ADHD mostly uses pharmacological intervention to improve attention and alleviate hyperactive impulse and other explicit behavior by regulating the transmission of signal factors between synapses [6]. For example, central stimulants such as methylphenidate and amphetamine, one of the most commonly used dopamine and norepinephrine reuptake inhibitors, enhance the effects of monoamines and increase arousal levels in the brain's limbic nervous system by gradually increasing the concentration of these two neurotransmitters in the synaptic cleft. In this way, the attention level and inhibition control

ability of patients can be improved [7]. Noncentral stimulant drugs, such as atomoxetine, selectively inhibit the reuptake of noradrenaline, 5-HTR2A, and dopamine by NETS, increase the concentration of noradrenaline in the prefrontal cortex (PFC), and thus, improve the hyperactivity symptoms [8, 9]. Although pharmacological therapy has the advantages of short duration and quick effect, it has been criticized for the rapid rebound of symptoms after drug withdrawal, accompanied by adverse short-term negative effects such as nausea, drowsiness, insomnia, and low emotional tolerance [10], as well as the obstruction of its life-long growth and development process [11], leading to a high withdrawal rate [12, 13]. On the other hand, although psychobehavioral intervention therapy has no obvious physiological negative effects, it is difficult to be adopted by most patients because of the complicated treatment process and long cycle with slow effect [14]. In addition, hyperactivity symptoms usually recur with the end of the medication or psychobehavioral therapy cycle [15]. Therefore, there is an urgent need for a highly effective, cheap, and operable nonpharmacological therapy.

Based on the characteristics of hyperactive impulsion of patients, modern scholars have integrated sport intervention therapy into traditional treatment methods and achieved the expected effect. Studies demonstrate that [16], in addition to the general health benefits, exercise can also increase the level of blood flow and neurotransporter in the brain, thus improving neuroplasticity, so as to better concentrate and process information. A recent meta-analysis also showed that [17], under the intervention of multiple combinations of moderate-intensity aerobic exercise, ADHD patients' attention deficit can not only be alleviated in the short term but also obtain long-term enhancement effect. However, compared with sport intervention, other non-pharmacological therapies have different mechanisms of action, but their efficacy in practice is also worthy of affirming [18–23]. For a long time, there are still differences in the ranking of the advantages and disadvantages of various nonpharmacological therapies in improving ADHD symptoms [24–27]. In view of the fact that the traditional meta-analysis only compares the efficacy differences of pharmacotherapy such as stimulant (amphetamine and methylphenidate) and nonstimulant therapy (tomoxetine, clonidine sustained release, and guanfacine sustained release), so far, few studies have compared the effects of various nonpharmacotherapies in practice, and there is no study to directly compare the efficacy of exercise intervention with other nonpharmacotherapies. Therefore, it is not possible to confirm the overranking of sport interventions in terms of specific efficacy and acceptability compared with other nonpharmacological therapies. Consequently, this study intends to explore the ranking of sport intervention therapy in nonpharmacological therapy for ADHD through network meta-analysis on the basis of comprehensive comparison of efficacy and acceptability.

2. Materials and Methods

2.1. Retrieval Strategy and Selection Criteria. The published and unpublished randomized controlled trials (RCTs) from PubMed, Cochrane Library, Psycinfo, and Web of Science were systematically searched. The searching items included "Attention Deficit Hyperactivity Disorder," "Non-Pharmacotherapy," "Cognitive Behavior Therapy," "Physical Activity," "Cognitive Training," and "Mindfulness," Working Memory Training," "Neurofeedback," "Biofeedback," "Psychoeducation," "School-based Treatment," "Dietary," "Multivitamin," "Mineral," and "Polyunsaturated Fatty Acid." The searching content was limited to English literature, and the searching time span was from January 2011 to January 2021. For articles that are registered but not yet published, or where the relevant data is not fully presented in the results, the researchers contacted the author by e-mail or searched the journal's website for unpublished data to supplement the incomplete report in the original paper or to provide data for unpublished research.

Non-RCT studies, systematic reviews, animal studies, and studies with a sample size of less than 10 people were excluded. Eventually, 14 kinds of nonpharmacological therapy were included: cognitive behavioral therapy (CBT), working memory training (WMT), computer training (CT), meditation (MAP), meditation and cognitive training (MC), vitamin and mineral (VM) supplements, vitamin (VI), mineral (MI), polyunsaturated fatty acids (PUFAs), neural feedback training (NF), school-based training (SB), biofeedback training (BF), psychological education (PE), and sport intervention (SPT).

2.2. Data Extraction and Quality Assessment. Four researchers (WLY, XSY, WC, and CJH) independently screened the qualified literature and collected the main outcomes and supplementary materials which support the original reports and could be used for this analysis, and four researchers (CZY, SJ, YD, and XHS) extracted relevant information using predetermined data extraction tables and assessed the risk of bias. Any differences shall be resolved by consensus and arbitration by the corresponding author (XSC).

2.3. Extraction of Results. In this study, the score changes of inattention of the subjects before and after the experiment were extracted as the efficacy evaluation index. The scores were derived from results measured by a variety of standardized psychological scales, such as The Barkley ADHD Current Symptoms Scale, ADHD Rating Scale, "Conners Adult ADHD Rating Scale Self-Report," and "Swanson, Nolan, and Pelham (SNAP-IV) DSM-IV ADHD Rating Scale." For the results of different surveyors in the same scale, priority is given to the results reported by observers, followed by those reported by teachers and finally by parents

[28]. The study also assessed the acceptability of each treatment or withdrawal from the course of treatment due to certain reasons.

2.4. Data Analysis. Under the random-effects model, a series of paired meta-analyses were performed for all directly compared studies, with relative risk (RR) used for dicaromatic outcomes and normalized mean difference (SMD) used for continuous outcomes, with a 95% confidence interval. I^2 and τ^2 were used to assess homogeneity between studies [29].

$$RR = \frac{a/(a+b)}{c/(c+d)}, \tag{1}$$

where a is the number of people who quit the experimental group; $a + b$ is the total number of people in the experimental group; c is the number of dropouts in the control group; and $c + d$ is the total number in the control group.

$$SMD = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\left((n_1 - 1)s_1^2 + (n_2 - 1)s_2^2\right)/\left((n_1 - 1) + (n_2 - 1)\right)}}, \tag{2}$$

where $\overline{X}_1$ is the mean of group 1, n_1 is the sample size of group 1, s_1^2 is the standard deviation of group 1, $\overline{X}_2$ is the mean of group 2, n_2 is the sample size of group 2, and s_2^2 is the standard deviation of group 2.

Homogeneity test:

$$Q = \sum_{i=1}^{m} wMH_1 \left(Ln(OR_i) - Ln(OR_{MH})\right)^2,$$

$$OR_{MH} = \frac{\sum_{i=1}^{m} wMH_1^{OR_i}}{\sum_{i=1}^{m} W},$$

$$W_{MH_i} = \frac{1}{Variance_i}, \tag{3}$$

$$Variance_i = \left(\frac{Ln(OR_i) - Ln(OR_{iL})}{1.96}\right)^2,$$

$$I^2 = \frac{Q - (K-1)}{Q} * 100\%,$$

where Q is standardized sum of squares of effect size, w is the weight of the Nth study in all the included studies, K is the number of studies included in meta-analysis, OR is the odds ratio, MH: Mantel–Haenszel method, and m is the number of target events in the experimental group.

