

Case Study 1: An Evidence-Based Practice Review Report

Theme: School (setting) based interventions for children with special educational needs (SEN)

The Effectiveness of Mindfulness-Based Interventions for reducing behavioural difficulties in children and adolescents with Autism Spectrum Disorders

Summary

Mindfulness can be defined as purposely paying attention in the present moment. The application of mindfulness in intervention approaches has been seen in various fields of research. In the field of education, systematic reviews and meta-analysis have found Mindfulness-Based Interventions (MBIs) to be effective in, for example, Special Educational Need populations and for individuals experiencing mental health difficulties. However, systematic reviews investigating the effectiveness of MBI in a variety of areas relevant to Autism Spectrum Disorders (ASD), including behavioural difficulties in ASD populations, are yet to be conducted. Therefore, the current systematic review aims to investigate the effectiveness of MBIs in reducing behavioural difficulties for individuals with ASD. Six studies met the inclusion criteria and were appraised using the Weight of Evidence (WoE) Framework. All six studies were found to be effective at reducing a wide range of behavioural difficulties for individuals with ASD, with a majority of the research showing medium to large effect sizes. Additionally, The WoE framework scored five studies as 'Medium' and one study as 'High' in terms of their quality and relevance. Overall, the implementation of MBIs for reducing behavioural difficulties in individuals with ASD is recommended. Limitations and suggestions for future research are discussed.

Introduction

Mindfulness-Based Interventions

Mindfulness finds its historical roots in Buddhism and has been defined as “paying attention in a particular way: on purpose, in the present moment and non-judgmentally” (Cullen, 2011, p. 187). Over the past few decades, mindfulness has increased in popularity in western societies and mindfulness-based interventions (MBIs) have been developed for therapeutic implementation across various fields of research (Cullen, 2011). This has ranged from use in cancer care (Carlson, 2016) and for individuals with mental health difficulties (Kallaprian et al., 2015), to use with young offenders (Simpson et al., 2018) and Chronic Pain sufferers (Veehof et al., 2016).

Furthermore, meta-analysis of MBIs has revealed high degrees of effectiveness across these areas of research. For example, a systematic review and meta-analysis on MBI for youth with anxiety reported significant effects when using MBIs in treatment (Borquist-Conlon et al., 2017). Similar results were found for use with psychiatric disorders (Goldberg et al., 2018), obesity-related eating behaviours (Reilly et al., 2014), Substance Use Disorders (Chiesa & Serretti, 2014; Sancho et al., 2018) and for ‘general health’ consequences, such as improved emotional regulation, reduced stress and heightened cognitive outcomes (Howarth et al., 2019).

Theories of effectiveness

Research examining the underlying effectiveness of MBIs suggests that MBIs may enhance positive emotional regulation strategies and self-compassion levels as well as decreasing rumination and experiential avoidance (Chiesa et al., 2014). These changes, in turn, are associated with the overt benefits of mindfulness, such as improved mental wellbeing

(Chiesa et al., 2014). The possible mediating effect of emotional regulation and emotion-related processing has been found across research (Hoge et al., 2020; Ma et al., 2018).

Furthermore, evidence suggests positive neurological effects of MBI. A systematic review by Young et al. (2018) suggests that MBIs are associated with neurological changes in functioning of the insula, plausibly impacting awareness of internal reactions 'in-the-moment' (Young et al., 2018). There may also be a possibility for MBIs to act as a mediating factor for increased executive functioning capabilities in childhood (Tang et al., 2012). A meta-analysis identified improvement in attention, inhibition, cognitive flexibility and working memory for those receiving MBI compared to control groups (Jansen et al., 2016). However, it has been noted that positive outcomes as a result of MBIs may vary depending on the specific mindfulness techniques utilised (Kropp & Sedlmeier, 2019).

Mindfulness-Based Intervention in Education

Due to the promising evidence base, research into the implementation of MBIs in educational contexts is ever expanding (Frank et al., 2013; Felver & Jennings, 2016). A systematic review and meta-analysis by Zenner et al. (2014) identified the effectiveness of MBIs for children and young people in schools, particularly in relation to improved cognitive performance and resilience to stress. Similarly, a second systematic review identified positive improvements in well-being measures for adolescents engaging with MBIs in school (McKeering & Hwang, 2019) and an integrative model of mindfulness in schools to promote mental health, well-being, peer relationships, classroom behaviour and academic performance has been suggested (Andreu & Garcia-Rubio, 2019).

Furthermore, teachers have been found to hold positive perceptions of MBIs (Wigelsworth & Quinn, 2020) and analysis has found that MBIs could be considered a cost-effective intervention, although, further economic analysis is needed to confirm this (Duarte et al., 2019).

The application of MBIs for individuals with Special Educational Needs and Disability (SEND) in educational contexts has also been found to be effective. For example, a systematic review indicated that MBIs can reduce behavioural difficulties for individuals with Intellectual Disabilities (Harper et al., 2013) and multiple meta-analyses have identified MBIs as effective in reducing ADHD symptoms (Oliva et al., 2021; Xue, Zhang & Huang, 2019). Equally, promising data has emerged indicating the potential for the use of MBI in addressing parental stress and family functioning in parents of individuals with ADHD (Tercelli & Ferreira, 2019).