First, Stata16 was used to map the network evidence for each therapy and to test for homogeneity. Secondly, based on the Bayesian framework, WinBugs1.4.3 was used for network analysis, and all relative treatment effects were compared and evaluated by combining direct and indirect comparative evidence. The average effect estimate (SMD or RR) and its 95% confidence interval (CI) for each comparison were calculated using the Markov chain Monte Carlo (MCMC) method, with both Markov chains running simultaneously [30]. Under the assumption that the convergence degree of the MCMC model is stable (the value of R approaches 1, indicating that MCMC simulation has good convergence and is relatively stable), the posterior probability is inferred according to the prior probability.

$$R = \sqrt{\frac{(m - 1/m)W + (1/m)B}{W}}, \tag{4}$$

where B is the interchain variance, W is the mean of the inchain variances, and m is the total amount of Markov chains.

Because fixed-effect models are based on the assumption that all studies come from the same population, they deviate from reality. In order to better fit the model, the random-effects model was used for analysis in this study. The model is iterated 100,000 times, and the first 5000 times are used for annealing to eliminate the influence of the initial value. The degree of convergence is judged according to the model iteration diagram. The iterative steps of the algorithm are as follows:

$P(X)$: random sample; f_{mn}: sample mean of the function

m: number of convergent steps; n: number of iteration steps

(1) A candidate state $X\prime$ is randomly selected according to the suggested distribution $q(X, X\prime)$.

(2) The acceptance probability is calculated.

(3) A number u is randomly selected from the interval $(0, 1)$ according to uniform distribution. If $u \leq$ accept probability $a(X, X\prime)$, then $x_i = x'$; otherwise, $x_i = x$.

(4) The three steps mentioned above are repeated n times; then, the posterior sample set $X^1, X^2, \ldots, X^n$ can be obtained.

(5) Each moment of the posterior distribution is calculated according to the posterior samples, and the corresponding statistical inference is made.

$$a(X, X') = \min\left\{\frac{P(X')q(X, X')}{P(X)q(X, X')}\right\},$$

$$f_{mn} = \frac{1}{n-m} \sum_{i=m+1}^{n} f(x_i). \tag{5}$$

After dividing the evidence of a specific comparison into direct evidence and indirect evidence by the node-splitting method, the inconsistency of the model was calculated [31], and local and global inconsistency tests were used to check the consistency of the network. The local inconsistency test is used to evaluate the inconsistency of any closed loop in the network evidence graph. The overall inconsistency test is to test the goodness of fit of the model through the interaction design of each therapy [32]. If any relevant sources of deviation are

found, sensitivity analysis or metaregression analysis will be performed [31, 33, 34]. By drawing a cumulative probability chart of the efficacy and acceptability of each nonpharmacological therapy, the area under the cumulative probability curve (SUCRA) was used to rank the efficacy and acceptability of each therapy [32, 35, 36]. If more than 10 studies were included, publication bias and small-sample study effect were verified by Egger [37]. The Modified JADAD scale was used to evaluate the risk of bias. Additionally, we assessed the certainty of evidence contributing to this network analysis of the main outcomes with the Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework.

3. The Results

3.1. Literature Retrieval Results. A total of 2952 studies were retrieved, including 2118 from the Cochrane Library, 465 from Web of Science, 174 from Psycinfo, and 195 from PubMed. 2,715 either repeated studies or inconsistent research topics were excluded from systematic reviews. After reading the full text, 153 studies with inconsistent outcome indicators and nonrandomized controlled trials were excluded, and 86 studies were included, six of which were CBT vs. NF; one study was CBT vs. PE; seven studies were CBT vs. control; nine studies were WMT vs. control; one study was CT vs. NF; six studies were CT vs. control; eight studies were MAP vs. control; two studies were MAP vs. control; two studies were MC vs. control; three studies were VM vs. control; five studies were MI vs. control; nine studies were PUFA vs. control; three studies were NF vs. BF; two studies were NF vs. SPT; eleven studies were NF vs. control; two studies were SB vs. control; four studies were PE vs. control; and two studies were SPT vs. control. See Figure 1 for the literature screening process.

General characteristics of the literature: 86 RCTS were included, involving 14 kinds of nonpharmacological treatments, and they are cognitive behavioral therapy (CBT), working memory training (WMT), computer training (CT), meditation (MAP), meditation and cognitive (MC), vitamin and mineral (VM), vitamin (VI), mineral (MI), polyunsaturated fatty acid (PUFA), neural feedback (NF), biofeedback (BF), school-based training (SB), psychological education (PE), and sport intervention therapy (SPT). A total of 4998 participants were included, with 2538 in the experimental group and 2460 in the control group. Forty-three studies reported CAARS scores; three studies reported BCS scores; ten studies reported SNAP scores; three studies reported IPDDAI scores; two studies reported DBDRS-P scores; sixteen studies reported ASRS scores; two studies reported DISYPs scores; CBCL scores were reported in four studies; SWAN score was reported in three studies; three studies reported FBB-HKS scores; one study reported DSM-IV scores; and two studies reported a CSI-4 score. The Jadad score is above average, which means the quality of included studies in this analysis is above average (Jadad score ≥ 4), and only six studies were below average in quality (Jadad score < 4) (See Table 1). Our results also consider the GRADE quality ratings.

3.2. Network Meta-Analysis

3.2.1. Homogeneity Test. Homogeneity test results indicate that cognitive behavioral therapy SMD = −0.77 (−1.00, −0.54), working memory training SMD = −0.49 (−0.71, −0.27), computer training SMD = −0.94 (−1.87, −0.01), meditation SMD = −0.66 (−0.85, −0.47), meditation and cognitive training SMD = −0.99 (−1.33, −0.66), vitamin and mineral SMD = −1.78 (−2.13, −1.44), vitamin SMD = −0.86 (−1.17, −0.55), mineral SMD = −0.52 (−0.88, −0.16), polyunsaturated fatty acid SMD = −0.42 (−0.58, −0.26), neural feedback SMD = −0.26 (−0.46, −0.05), school-based practice SMD = −0.60 (−1.11, −0.08), the psychological education SMD = −0.39 (−0.60, −0.19), the sport intervention SMD = −1.04 (−1.68, −0.39), the efficacy was significantly better than that of the control group, and the computer training is superior to the neural feedback therapy SMD = −0.94 (−1.87, −0.01). The efficacy of other comparative studies was not statistically significant. The homogeneity test results showed that 11 groups of comparative studies had high homogeneity, while the degree of heterogeneity among the other comparative studies was medium to high (Table 2).

3.2.2. Network Evidence Diagram. As can be seen from Figure 2, there were a total of 14 nonpharmacological therapies and 15 comparative studies included. There were direct comparisons between 6 closed loops and 7 nonpharmacologic therapies. The size of the node represents the sample size of the study, and the width of the line represents the number of comparative studies between the two therapies. The most compared treatments included neurofeedback therapy (NF), polyunsaturated fatty acids (PUFAs), meditation (MAP), mineral (MI), cognitive behavioral therapy (CBT), and working memory training (WMT). Vitamin (VI), school-based training (SB), vitamin and mineral (VM), and meditation and cognitive therapy (MC) had a weak overall relationship with the network structure. In all studies, there was at least one control trial. Due to the presence of closed loops in the network evidence map, a closed loop inconsistency test was required.

3.2.3. Consistency Test. The loop inconsistency test was used to explore the level of inconsistency among the internal comparison studies of each closed loop. As shown in Figure 3, among the 6 closed loops, the inconsistency factor IF of the other closed loops was close to 0 and all the 95% confidence intervals contained 0, *P* > 0.05, except for the neurofeedback-motor intervention-control group (NF-SPT-ctrl). Therefore, there was no statistical inconsistency among the internal studies of each closed loop, so the consistency model was adopted for analysis in subsequent studies.

As can be seen from Figure 2, there is a closed loop composed of four studies in the network evidence graph. Therefore, the closed loop was split into two independently closed triangular loops using the node-splitting model. By calculating the absolute value of the difference between
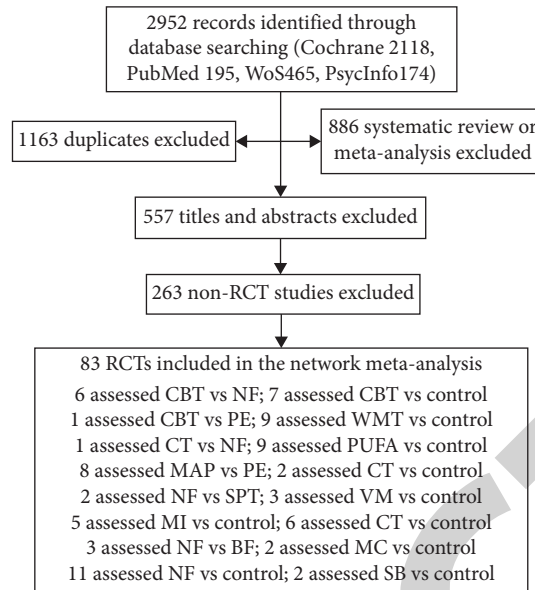
Figure 1: Flowchart of study selection.

Table 1: Characteristics of included studies.

Author, year	Design		Sample size		Age		Jadad score	Tool
	Expl	Ctrol	Expl	Ctrol	Exp	Ctrol		
Naomi, 2014	CBT	Ctrol	34	36	8.9 ± 1	8.4 ± 1.1	4	CAARS
Young, 2016	PUFA	PE	11	14			7	SNAP
Safren, 2010	CBT	Ctrol	43	43	42.3 ± 10	44 ± 12.2	6	CAARS-S
Young, 2016	PUFA	Ctrol	11	11			7	SNAP
Arthur, 2015	CBT	Ctrol	43	43	20.3		6	CAARS-S
Toshiko, 2015	PUFA	Ctrol	38	38	13.7 ± 1.1		3	CAARS
LaCount, 2015	CBT	Ctrol	17	17			4	BCS
Crippa, 2017	PUFA	Ctrol	25	23	11.1 ± 1.9	10.9 ± 1.4	6	ASRS
Leanne, 2015	CBT	Ctrol	10	9	4.9 ± 1.1	5.2 ± 1.4	4	SNAP-IV
Tzang, 2016	PUFA	Ctrol	58	58	9.3 ± 2.7	9 ± 2.2	6	SNAP
Fleming, 2015	CBT	Ctrol	19	16	21.2 ± 1.7	21.5 ± 1.1	6	BCS
Cornu, 2017	PUFA	Ctrol	80	82	7 ± 3	6.9 ± 2.9	6	ASRS
Wang, 2016	CBT	Ctrol	10	12	26 ± 4.5	24.8 ± 4	7	CAARS-S
Muller, 2014	PUFA	Ctrol	55	55			6	DISYPs
Zahra, 2014	WMT	Ctrol	12	12			5	SNAP
Dienke, 2015	PUFA	Ctrol	19	18	10.3 ± 2.0		6	CBCL
Anna, 2015	WMT	Ctrol	13	13	5.29 ± 0.4	5.3 ± 0.4	7	IPDDAI
Crippa, 2019	PUFA	Ctrol	25	25	11.1 ± 1.9	10.9 ± 1.4	6	ASRS
Wei, 2017	WMT	Ctrol	11	9	10.3 ± 3.5	10.3 ± 2.9	5	SNAP-IV
Celestino, 2019	PUFA	Ctrol	46	49			6	CAARS
Martine, 2014	WMT	Ctrol	27	24	6.5 ± 0.6	6.6 ± 0.7	6	CAARS-S
Pelsser, 2011	PUFA	Ctrol	50	50	6.8 ± 1.3	7 ± 1.3	6	ASRS
Jens, 2013	WMT	Ctrol	38	37			2	CAARS-S
Moreno, 2019	NF	CBT	21	19	9.21 ± 1.9	8.1 ± 1.3	7	ASRS
Agnese, 2018	WMT	Ctrol	40	40			6	IPDDAI
Minder, 2018A	NF	CBT	29	23	11.4 ± 1.7	10.8 ± 1.8	6	CAARS
Beck, 2013	WMT	Ctrol	26	26			6	CAARS-S
Minder, 2018B	NF	CBT	25	25	10.6 ± 2.3	10.4 ± 2.0	6	CAARS
Sandie, 2018	WMT	Ctrol	22	13			6	CAARS-S
Michael, 2017A	NF	CBT	38	41	40 ± 11.2	38 ± 11.3	4	CAARS
Naomi, 2011	CT	Ctrol	13	15	12.4 ± 0.9		6	CAARS-S
Michael, 2017B	NF	CBT	39	41	35.7 ± 11	38 ± 11.3	4	CAARS
Aida, 2018	CT	Ctrol	35	35	9.8 ± 2.0	10.1 ± 1.5	6	CAARS-S
Maurizio, 2014	NF	BF	13	12	10.6 ± 1.3	10 ± 1.2	7	CAARS

TABLE 1: Continued.