Mindfulness-Based Intervention and ASD

Autism Spectrum Disorder (ASD) is medically defined as a neurodevelopmental disorder characterised by deficits in social communication and the presence of restricted interests and repetitive behaviours (Hodges et al., 2020). However, preferred terms and strength-based definitions developed with the autism community vary from this (see Kenny et al., 2016).

The current research into the use of MBIs in ASD populations indicate that mindfulness training can lead to a reduction in anxiety, increased social responsiveness and reduced aggression in adolescents (Cachia et al., 2016). Mindfulness training has also been found to reduce anxiety, depression and rumination and increasing positive affect in adults with high functioning ASD (Cachia et al., 2016) and caregivers, children and adults who received mindfulness have been found to report significant gains in subjective wellbeing post-intervention (Hartley et al., 2019).

However, there is currently limited research, systematic review and meta-analysis on the usefulness of MBIs for specific difficulties individuals with ASD may experience, such as emotional regulation and behavioural difficulties. There are currently no systematic reviews, and a limited evidence base, examining the influence of MBI on the emotional regulation or executive functioning of individuals with ASD. Likewise, while there are current systematic

reviews and meta-analysis indicating MBI as effective in reducing behavioural difficulties in the general population (Klingbeil et al., 2017; Tao et al., 2021) and for individuals with Intellectual Disability (Harper et al., 2013), there are currently no systematic reviews that synthesise data on a wide range of behavioural dimensions, including physical, verbal, self-injurious and destructive behaviour in ASD populations. Therefore, this review aims to fill this gap in the evidence base.

Relevance to the field of Educational Psychology

In Educational Psychology, Educational Psychologists (EPs) are often called into schools to help respond to behavioural difficulties and the mechanisms and/or communicative factors underpinning the behaviour (Hart, 2010) in children and adolescents aged 0-25. Evidence-based, cost-effective and easy-to-implement intervention that can be used at home and at school is a valuable asset for an EP to possess in their recommendations 'tool-box'. MBIs could function as an easily implemented, cost effective intervention (Duarte et al., 2019) if evidence supports the use of MBIs for reducing behavioural difficulties in ASD populations. The current review aims to examine this evidence base.

Review Question

Due to the rationale provided above, the current systematic review asks: 'What is the effectiveness of mindfulness-based interventions for reducing behavioural difficulties in children and adolescents with ASD'.

Critical Review of the Evidence Base

Systematic Literature Search

A systematic literature search was conducted in December 2021 using the online databases: PsycINFO (Ovid), Education Resource Information Centre (ERIC, EBSCO) and Web of Science using the search terms outlined in Table 1.

Table 1

Literature search terms

Search terms	PsycINFO	ERIC	Web of Science
Mindfulness-Based Interventions OR Mindfulness AND Autism Spectrum Disorder* OR Aspergers Syndrome OR Autism OR Autistic Spectrum Condition OR Autistic Children OR Autistic Psychopathy OR Early Infantile Autism OR Pervasive Developmental Disorders AND Behavior?	47	16	107

A total of 170 studies were identified across the three databases. These studies were screened by title and abstract using pre-determined inclusion and exclusion criteria, as outlined in Table 2. Where studies did not meet the criteria, they were excluded from the review. Figure 1. Outlines the screening process undertaken to identify relevant studies. The four studies excluded at full text screening are set out in appendix A. No additional studies were identified through an ancestral hand search. Table 3. outlines the six studies included in the final review.

Table 2

Inclusion and Exclusion Criteria

		Inclusion Criteria	Exclusion Criteria	Rationale
1	Age of participants	Under the age of 25	Over the age of 25	The current review is interested in examining the impact of MBIs for use in Educational Psychology. The SEND Code of Practice (2014) outlines the age range relevant to the work of EPs as 0-25.
2	Diagnosis	The participants have an official diagnosis of ASD	Participants are awaiting official diagnosis or have no diagnosis	The current review aims to examine the effectiveness of MBIs in ASD populations. Therefore, a diagnosis of ASD is needed.
3	Content of the intervention	Mindfulness must be a central aspect of the intervention	Mindfulness is a minor aspect of the intervention	As this review is asking whether MBIs are effective, if an intervention involves additional aspects other than mindfulness, mindfulness must be considered a central aspect of the overall intervention. This is because it will become unclear as to which variables are leading to specific outcomes and, therefore, it will become difficult to accurately determine

whether mindfulness in and of itself led to decreases in behavioural difficulties.

4	Mindfulness training	Mindfulness training is delivered directly to the child or young person, either by a trained professional or a trained parent	Mindfulness is not delivered directly to the child or young person. For example, mindfulness training is delivered to parents only and the parent does not train the child in mindfulness	This review is interested in the effectiveness of MBI for children and young people directly. Therefore, training must be delivered directly to the child or young person.
5	Epistemological underpinning	Must be a quantitative, empirical evaluation of mindfulness intervention	Anecdotal reports, case studies, qualitative research	Due to the review question being an 'effectiveness' question, then quantitative studies are more appropriate to answering this type of review question (Petticrew & Roberts, 2003).
6	Outcome variables	At least one outcome measure should measure a child or young	Outcome variables that do not explicitly measure behaviour or variables	Due to the current review examining the effectiveness of mindfulness intervention for behavioural difficulties, behavioural difficulties here are defined as verbal or physical

persons externalised (objective, observable) behaviour, including verbal, physical, destructive, self-injurious behaviour which measure internalised behaviour externalised behaviours, not internalised social and emotional difficulties.

7	Peer review	The study must appear in a peer reviewed journal	Unpublished articles or thesis projects	In order to confidently examine the effectiveness of MBIs, only studies that have gone through the peer review process will be considered. This is due to the peer review process encouraging high quality research and rigorous evaluation by experts within the field.
8	Language	Studies are available in English	Studies are only in a language other than English	As the reviewer is English, in order to effectively and accurately review research articles, these articles must be in English.

Figure 1

Flow Chart of the Literature Search

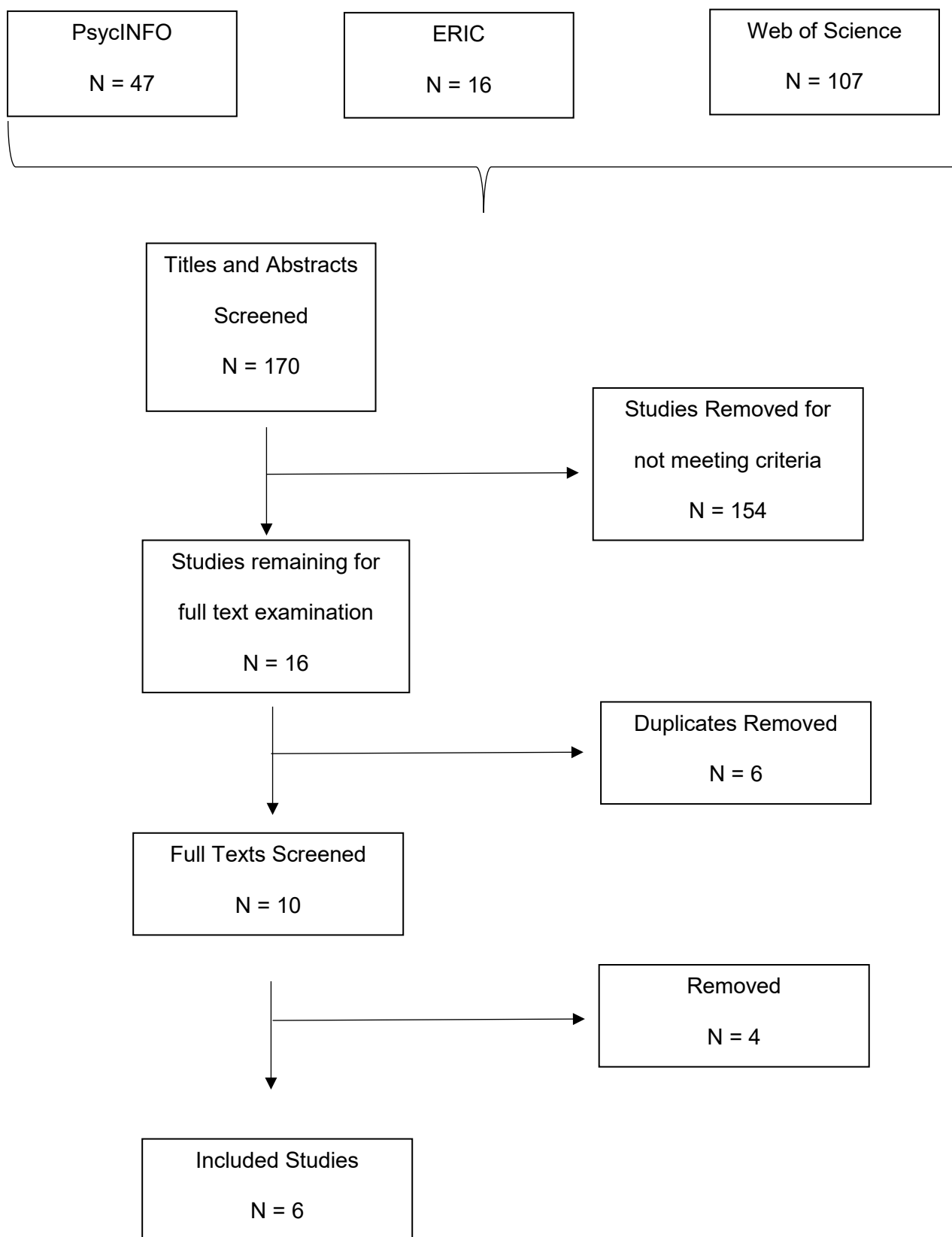


Table 3

List of Six Included Studies

Full journal reference
Singh, N. N., Lancioni, G. E., Manikam, R., Winton, A. S., Singh, A. N., Singh, J., & Singh, A. D. (2011A). A mindfulness-based strategy for self-management of aggressive behavior in adolescents with autism. <i>Research in Autism Spectrum Disorders</i> , 5(3), 1153-1158.
Singh, N. N., Lancioni, G. E., Singh, A. D., Winton, A. S., Singh, A. N., & Singh, J. (2011B). Adolescents with Asperger syndrome can use a mindfulness-based strategy to control their aggressive behavior. <i>Research in autism spectrum disorders</i> , 5(3), 1103-1109.
Ahemaitijiang, N., Hu, X., Yang, X., & Han, Z. R. (2020). Effects of meditation on the soles of the feet on the aggressive and destructive behaviors of Chinese adolescents with autism spectrum disorders. <i>Mindfulness</i> , 11(1), 230-240.
Ridderinkhof, A., de Bruin, E. I., Blom, R., & Bögels, S. M. (2018). Mindfulness-based program for children with autism spectrum disorder and their parents: Direct and long-term improvements. <i>Mindfulness</i> , 9(3), 773-791.
Singh, N. N., Lancioni, G. E., Karazsia, B. T., Myers, R. E., Kim, E., Chan, J., ... & Janson, M. (2019). Surfing the urge: An informal mindfulness practice for the self-management of aggression by adolescents with autism spectrum disorder. <i>Journal of Contextual Behavioral Science</i> , 12, 170-177.
Singh, N. N., Lancioni, G. E., Medvedev, O. N., Hwang, Y. S., & Myers, R. E. (2021). Real-time telehealth treatment team consultation for self-injury by individuals with autism spectrum disorder. <i>Advances in neurodevelopmental disorders</i> , 5(2), 170-182.