Author, year	Design		Sample size		Age		Jadad score	Tool
	Expl	Ctrol	Expl	Ctrol	Exp	Ctrol		
Leanne, 2013	CT	Ctrol	51	51	9.1 ± 1.2	9.5 ± 1.5	6	SNAP-IV
Ali, 2011	NF	BF	18	17	9.6 ± 2.2	9.1 ± 1.6	6	CAARS
Oord, 2012	CT	Ctrol	21	22	10 ± 1.0	9.6 ± 1.4	6	DBDRS-P
Strehl, 2017	NF	BF	76	74	8.6 ± 0.9	8.6 ± 0.9	4	ASRS
Choon, 2019	CT	Ctrol	85	87	8.7 ± 1.4	8.6 ± 1.7	6	CAARS-S
Gelade, 2018	NF	SPT	39	37	10 ± 1.9	9.8 ± 2.0	6	SWAN
Bachmann, 2018	MAP	PE	21	19	40 ± 10.6	40 ± 13.8	7	CAARS-S
Gelade, 2016	NF	SPT	39	37	9.8 ± 1.9	9.6 ± 1.8	6	SWAN
Dovis, 2015	MAP	PE	41	40	10.3 ± 1.3	10.5 ± 1.3	6	CAARS-S
Chien, 2016	SPT	Ctrol	16	16	10.7 ± 1	10 ± 1.2	7	CBCL
John, 2017	MAP	Ctrol	11	11	40.6 ± 6.8	36.2 ± 6.9	2	CAARS-S
Claudia, 2012	SPT	Ctrol	10	11	9.1 ± 1.1		6	CBCL
Huguet, 2017	MAP	Ctrol	5	5	9.2 ± 1.3		7	CAARS-S
Naomi, 2014	NF	Ctrol	34	36	8.4 ± 1.1	8.9 ± 1	5	CAARS
Poppy, 2013	MAP	Ctrol	32	29	39.5 ± 9.5	33.9 ± 9.8	2	CAARS-S
Naomi, 2011	NF	Ctrol	13	15	12.4 ± 0.9		6	CAARS-S
Jillian, 2013	MAP	Ctrol	20	20	15.5 ± 1.6		3	CAARS-S
Holger, 2010	NF	Ctrol	59	35	9.1 ± 1.3	9.5 ± 1.1	7	FBB-HKS
Herman, 2017	MAP	Ctrol	50	50	6.3 ± 0.9	5.92 ± 0.7	6	ASRS
M.M, 2010	NF	Ctrol	8	6	10.4 ± 2.3	10 ± 1.7	7	DSM-IV
Lotte, 2018	MAP	Ctrol	60	60	39.7 ± 1	39 ± 10.1	6	CAARS
Meise l, 2013	NF	Ctrol	14	13	9.53 ± 1.8		6	ASRS
Edel, 2014	MAP	Ctrol	39	52	33.8 ± 10	36.7 ± 10	7	CAARS
Bink, 2016	NF	Ctrol	59	31	15.9 ± 3.3	16.2 ± 3	6	ASRS
Gu, 2018	MC	Ctrol	30	26			4	CAARS
Shereena, 2018	NF	Ctrol	24	19	8.7 ± 1.8	9.7 ± 2.4	6	ASRS
Hepark, 2019	MC	Ctrol	55	48	36.5 ± 10	35.2 ± 9	6	CAARS-S
Albrecht, 2017	NF	Ctrol	24	24	11.3 ± 2.8	11.5 ± 3	6	FBB-HKS
Kathryn, 2019	VM	Ctrol	47	46	9.3 ± 1.1	9.9 ± 1.8	6	ASRS
ManHee, 2015	NF	Ctrol	8	8			5	CAARS
Julia, 2018	VM	Ctrol	47	46	10.1 ± 1.6	9.4 ± 1.5	6	ASRS
Alegria, 2017	NF	Ctrol	18	13	14.1 ± 1.5	13.6 ± 2	7	CAARS
Julia, 2017	VM	Ctrol	42	38	34 ± 12.7		6	CAARS
Harris, 2019	NF	Ctrol	11	11			7	CAARS
Hatem, 2018	VI	Ctrol	20	20	9.3 ± 2.6	8.8 ± 3.72	6	CAARS
Joshua, 2012	SB	Ctrol	23	24			3	ASRS
Nadia, 2019	VI	Ctrol	51	51	9.8 ± 2.4	8.6 ± 2.0	6	CAARS
Looyeh, 2012	SB	Ctrol	7	7			5	CSI-4
Eugene, 2011	MI	Ctrol	8	24	8.9 ± 2.3	10.2 ± 2.7	7	SNAP
Young, 2016	PE	Ctrol	14	11			7	SNAP
Fereshteh, 2015	MI	Ctrol	33	33	7.8 ± 1.2	8.4 ± 1.4	6	ASRS
Alexandra, 2015	PE	Ctrol	107	109	35 ± 11	35 ± 10	6	CAARS-S
Vidal, 2013	PE	CBT	17	15	39.4 ± 9.3	39.5 ± 6	4	CAARS-S
Bai, 2015	PE	Ctrol	44	45	9.3 ± 2.8	9.6 ± 2.9	7	ASRS
Maite, 2013	PE	Ctrol	44	37	11.3 ± 3.0	9.9 ± 3.0	6	CAARS
Naomi, 2014	CBT	NF	34	34	8.4 ± 1.1		4	CAARS
Naomi, 2011	CT	NF	13	13	12.4 ± 0.9		6	CAARS-S

Note: CBT = cognitive behavioral therapy; WMT = working memory training; CT = computer training; MAP = meditation; MC = meditation and cognition; VM = vitamin and mineral; VI = vitamin; Mi = mineral; PUFA = polyunsaturated fatty acid; NF = neurofeedback; BF = biofeedback; SB = school-based training; PE = psychological education; SPT = sport intervention therapy; ctrol = control group; CAARS-S = Conners' Adult ADHD Rating Scale Self-Report; BCS = Barkley ADHD Current Symptoms Scale; SNAP = Swanson, Nolan, Pelham; IPDDAI = rating scale "identificazione precoce del disturbo da deficit di attenzione iperattivita; DBDRS-P = Disruptive Behavior Disorders Rating Scale; ASRS = adult ADHD Self-Report Scale; DISYPs = FBB ADHS parent-rated and teacher-rated programmes; CBCL = Child Behavior Checklist; SWAN = Strengths and Weaknesses in ADHD and Normal Behaviors; FBB-HKS = Fremdbeurteilungsbogen fur Hyperkinetische Storungen; DSM-IV = Diagnostic and Statistical Manual of Mental Disorders; CSI-4 = Children Symptom Inventory.

direct and indirect evidence in each closed loop, the consistency between direct and indirect evidence in the overall model was explored. From the results of local inconsistency of Table 3, it can be seen that there is no inconsistency between the direct and indirect comparisons of the efficacy of the two treatments in all the closed loops ($P > 0.05$), nor

TABLE 2: Homogeneity test.

Study	SMD	95% CI		% weight	HI	P	I^2 (%)	Z	P
CBT-NF	0.12	0.34	0.10	7.46	24.65	0.00	0.80	1.08	0.28
CBT-ctrol	0.77	1.00	0.54	6.76	7.88	0.25	0.24	6.57	0.00
CBT-PE	0.16	0.62	0.94	0.59	0.00	0.00	0.00	0.40	0.69
WMT-ctrol	0.49	0.71	0.27	7.61	110.31	0.00	0.93	4.43	0.00
CT-NF	0.94	1.87	0.01	0.41	0.00	0.00	0.00	1.98	0.05
CT-ctrol	0.53	0.72	0.34	9.96	26.99	0.00	0.82	5.47	0.00
MAP-PE	0.06	0.43	0.30	2.67	0.15	0.70	0.00	0.34	0.73
MAP-ctrol	0.66	0.85	0.47	10.19	16.39	0.02	0.57	6.91	0.00
MC-ctrol	0.99	1.33	0.66	3.21	2.23	0.14	0.55	5.83	0.00
VM-ctrol	1.78	2.13	1.44	3.03	11.44	0.00	0.83	10.16	0.00
VI-ctrol	0.86	1.17	0.55	3.82	10.15	0.00	0.90	5.51	0.00
MI-ctrol	0.52	0.88	0.16	2.79	29.28	0.00	0.86	2.83	0.01
PUFA-PE	0.37	1.15	0.41	0.59	0.00	0.00	0.00	0.92	0.36
PUFA-ctrol	0.42	0.58	0.26	14.19	61.88	0.00	0.87	5.14	0.00
NF-BF	0.16	0.45	0.12	4.46	2.48	0.29	0.19	1.13	0.26
NF-SPT	0.00	0.33	0.33	3.23	0.02	0.87	0.00	0.00	1.00
NF-ctrol	0.26	0.46	0.05	8.20	18.62	0.05	0.46	2.39	0.02
SB-ctrol	0.60	1.11	0.08	1.35	0.28	0.60	0.00	2.26	0.02
PE-ctrol	0.39	0.60	0.19	8.62	49.72	0.00	0.94	3.76	0.00
SPT-ctrol	1.04	1.68	0.39	0.86	13.23	0.00	0.92	3.16	0.00

CBT, cognitive behavioral therapy; WMT, working memory training; CT, computer training; MAP, meditation; MC, meditation and cognition; VM, vitamin and mineral; VI, vitamin; MI, mineral; PUFA, polyunsaturated fatty acid; NF, neurofeedback therapy; BF, biofeedback therapy; SB, school-based exercise; PE, psychological education; SPT, sport intervention; ctrol, control group.

does the inconsistency between the studies included in each of the treatments in all the closed loops reach a significant level ($\tau > 0.05$).

The results of the inconsistency model test show that both the local inconsistency and loop inconsistency test prove that there is a high consistency among the studies included in the network evidence model. Therefore, the subsequent analysis results are based on the consistency model.

3.2.4. Assessment of Transitivity. In order to adhere to the assumption of transitivity and reduce the risk of biased estimates, the distribution of methodological variables that may act as effect modifiers across treatment comparisons has been compared such as age and nonpharmacotherapy. Most of the participants had a similar mean age from 10 to 20, but there were a few comparisons which had relatively low or high age. Additionally, the comparison of baseline severity also showed that the baseline severity distributed in a similar range on this network analysis, even though this analyses might suffer from ecological bias. See Figure 4 for the assessment of transitivity.