Critical appraisal of included studies

The Gough (2007) Weight of Evidence (WoE) Framework was used to critically appraise the included studies. Overall WoE (WoE D) is comprised of three dimensions: the methodological quality of the evidence (WoE A); methodological relevance to the current review question (WoE B) and the relevance of the topic of study to the current review question (WoE C). An average of these scores was calculated to provide an overall WoE D.

WoE A comprises the methodological quality of the evidence in relation to quality standards. Five of the included studies were Single-Case Experimental Designs (SCED). For these studies, the Horner et al. (2005) critical appraisal protocol was used to assess for the methodological quality of the studies. One study (Ridderinkhof et al., 2018), was a repeated measures design and was appraised using the Law et al. (1998) quantitative appraisal protocol. On each appraisal item, the studies were given a rating out of three based on how much of the quality criteria were fulfilled (Gough, 2007). See Appendix C for completed protocols. Appendix D provides an overview of the WoE A weightings for each of the included studies. WoE A scores were obtained by scores being averaged across each of the seven dimensions of both the Horner et al. (2015) and the Law et al. (1998) protocol. The evidence ratings assigned across all WoE A dimensions were then averaged to give an overall WoE A rating.

For WoE B, Petticrew and Roberts (2003) typology was used to determine the appropriateness of the studies' research designs for addressing the current review question. All six of the included studies were rated with a 'medium' weighting threshold as five studies were SCED and one study was a repeated measures design (See Appendix E).

WoE C assessed how appropriate the studies' focus is to the current review question (Gough, 2007). All studies were assessed according to the criteria outlined in Appendix F. An overview of these scores for each study is provided in Appendix G. Table 4 outlines calculated WoE scores for each study and an overall WoE D score and rating.

Table 4

Weight of Evidence (WoE) ratings for the studies evaluated in this review

	WoE A	WoE B	WoE C	WoE D
Singh et al. (2011A)	2.52	2	2.17	2.23 (Medium)
Singh et al. (2011 B)	2.61	2	2.17	2.26 (Medium)
Ahemaitijiang et al. (2020)	2.66	2	2.83	2.5 (High)
Ridderinkhof et al. (2018)	2.19	2	2.83	2.12 (Medium)
Singh et al. (2021)	2.76	2	2.17	2.31 (Medium)
Singh et al. (2019)	2.57	2	2.33	2.3 (Medium)

Note. <1.5 is low; 1.5 – 2.4 is medium; >2.4 is high

Participants and Setting

Across the six included studies, 60 participants were involved. In all studies except Ridderinkhof et al. (2018) 3 participants were studied, in Ridderinkhof et al.’s (2018) study, 45 children participated. Across the studies an age range of 8-19 was observed, hence a predominant focus in secondary aged young people. All participants had a clinical diagnosis of ASD, however, due to the varying diagnostic criteria historically used to diagnose ASD; 6 participants identified as having ASD, 7 autism, 17 Asperger’s and 25 Pervasive Developmental Disorder-Not Otherwise Specified (PDD-NOS).

Horner et al.’s (2005) appraisal protocol sets out that the demographic features of participants should be described sufficiently, the process of selection should be outlined effectively as well as the physical setting the intervention took place in. Across the five studies appraised using Horner et al.’s (2005) protocol, there was a good general description

of the demographics of participants, however, this sometimes excluded ethnicity data. In Ridderinkhof et al. (2018), the sample was described in good detail, however, the size of the sample was not justified. This was reflected in WoE A, in line with Law et al.'s (1998) coding protocol.

As is common in ASD diagnosis and statistics, participants were predominately male. All studies except Ridderinkhof et al.'s (2018) had solely male samples. Ridderinkhof et al.'s (2018) study had 80% male participants (n=36). All studies, excluding Ridderinkhof et al.'s (2018) study, included a qualitative summary of the participants' behavioural difficulties.

In all studies, with the exception of Singh et al. (2021) and Ridderinkhof et al. (2018), there was a limited description of how participants were selected. In Ahemaitijiang et al. (2020) no description of how participants were selected was given. This is reflected in WoE A and could indicate potential selection bias in studies.

Description of the setting that the intervention was carried out in was also limited, with the exception of Singh et al. (2021) and Singh et al. (2011B). Therefore, all other studies (Ahemaitijiang et al., 2020; Singh et al., 2011A; Singh et al., 2019), excluding Ridderinkhof et al. (2018) who were appraised using a different coding protocol, received a low WoE A rating for this criterion.