3.2.5. Publication Bias Test. In traditional meta-analysis, because there is only one effect size, funnel plots are drawn using the standard error of effect value as the vertical axis and effect size as the horizontal axis [38]. However, in the network meta-analysis, multiple meta-analyses with direct comparisons of different controls exist simultaneously. Therefore, the publication bias of different control groups needs to be adjusted at the same time when making Egger detection. Accordingly, when the funnel chart is drawn and adjusted, the vertical axis is the effect size of each study, the

horizontal axis is the total effect size of each control group, and the regression line after adjustment is in the middle. As can be seen from the comparison of funnel plots (Figure 5), all the included studies were centrally distributed above the funnel plots and showed a left-right symmetric trend around the zero position. Therefore, it was concluded that there was no publication bias in the included studies on the whole. However, some studies were distributed below the funnel plots, and it indicated that there was a small-sample study effect.

3.2.6. Network Meta-Analyses. As there was no direct comparison between sport intervention therapy and many nonpharmacological therapies in the included studies, head-to-head comparison was used to provide indirect evidence for the studies that lacked direct comparison [28]. According to the head-to-head comparison of efficacy in Figure 6, it can be seen that vitamin and mineral (VM, SMD = −1.79 (−2.69, −0.88)), meditation and cognition (MC, SMD = −1.07 (−2.15, 0.00)), mineral (MI, SMD = −0.79 (−1.75, −0.19)), working memory training (WMT, SMD = −0.93 (−1.47, −0.38)), sport intervention therapy (SPT, SMD = −0.90 (1.76, 0.04)), meditation (MAP, SMD = −0.80 (1.32, 0.29)), the psychological education (PE, SMD = −0.67 (−1.27, −0.08)), cognitive behavior therapy (CBT, SMD = −0.65 (−1.12, −0.17)), computer training (CT, SMD = −0.63 (−1.25, −0.02)), polyunsaturated fatty acid (PUFA, SMD = −0.57 (−1.08, −0.07)), and neurofeedback therapy (NF, SMD = −0.45 (−0.87, −0.03)) were significantly better than the control group in improving attention deficit in ADHD patients. In addition, the efficacy of vitamin and mineral combined supplements was significantly better than that of polyunsaturated fatty acids (SMD = −1.21 (−2.25, −0.18)),
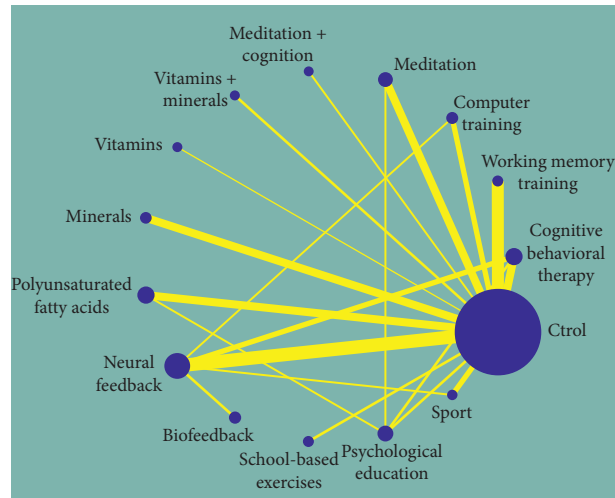
Figure 2: Network plot of meta-analysis.

Loop		IF	SeIF	z_value	P_value	95% CI (trancated)	Loop-specific heterogeneity (τ^2)
NF-SPT-Ctrol		1.03	1.03	0.72	1.45	(0.00, 2.43)	0.170
CBT-NF-Ctrol		0.55	0.55	0.34	1.62	(0.00, 1.22)	0.151
PUFA-PE-Ctrol		0.46	0.46	0.97	0.47	(0.00, 2.36)	0.552
CT-NF-Ctrol		0.34	0.34	0.69	0.48	(0.00, 1.70)	0.192
CBT-PE-Ctrol		0.33	0.33	0.87	0.38	(0.00, 2.05)	0.408
MAP-PE-Ctrol		0.07	0.07	0.60	0.11	(0.00, 1.24)	0.333

MAP: meditation;
NF: neurofeedback therapy;
PE: psychological education;
CBT: cognitive behavioral therapy

Ctrol: control group;
CT: computer training;
SPT: sport intervention;
PUFA: polyunsaturated fatty acids

0 1 2 3

Figure 3: Loop inconsistency test.

neurofeedback (SMD = −1.34 (−2.33, −0.34)), biofeedback (SMD = −1.65 (−2.99, −0.30)), and psychoeducation (SMD = −1.11 (−2.19, −0.03)), while there was no significant difference between other therapies. These results were basically consistent with the results of general meta-analysis. The acceptability analysis demonstrated that there was no significant difference between the acceptability of exercise intervention therapy and the remaining nonpharmacological therapy. The acceptability of meditation was significantly better than that of vitamin supplements (RR = 0.10 (0.01, 0.73)), neurofeedback (RR = 0.39 (0.15, 1.00)), and biofeedback (RR = 0.22 (0.07, 0.70)). The acceptability of biofeedback therapy was significantly better than that of the control group (RR = 2.86 (1.14, 7.16)).

Figure 7 demonstrates a two-dimensional diagram of the efficacy and acceptability of all cross-comparison studies. According to the SUCRA ranking results, the cumulative probability of efficacy of sport intervention was 62%, slightly lower than vitamins and minerals (95%), meditation and cognition (68.8%), minerals (66.4%), and working memory training (65.1%). It was only secondary to vitamins (89.3%) and biofeedback (79.5%) for acceptability.

Taking into account the efficacy and acceptability of each nonpharmacological therapy, the following results were obtained by ranking the area under the cumulative probability curve: in 14 kinds of nonpharmacological intervention therapy, sport intervention therapy (SPT) effect on the improvement of the patients with ADHD attention deficit disorder is superior to the other 12 kinds of nonpharmacological treatments, only secondary to vitamin (VI) supplements and cognitive training (MC) based on meditation, and the overall ranking is third. However, the pairwise comparison of Figure 6 indicates that although vitamin (VI) supplements can improve attention deficit in ADHD patients to some extent, the effect is not significant. So, it was excluded. However, the effect size of meditation and cognitive therapy (SMD = −1.07, (−2.15, 0.00)) was at a marginal significant level, and the robustness of its results

TABLE 3: Local inconsistency test.

	Direct		Indirect		Difference		$P > |z|$	Tau
	Coef	SE	Coef	SE	Coef	SE		
CBT-NF	0.01	0.32	0.52	0.40	0.54	0.51	0.30	0.73
CBT-PE	0.15	0.84	0.00	0.41	0.16	0.94	0.87	0.74
CBT-ctrol	0.84	0.31	0.34	0.39	0.51	0.50	0.31	0.73
WMT-ctrol*	0.93	0.28	0.37	208.78	0.56	208.78	1.00	0.73
CT-NF	0.69	0.87	0.07	0.41	0.62	0.96	0.52	0.74
CT-ctrol*	0.60	0.32	1.31	1.57	0.71	1.60	0.66	0.74
MAP-PE	0.08	0.56	0.16	0.45	0.08	0.72	0.91	0.74
MAP-ctrol	0.82	0.29	0.74	0.66	0.08	0.72	0.91	0.74
MC-ctrol*	1.07	0.55	0.23	447.18	0.85	447.18	1.00	0.73
VM-ctrol*	1.79	0.46	0.49	365.30	2.28	365.30	1.00	0.73
VI-ctrol*	0.92	0.54	0.38	445.12	0.54	445.12	1.00	0.73
MI-ctrol*	0.97	0.40	0.33	282.72	0.64	282.72	1.00	0.73
PUFA-PE	0.35	0.84	0.22	0.43	0.57	0.94	0.55	0.74
PUFA-ctrol*	0.54	0.26	1.67	1.59	1.13	1.61	0.49	0.74
NF-BF*	0.31	0.46	0.09	366.36	0.40	366.36	1.00	0.73
NF-SPT	0.00	0.55	1.19	0.70	1.19	0.88	0.18	0.73
NF-ctrol	0.25	0.25	0.96	0.40	0.71	0.47	0.13	0.73
SB-ctrol*	0.63	0.60	0.66	448.17	0.03	448.17	1.00	0.73
PE-ctrol	0.65	0.39	0.70	0.49	0.05	0.63	0.94	0.74
SPT-ctrol	1.56	0.66	0.37	0.59	1.19	0.88	0.18	0.73