Research Design

Five of the included studies utilised a SCED and one study (Ridderinkhof et al., 2018) utilised a repeated measures design. No randomised control trials (RCT) or alternative experimental designs that met inclusion criteria were identified during systematic searching. However, SCED and repeated measure designs can provide a viable alternative to large group studies such as RCTs, particularly when rigorously designed (Lobo et al., 2017). SCEDs can be particularly effective when resources are limited and can be designed to have strong internal validity for assessing causal relationships between interventions and outcomes and external validity for generalisability of results (Lobo et al., 2017). Therefore,

when considering the appropriateness of the studies' research design for addressing the current review question (WoE B), all studies were awarded a WoE B 'medium' rating. This corresponds to the RCT being considered the 'gold standard' of design, but SCED being an appropriate alternative when rigorously designed (Lobo et al., 2017).

Similarly, a repeated measures design, as seen in Ridderinkhof et al. (2018) would not be regarded as a 'gold standard' in experimental research but can equally be useful design method when practical limitations apply. Therefore, Ridderinkhof et al.'s (2018) study also received a WoE B 'medium' rating.

Additionally, it is regarded in quality criteria that SCED should provide at least three demonstrations of experimental effect and dependent variables should be measured repeatedly over time (Horner et al., 2005), as all included SCED studies demonstrated at least three experimental effects, this was reflected in WoE A.

Mindfulness-Based Intervention

The focus of the current review question regarded MBI delivered directly to participants. Four of the studies (Ahemaitijiang et al.2020; Singh et al., 2011A; Singh et al., 2011B; Singh et al., 2021) used a 'Soles of the Feet' mindfulness programme, Ridderinkhof et al. (2018) used the 'MYmind' mindfulness programme and Singh et al. (2019) used a 'Surfing the Urge' mindfulness practice. Criteria regarding, the implementation of intervention, modification of the intervention and monitoring of the intervention were considered in WoE C criteria.

The Soles of the Feet mindfulness programme trains individuals to focus their attention on a neutral part of the body, the soles of the feet, when experiencing feelings of anger that may result in behavioural outbursts (Singh et al., 2011C). Individuals were individually taught Soles of the Feet mindfulness in a period of training which varied slightly between studies, see Appendix H for details. The period of training was reflected in WoE C.

Ridderinkhof et al. (2018) utilised the MYmind mindfulness programme. This is a group-based mindfulness intervention consisting of nine, weekly group sessions for children and

parents separately, lasting 1.5 hours. Children and parents follow an additional booster session nine weeks after the final session to encourage continuing practice. The programme includes mindfulness exercise based on Mindfulness-based cognitive therapy such as breathing meditation, body scans, 3-minute breathing space and yoga practices.

Singh et al. (2019) used a Surfing the Urge Practice. This involved an experienced mindfulness trainer teaching the participants in individual 30-minute sessions, three times a week, for the first two weeks, for a total training time of 3 hours. The practice involved thinking about urges and, when feeling an urge, bringing attention back to the breath, using waves as a visual metaphor, until calm is achieved.

The fidelity of training was explicitly addressed in Ahemaitijiang et al. (2020) and Singh et al. (2021) using fidelity checklists (Singh et al., 2011C), through videotaped sessions and assessment from the trainers and a MYmind Treatment Adherence and Competence Scale for the MYmind mindfulness programme. Fidelity of training is outlined in WoE C criteria, with all studies scoring highly except for Singh et al. (2011A) who received a medium rating for implementation of intervention.

WoE C equally reflected the importance of the intervention being delivered as intended and not being modified, particularly when parents were implementing the MBI. All studies delivered mindfulness intervention as originally intended during the development of the interventions.

Singh et al. (2011A) and Singh et al. (2011B) did not provide information on the monitoring of whether participants accurately implemented the mindfulness intervention and, therefore, this was reflected in WoE C.

Measures

Rates of externalising behaviour were measured by parents of participants who systematically recorded instances of behaviour day to day in Singh et al. (2011A), Singh et al. (2011B), Ahemaitijiang et al. (2020), Singh et al. (2021) and Singh et al. (2019). This

included parents recording instances of physical aggression, verbal aggression, destructive behaviour and self-injury. In all studies these behaviours were operationalised further (for example, 'arm and hand biting', 'kicking', 'slapping', 'breaking'), in detail, depending on the precise pre-existing behavioural difficulties of the participants. Definitions of behavioural difficulties were assessed in WoE C, this included both breadth and depth of definition and all studies were rated 'medium' or 'high'.

To ensure appropriate rating and data collection, inter-rater reliability was assessed. This typically consisted of siblings (Singh et al, 2011A; Singh et al., 2011B), 'nannies' (Ahemaitijiang et al., 2020) or other trained professionals (Singh et al., 2021). Inter-rater reliability was conducted for all studies except Ridderinkhof et al. (2018). This was due to questionnaire measures being used as outcome variables. Inter-rater reliability was identified as high in all studies, where it was assessed, and this was reflected in WoE A criteria.

Ridderinkhof et al. (2018) used the Child Behaviour Checklist (CBCL) (a questionnaire measure completed by parents about their children) for children under the age of 11 and the Youth Self Report (YSR) measure (a self-report questionnaire measure completed by young people on themselves) for individuals over the age of 11 to assess for externalising behaviours. For these measures Cronbach's α was .91 for the CBCL of mothers, .89 for the CBCL of fathers, and .76 for the YSR.

Horner et al.'s (2005) protocol also reflected that the measures used were described with operational and replicable precision. All SCED studies scored highly on this appraisal item.