CBT: cognitive behavioral therapy; WMT: working memory training; CT: computer training; MAP: meditation; MC: meditation and cognition; VM: vitamin and mineral; VI: vitamin; MI: mineral; PUFA: polyunsaturated fatty acid; NF: neurofeedback therapy; BF: biofeedback therapy; SB: school-based exercise; PE: psychological education; SPT: sport intervention; ctrol: control group.

was worse than that of sport intervention therapy, so it needs careful interpretation in practice.

The overall ranking of all kinds of the non-pharmacological therapy is as follows: (1) medication and cognitive (MC); (2) sport intervention therapy (SPT); (3) vitamin and mineral (VM); (4) cognitive behavioral therapy (CBT); (5) computer training (CT); (6) psychological education (PE); (7) working memory training (WMT); (8) nerve feedback therapy (NF); (9) polyunsaturated fatty acids (PUFAs); (10) mineral (MI) supplements; (11) meditation (MAP); (12) vitamin (VI); (13) biofeedback therapy (BF); and (14) school-based training (SB).

4. Discussion

A total of 86 studies were included in this network meta-analysis, involving 68 double-blind studies and 1 single-blind study. A total of 4,998 study samples were collected. Of these, 2,538 patients were randomly assigned to 14 non-pharmacological treatments and 2,460 to a control group. Through a detailed search of published and unpublished research data, the efficacy and acceptability of each therapy were compared directly and indirectly, and the overall ranking provided the latest and comprehensive structured mathematical evidence for the clinical advantages of exercise intervention therapy.

The study indicates that all of the 11 nonpharmacological treatments were found to have superior curative effect on the control group (SMD = (−1.79, −0.14)). Among them, the improvement effect of sport intervention therapy (SPT, SMD = −0.90(−1.76, −0.04)) on attention deficit was only

secondary to working memory training (WMT, SMD = −0.93 (−1.47, −0.38)), which reached the high effect size level. The vitamin and mineral (VM) supplementation was significantly better than other treatments (VM, SMD = (−1.79, −1.11)). A comparative analysis of the acceptability of nonpharmacological therapies found that there was no significant difference in acceptability between the sport intervention and other nonpharmacological therapies. The acceptability of meditation therapy alone was significantly better than vitamin (VI, RR = 0.1 (0.01, 0.73)), neurofeedback (NF, RR = 0.39 (0.15, 1.00)), and biofeedback (BF, RR = 0.22 (0.07, 0.70)). The acceptability of biofeedback therapy was inferior to that of the control group (ctrol, RR = 2.86 (1.14, 7.16)). Thus, when efficacy was considered only, there was no significant difference in the effect of each therapy, and sport intervention therapy was not the best choice, only ranking the fourth (Figure 7). However, after taking into account the high dropout rate among other treatments, sport intervention was found to rank second, after meditation-based cognitive training (MC) (Figure 7).

In order to make the abovementioned results as robust as possible to provide reference information for clinical practice, this study focuses on the results of head-to-head interaction comparison under the condition that the retrieved information is completely reliable. Figure 7 shows that low efficacy of pharmacological therapy is usually accompanied by a high level of sample loss (BF (SMD = −0.14, RR = 2.86), SB (SMD = −0.63, RR = 1.02), and VI (SMD = −0.92, RR = 6.03)). This may be due to the slow and imperceptible improvement in attention levels from non-pharmacological therapies, and the lengthy intervention
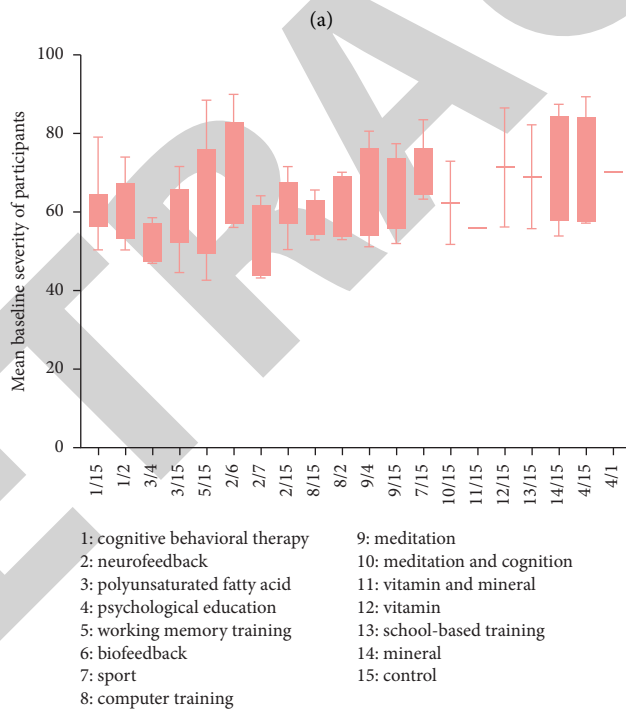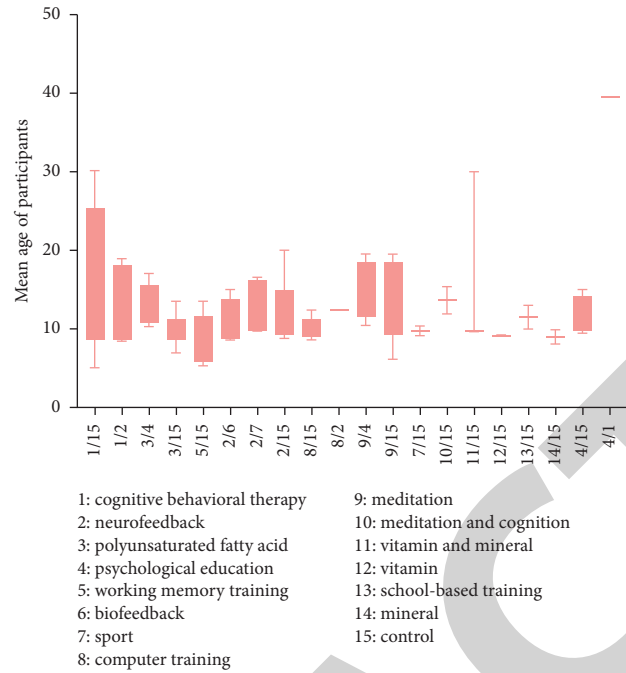
(a)

(b)

Figure 4: Assessment of transitivity.