Results

In order to examine the relationship between pre-intervention baseline behaviour levels and intervention phase behaviour levels, Tau-U effect sizes were calculated. In Singh et al. (2019) comparable Phi coefficient effect sizes were reported and in Ridderinkhof et al. (2018) the reported Cohen's d effect sizes were converted to r .

All studies found medium to large negative effects for the implementation of MBI compared to pre-intervention baseline phases excluding Ridderinkhof et al. (2018) who reported small effects. Negative effect sizes indicate a reduction in behaviour over time. These effect sizes were statistically significant excluding participant B2's baseline-intervention effect in Singh et al. (2011B) and participant C3 for the 'frequency of destructive behaviour per week' follow up effect size in Ahemaitijiang et al. (2020) (See Table 5 below).

Furthermore, five studies scored a 'medium' WoE rating and one study (Ahemaitijiang et al., 2020) scored a 'high' rating for overall WoE. Ahemaitijiang et al. (2020) reported medium effect sizes and one large effect size. Largest negative effect sizes were seen for the follow up phase for the 'frequency of physical aggression per week' outcome measure (Ahemaitijiang et al., 2020).

Singh et al. (2011B) reported large negative effect sizes for the number of aggressive behaviours during follow up compared to the pre-intervention baseline phase for two of its three participants. Equally, Singh et al. (2021) reported large negative effects for the frequency of self-injurious behaviours when comparing baseline and intervention data and Singh et al (2019) reported a large effect for verbal aggression when comparing baseline and intervention data.

In terms of specific MBI used, studies which used the Soles of the Feet mindfulness technique showed moderate and large negative effects at both intervention and follow up phases, Surfing the Urge intervention showed large and medium effect sizes during the intervention phase and the MYmind mindfulness programme showed small effects during the intervention and small to medium effects during the follow up phase.

Table 5.

Table of effect sizes and WoE D ratings

Study	Outcome	Target Participant	Baseline – intervention effect		Follow up effect		WoE D
			Effect size	P value	Effect Size	P Value	
Singh et al. (2011A)	Number of aggressive behaviours	A1	Tau-u = - 0.344** (Medium)	P = 0.048	Tau – U = - 0.712** (Medium)	P=0.006	2.23 (Medium)
		A2	Tau – U = - 0.522** (Medium)	P = 0.000	Tau – U = - 0.786** (Medium)	P = 0.001	
		A3	Tau- U = - 0.526** (Medium)	P = 0.000	Tau – U = - 0.759** (Medium)	P=0.000	
Singh et al. (2011B)	Number of aggressive behaviours	B1	Tau-U = - 0.512** (Medium)	P=0.018	Tau-U = - 0.926*** (Large)	P=0.030	2.26 (Medium)
		B2	Tau-U = - 0.363** (Medium)	P=0.50	Tau-U = - 0.853*** (Large)	P=0.021	
		B3	Tau-U = - 0.499** (Medium)	P=0.004	Tau-U = - 0.805** (Medium)	P=0.011	
Ahemaitijiang et al. (2020)	Frequency of verbal aggression per week	C1	Tau-U = - 0.389** (Medium)	P=0.005	Tau-U= - 0.775** (Medium)	P=0.050	2.5 (High)
		C2	Tau-U = - 0.500** (Medium)	P=0.000	Tau-U = - 0.767** (Medium)	P=0.019	

		C3	Tau-U = - 0.594** (Medium)	P=0.000	Tau-U = - 0.736** (Medium)	P=0.008	
Frequency of physical aggression per week		C1	Tau-u = - 0.440** (Medium)	P = 0.003	Tau-U = - 0.926*** (Large)	P=0.030	
		C2	Tau-u = - 0.529** (Medium)	P=0.000	Tau-U = - 0.830** (Medium)	P=0.015	
		C3	Tau-U = - 0.583** (Medium)	P=0.000	Tau-u = - 0.749** (Medium)	P=0.007	
Frequency of destructive behaviour per week		C1	Tau-U = - 0.391** (Medium)	P=0.005	Tau-u = - 0.775** (Medium)	P=0.050	
		C2	Tau = - 0.480** (Medium)	P=0.001	Tau-u = - 0.795** (Medium)	P = 0.048	
		C3	Tau-u = - 0.590** (Medium)	P=0.000	Tau-u = - 0.756** (Medium)	P=0.052	
Singh et al. (2021)	Frequency of self-injury	D1	Tau – U = - 1.00*** (Large)	P = 0.004	-	-	2.31 (Medium)
		D2	Tau – u = - 0.88*** (Large)	P = 0.002	-	-	
		D3	Tau-u = - 0.84** (Medium)	P < 0.001	-	-	

Singh et al. (2019)	Verbal Aggression	E1, E2, E3	Phi = 0.550*** (Large)	P<.001	-	-	2.3 (Medium)
	Physical Aggression	E1, E2, E3	Phi = 0.293** (Medium)	P = .003	-	-	
Ridderinkhof et al. (2018)	CBCL Externalising		r=-0.104* (Small)	P<.05	r=-0.206* (Small)	P<.01	2.12 (Medium)
	YSR externalising		r=-0.100* (Small)	Not sig	r=-0.291** (Small)	P<.05	

Note. Tau-U effect sizes = +/-0 to +/-0.31 (small); +/-0.32 to +/-0.84 (Medium)**; +/-0.85 to +/-1 (Large)***