cycle that leads to the withdrawal of patients with more severe symptoms undermines the stability of the randomization of the original study. As a result, most of the participants retained were those with mild symptoms and low improvement. Therefore, the real effects of nonpharmacological therapies were easily underestimated in the final evaluation of effect. According to the difference in analysis results between meditation and cognitive therapy (MC) and the control group, the effect size not only reached

the high effect level but also had a large span of confidence interval, and the lower limit reached the point of no difference (SMD = −1.07 (−2.15, 0.00)) (P = 0.05), leading to the marginal significance of the difference between MC and the control group (Figure 5). So, careful interpretation and application should be carried out in the interpretation of results and practical guidance [39]. In this network meta-analysis, only two studies reported the results of the combination of meditation and cognitive therapy (MC), so the
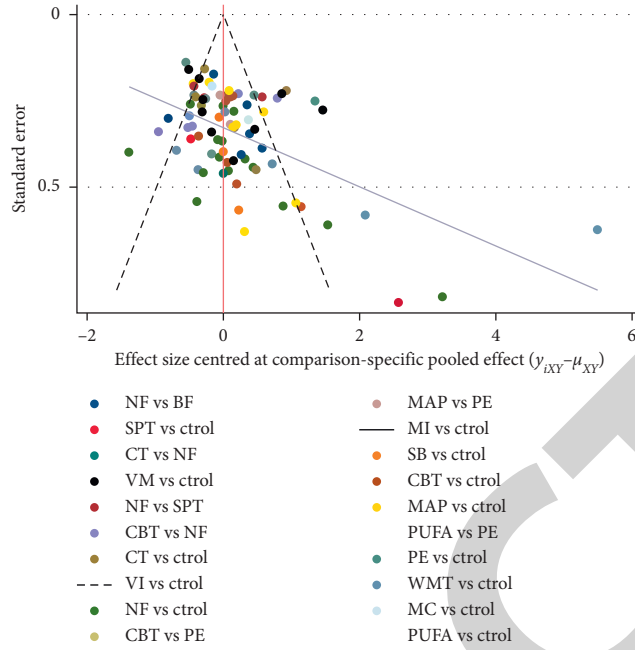
Figure 5: Comparison-adjusted funnel plot and Egger test for each outcome.

Legend:
- NF vs BF
- SPT vs ctrol
- CT vs NF
- VM vs ctrol
- NF vs SPT
- CBT vs NF
- CT vs ctrol
- VI vs ctrol (dashed)
- NF vs ctrol
- CBT vs PE
- MAP vs PE
- MI vs ctrol (line)
- SB vs ctrol
- CBT vs ctrol
- MAP vs ctrol
- PUFA vs PE
- PE vs ctrol
- WMT vs ctrol
- MC vs ctrol
- PUFA vs ctrol

CBT	WMT	CT	MAP	MC	VM	VI	MI	PUFA	NF	BF	SB	PE	SPT	Ctrol
CBT	2.34 (0.71, 7.68)	0.97 (0.33, 2.81)	3.14 (1.16, 8.51)	0.75 (0.10, 5.78)	1.53 (0.41, 5.65)	0.32 (0.05, 2.28)	3.54 (0.42, 29.68)	1.73 (0.75, 4.00)	1.24 (0.58, 2.66)	0.68 (0.24, 1.92)	1.90 (0.10, 35.07)	1.41 (0.52, 3.82)	0.81 (0.18, 3.52)	1.94 (0.96, 3.92)
0.28 (−0.44, 1.00)	WMT	0.41 (0.12, 1.47)	1.34 (0.40, 4.47)	0.32 (0.04, 2.73)	0.65 (0.15, 2.81)	0.14 (0.02, 1.08)	1.51 (0.16, 13.96)	0.74 (0.26, 2.13)	0.53 (0.17, 1.63)	0.29 (0.08, 1.09)	0.81 (0.04, 16.08)	0.60 (0.17, 2.13)	0.34 (0.07, 1.81)	0.83 (0.32, 215)
−0.02 (−0.78, 0.75)	−0.29 (−1.12, 0.53)	CT	3 24 (1.07, 9.76)	0.78 (0.10, 6.24)	1.58 (0.40, 6.25)	0.33 (0.04, 2.47)	3.66 (0.42, 31.98)	1.79 (0.70, 4.56)	1.28 (0.49, 3.30)	0.70 (0.21, 2.29)	1.96 (0.10, 37.36)	1.45 (0.45, 4.67)	0.83 (0.17, 3.97)	2.00 (0.87, 4.57)
0.16 (−0.53, 0.85)	−0.12 (−0.87, 0.63)	0.17 (−0.63, 0.97)	MAP	0.24 (0.03, 1.88)	0.49 (0.13, 1.83)	0.10 (0.01, 0.73)	1.13 (0.13, 9.54)	0.55 (0.23, 1.30)	0.39 (0.15, 1.00)	0.22 (0.07, 0.70)	0.60 (0.03, 11.25)	0.45 (0.17, 1.19)	0.26 (0.06, 1.20)	0.62 (0.30, 1.28)
0.42 (−0.75, 1.60)	0.15 (−1.06, 1.35)	0.44 (−0.80, 1.68)	0.27 (−0.93, 1.46)	MC	2.02 (0.22, 18.35)	0.43 (0.03, 5.99)	4.70 (0.29, 74.85)	2.29 (0.32, 16.32)	1.64 (0.22, 12.10)	0.90 (0.11, 7.49)	2.51 (0.08, 76.42)	1.86 (0.23, 14.96)	1.07 (0.10, 11.11)	2.57 (0.38, 17.33)
1.14 (0.12, 2.16)	0.86 (−0.19, 1.92)	1.16 (0.08, 2.25)	0.98 (−0.06, 2.02)	0.72 (−0.69, 2.12)	VM	0.21 (0.02, 1.78)	2.32 (0.24, 22.86)	1.13 (0.34, 3.74)	0.81 (0.23, 2.83)	0.44 (0.11, 1.87)	1.24 (0.06, 25.92)	0.92 (0.23, 3.67)	0.53 (0.09, 3.03)	1.27 (0.42, 3.82)
0.27 (−0.89, 1.43)	−0.01 (−1.20, 1.18)	0.28 (−0.94, 1.51)	0.11 (−1.07, 1.29)	−0.15 (−1.66, 1.35)	−0.87 (−2.26, 0.52)	VI	11.03 (0.73, 165.5)	5.39 (0.82, 35.48)	3.85 (0.56, 26.33)	2.11 (0.27, 16.37)	5.90 (0.20, 171.8)	4.38 (0.59, 32.66)	2.51 (0.26, 24.46)	6.03 (0.97, 37.58)
0.32 (−0.59, 1.24)	0.04 (−0.90, 0.99)	0.34 (−0.66, 1.33)	0.16 (−0.77, 1.10)	−0.10 (−1.43, 1.23)	−0.82 (−2.01, 0.38)	0.05 (−1.26, 1.37)	MI	0.49 (0.06, 3.81)	0.35 (0.04, 2.82)	0.19 (0.02, 1.74)	0.54 (0.02, 17.18)	0.40 (0.05, 3.48)	0.23 (0.02, 2.56)	0.55 (0.07, 4.06)
−0.07 (−0.76, 0.62)	−0.35 (−1.10, 0.39)	−0.06 (−0.85, 0.74)	−0.23 (−0.94, 0.48)	−0.50 (−1.68, 0.69)	−1.21 (−2.25, −0.18)	−0.34 (−1.52, 0.83)	−0.39 (−1.32, 0.54)	PUFA	0.72 (0.34, 1.50)	0.39 (0.14, 1.09)	1.10 (0.06, 19.27)	0.81 (0.32, 2.08)	0.47 (0.11, 1.95)	1.12 (0.71, 1.76)
−0.20 (−0.69, 0.29)	−0.48 (−1.16, 0.21)	−0.18 (−0.90, 0.54)	−0.36 (−1.01, 0.30)	−0.62 (−1.77, 0.53)	−1.34 (−2.33, −0.34)	−0.47 (−1.61, 0.67)	−0.52 (−1.40, 0.36)	−0.13 (−0.78, 0.53)	NF	0.55 (0.27, 1.11)	1.53 (0.09, 27.61)	1.14 (0.42, 3.07)	0.65 (0.17, 2.44)	1.57 (0.87, 2.82)
−0.51 (−1.53, 0.52)	−0.78 (−1.92, 0.35)	−0.49 (−1.65, 0.66)	−0.66 (−1.78, 0.45)	−0.93 (−2.39, 0.53)	−1.65 (−2.99, −0.30)	−0.77 (−2.23, 0.68)	−0.83 (−2.09, 0.44)	−0.43 (−1.55, 0.68)	−0.31 (−1.21, 0.59)	BF	2.80 (0.14, 54.85)	2.07 (0.61, 7.02)	1.19 (0.27, 5.31)	2.86 (1.14, 7.16)
−0.01 (−1.28, 1.25)	−0.29 (−1.59, 1.00)	0.00 (−1.33, 1.33)	−0.17 (−1.46, 1.11)	−0.44 (−2.03, 1.16)	−1.15 (−2.64, 0.33)	−0.28 (−1.87, 1.30)	−0.34 (−1.75, 1.08)	0.06 (−1.22, 1.34)	0.18 (−1.07, 1.43)	0.49 (−1.05, 2.03)	SB	0.74 (0.04, 14.18)	0.43 (0.02, 9.81)	1.02 (0.06, 17.33)
0.03 (−0.69, 0.75)	−0.25 (−1.06, 0.55)	0.04 (−0.81, 0.90)	−0.13 (−0.81, 0.55)	−0.40 (−1.16, 0.83)	−1.11 (−2.19, −0.03)	−0.24 (−1.46, 0.97)	−0.30 (−1.28, 0.68)	0.10 (−0.65, 0.85)	0.22 (−0.49, 0.93)	0.53 (−0.61, 1.68)	0.04 (−1.28, 1.36)	PE	0.57 (0.12, 2.79)	1.38 (0.60, 3.17)
0.26 (−0.68, 1.19)	−0.02 (−1.04, 0.99)	0.27 (−0.78, 1.32)	0.10 (−0.90, 1.10)	−0.17 (−1.55, 1.21)	−0.88 (−2.13, 0.36)	−0.01 (−1.38, 1.35)	−0.07 (−1.22, 1.09)	0.33 (−0.67, 1.33)	0.45 (−0.39, 1.30)	0.76 (−0.47, 2.00)	0.27 (−1.19, 1.73)	0.23 (−0.81, 1.27)	SPT	2.40 (0.62, 9.32)
−0.65 (−1.12, −0.17)	−0.93 (−1.47, −0.38)	−0.63 (−1.25, −0.02)	−0.80 (−1.32, −0.29)	−1.07 (−2.15, 0.00)	−1.79 (−2.69, −0.88)	−0.92 (−1.98, 0.14)	−0.97 (−1.75, −0.19)	−0.57 (−1.08, −0.07)	−0.45 (−0.87, −0.03)	−0.14 (−1.13, 0.85)	−0.63 (−1.81, 0.54)	−0.67 (−1.27, −0.08)	−0.90 (−1.76, −0.04)	Ctrol