Phi effect sizes = 0.1 (small); 0.3 (medium effect)**; 0.5 (large effect)***

R effect sizes = 0.1 (small); 0.3 (medium)**; 0.5 (Large effect)***

Conclusions

The current review aimed to investigate the effectiveness of mindfulness-based interventions for reducing behavioural difficulties in individuals with ASD. Six research articles were identified for review. All six studies demonstrated reductions in the behavioural difficulties of individuals with ASD upon the implementation of MBIs. Medium to large effect sizes were identified for reductions in behavioural difficulties both after initial implementation and at follow up (where a follow-up was conducted). All effect sizes, excluding two, were found to be statistically significant. Smallest effect sizes were identified in Ridderinkhof et al., (2018) where the 'MYmind' intervention was implemented. Largest effect sizes were identified for the 'Soles of Feet' Mindfulness programme. After critical appraisal using Gough's (2007) Weight of Evidence (WoE) framework, five studies scored a 'Medium' overall WoE score and one study (Ahemaitijiang et al., 2020) score an overall 'High' WoE score. Consequently, the current systematic review implies that a good and, at times, a high-quality evidence base demonstrates strong effects for the implementation of MBIs in reducing physical, verbal, self-injurious and destructive behavioural difficulties for children and adolescents with ASD.

Recommendations

As a result of this finding, the application of MBIs for children and adolescents with ASD exhibiting behavioural difficulties could be considered appropriate. Therefore, in the field of Educational Psychology, practitioners could consider the systemic use of MBIs for individuals to apply at home, school and when in the community as an effective approach at reducing behavioural difficulties.

The evidence base appraised in the current review identified three approaches to MBI; the 'Soles of the Feet', 'Surfing the Urge' and 'MYmind' programmes. Four studies examined the Soles of the Feet programme, therefore, despite all programmes exhibiting significant effects, the programme with the strongest current evidence base is the Soles of the Feet programme. Consequently, this specific MBI could currently be prioritised over the Surfing

the Urge technique and the MYmind programme. Furthermore, the MYmind programme is a group run, weekly programme led by a trained professional, whereas, once taught, Soles of the Feet and Surfing the Urge are applied in the moment by individuals, when needed. The group-based nature of the MYmind programme will also have cost implications over the relatively cost-effective Soles of Feet and Surfing the Urge interventions. Overall, in professional practice EPs should weigh up this rationale and apply the 'best fit' intervention while considering that there may well be individual differences in preference of MBI that parents and individuals with ASD wish to engage with.

Limitations

Despite a majority of outcomes variables showing medium to high effects, limitations have been identified. Firstly, the heterogenous nature of SCED causes difficulties when generalising results. Therefore, despite consistent findings across samples, generalisation is limited (see future research below).

Secondly, none of the included studies took place in a UK context. A lack of research emphasis into MBIs in the UK means that generalisation of results to a UK population is limited. However, a majority of studies included in the review were conducted in western countries. Therefore, it is reasonable to assume that comparable results would be identified in the UK.

Thirdly, the research base into MBIs is built on the contributions of a small circle of academics. Although no bias was identified in the appraised studies, diversity in authorship would provide stronger evidence of effects and reduce the possibility of researcher bias.

Lastly, the emphasis in this research base centres on behavioural outcomes and fails to investigate the underlying causes of the behaviour. For example, a lack of research into to link between MBIs and emotional regulation in individuals with ASD is recognised. A focus on the underlying factors of behaviour may further strengthen the effects and understanding of MBI in ASD. This could be addressed in future research.

There are also limitations to the current systematic review. Critically, there is an overreliance on the Soles of the Feet MBI in the identified studies with only one study looking at Surfing the Urge (Singh et al., 2019) and MYmind (Ridderinkhof et al., 2018) MBI respectively. Consequently, the inference that can be made about the effectiveness of MBIs in general becomes limited and is mainly restricted to the effectiveness of the Sole of Feet MBI. Furthermore, five out of the six included studies were found to be SCED, although this was accounted for in the WoE framework, confidence in the findings of this review are limited as a result.

Future research

Although SCED can be considered an effective method of research (Lobo et al., 2017), for generalisation purposes and to tackle to limitation of heterogeneity, Randomised Control Trials should be conducted (Harper et al., 2013). This would also provide a gold standard measure of effectiveness, strengthen the evidence base and may act to widen the basis of academics conducting research in MBIs for ASD (Harper et al., 2013).

Due to the uncovering of the plausible effectiveness of MBIs in ASD populations, research trails should be conducted in a UK context. This would strengthen the applicability and generalisation to UK Educational Psychology practice.

Future research should also further investigate the effectiveness of MBIs in addressing the underlying factors of behavioural difficulties, for example, emotional regulation and executive functioning. There may be a theoretical basis for predicting that decreases in behavioural difficulties were observed in individuals with ASD due to the self-regulatory capabilities that MBIs provided them. Future research should seek to falsify this statement.

Overall, MBIs have been found to be effective at reducing a wide range of behavioural difficulties for individuals with ASD. Future research should develop this evidence base and MBIs should be considered as a part of professional practice in Educational Psychology.