Efficacy posttreatment (SMD)

Acceptability (RR)

Treatment

Figure 6: The results of network meta-analysis for efficacy and tolerability.

interpretation of the results was not only limited by the uncertainty of parameter estimation but also affected by selective reporting and potential risk of publication bias caused by the small-sample effect [40].

In conclusion, although meditation and cognitive therapy (MC) ranks first in the overall ranking, the results of clinical significance still have very high uncertainty. Not all people with ADHD have the external conditions of receiving psychological therapy and dietary supplements. Sport intervention therapy from economy and applicability are accepted for the majority of the population; therefore, in this study, the sport intervention therapy is recommended as the best intervention means. Existing studies have confirmed that [16] a certain period of sport intervention can promote the improvement of hyperactivity impulsivity in ADHD patients and, at the same time, attention deficit disorder can also be effectively alleviated. The long-term acute aerobic exercise can accumulate and enhance the short-term and
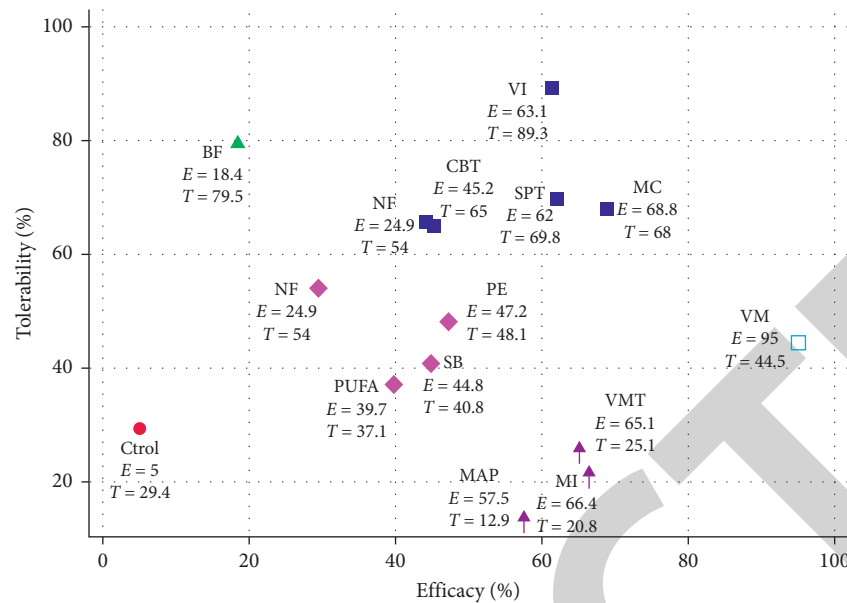
Figure 7: Treatment ranking and SUCRA plot for efficacy and tolerability.

immediate effects of the patient's apparent behavior and the intrinsic neurophysiology. Because of its low cost, ease of implementation, and additional psychological and physiological effects, the long-term acute aerobic exercise often serves as an auxiliary treatment method, as well as a kind of independent treatment, especially under special circumstances [41].

There are also limitations in this study. (1) the sample size of individual nodes in the network evidence map is too small, so the statistical efficacy is limited. (2) The overall inconsistency test is not significant, and the quality evaluation of some studies is still low. (3) Despite a detailed search of published and unpublished literature, complete collection of existing data cannot be ensured. (4) Due to the lack of comprehensive demographic data of patients, it is not possible to conduct subgroup regulation effect analysis.

5. Conclusions

This network meta-analysis showed that although meditation and cognitive therapy (MC) ranked first overall, the effect size of its efficacy was at a marginal significant level, so its results need to be carefully interpreted in clinical practice. Sport intervention therapy is not only very close to meditation and cognition (MC) in terms of efficacy but also has high acceptability and economic practicability. Therefore, sport intervention therapy is preliminarily judged to be the best nonpharmacological intervention means for the treatment of attention deficit in ADHD patients. In addition, meditation and cognitive therapy (MC), cognitive behavioral therapy (CBT), and computer training (MC) can also be effective complementary tools.

Although this analysis incorporates the most comprehensive literature currently available evidence about nonpharmacological treatment for ADHD, a small number of preregistered studies are still unavailable to us even though

we have try our best to collect reliable information about the most recent published studies. Still, we cannot rule out the possibility that some studies are absent in literature retrieval or recalculate the results of the same study in our analyses. Beside, considering the influence of the small-sample effect on the results, a large number of high-quality research designs are still needed to provide evidence to support the results of this study. We welcome any information that might help clarify any limitations in our manuscript.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no known conflicts of interest.

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