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Appendix A: Details of Excluded Studies

Table A1. List of excluded studies at full review

Reference	Criteria Number	Rationale
Hwang, Y. S., Kearney, P., Klieve, H., Lang, W., & Roberts, J. (2015). Cultivating mind: Mindfulness interventions for children with autism spectrum disorder and problem behaviours, and their mothers. <i>Journal of Child and Family Studies</i> , 24(10), 3093-3106.	6	Observable behavioural outcomes not assessed
Drüsedau, L., Schoba, A., Conzelmann, A., Sokolov, A., Hautzinger, M., Renner, T. J., & Barth, G. M. (2021). A structured group intervention (TütASS) with focus on self-perception and mindfulness for children with autism spectrum disorder, ASD. A pilot study. <i>European Archives of Psychiatry and Clinical Neuroscience</i> , 1-9.	5	Mindfulness not a central aspect to intervention
Singh, N. N., Singh, S. D., Sabaawi, M., Myers, R. E., & Wahler, R. G. (2006). Enhancing treatment team process through mindfulness-based mentoring in an inpatient psychiatric hospital. <i>Behavior Modification</i> , 30(4), 423-441.	4	Mindfulness programme delivered to parents not directly to children
Harmony, C., & Woodard, C. R. (2020). Mindfulness Training for Staff in a School for Children with Autism and Other Developmental Disabilities: Effects on Staff Mindfulness and Student Behavior. <i>Advances in Neurodevelopmental Disorders</i> , 4(2), 113-121.	4	Mindfulness not delivered directly to students

Appendix B: Details of Included Studies

Table B1. Overview of the included studies: Mapping the Field

Study	Design	Participants	Type of Mindfulness-Based Intervention	Outcome variables	Country
Singh et al. (2011A)	A multiple-baseline single case experimental design	Three adolescents (14, 16, 17) with a diagnosis of ASD	Soles of feet delivered to young people	'Physical aggression' defined as hitting, kicking and biting	America
Singh et al. (2011B)	A multiple-baseline single case experimental design	Three adolescents (15, 13, 18) with a diagnosis of Asperger syndrome	Soles of feet delivered to young people	'physical aggression' defined as hitting, biting, scratching, punching, kicking, slapping, or destroying property	America
Ahemaitijiang et al. (2020)	A multiple-baseline single case experimental design	Three adolescents (14, 15, 17) diagnosed with mild levels of autistic behaviour	Soles of feet delivered to young people	Verbal aggression, physical aggression and destructive behaviours	China
Ridderinkhof et al. (2018)	Repeated measures design	45 children with ASD (8-19) and their parents, all children diagnosed with autism	Mymind – delivered to child and parents	Both internalising and externalising behaviour was measured parents reported child behaviour checklist or older children reported youth self report	Dutch
Singh et al. (2021)	A multiple-baseline single case experimental design	Three adolescents diagnosed with ASD (17, 19, 13)	Soles of feet – delivered directly to adolescents via zoom	Self injury hitting the head, face, and other body parts; arm and hand biting and self-pinching; and hand hitting and eye poking	America

Singh et al. (2019)	Multiple baseline single case experimental design	Three adolescents diagnosed with ASD (16, 17, 17)	Surfing the urge – taught to adolescents	Verbal and physical aggression Verbal aggression was defined as yelling, screaming, cursing, or threatening physical harm to family members. Physical aggression was defined as kicking, hitting with a closed fist, biting, slapping, or punching family members.	America
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Appendix C: WoE A Coding Protocols

Coding protocol: Ahemitijiang et al. (2020)

Coding Protocol: Single-Case Experimental Research Design

Adapted from Horner et al. (2005): The Use of Single-Subject Research to Identify Evidence-Based Practice in Special Education

Full Study Reference:

Ahemaitijiang, N., Hu, X., Yang, X., & Han, Z. R. (2020). Effects of meditation on the soles of the feet on the aggressive and destructive behaviors of Chinese adolescents with autism spectrum disorders. *Mindfulness*, 11(1), 230-240.

1. Description of Participants and Settings

(a) Participants are described with sufficient detail to allow others to select individuals with similar characteristics (e.g., age, gender, disability, diagnosis).

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(b) The process for selecting participants is described with replicable precision.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(c) Critical features of the physical setting are described with sufficient precision to allow replication.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

2. Dependent Variable

(a) Dependent variable is described with operational precision.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(b) Each dependent variable is measured with a procedure that generates a quantifiable index.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(c) Measurement of the dependent variable is valid and described with replicable precision.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(d) Dependent variables are measured repeatedly over time.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(e) Data are collected on the reliability or interobserver agreement associated with each dependent variable, and IOA levels meet the minimal standards (e.g., IOA = 80%; Kappa = 60%).

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

3. Independent Variable

(a) Independent variable is described with replicable precision.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(b) Independent variable is systematically manipulated and under control of the experimenter.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(c) Overt measurement of the fidelity of implementation for the independent variable is highly desirable.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

4. Baseline

(a) The majority of single-subject research studies will include a baseline phase that provides repeated measurement of a dependent variable and establishes a pattern of responding that can be used to predict the pattern of future performance, if introduction or manipulation of the independent variable did not occur.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(b) Baseline conditions are described with replicable precision.

- All quality criteria are met = 3

- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

5. Experimental control/internal validity

(a) The design provides at least three demonstrations of experimental effect at three different points in time.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(b) The design controls for common threats to internal validity (e.g., permits elimination of rival hypotheses).

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(c) The results document a pattern that demonstrates experimental control.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

6. External validity

(a) Experimental effects are replicated across participants, settings, or materials to establish external validity.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

7. Social validity

(a) The dependent variable is socially important.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(b) The magnitude of change in the dependent variable resulting from the intervention is socially important.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(c) Implementation of the independent variable is practical and cost effective.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

(d) Social validity is enhanced by implementation of the independent variable over extended time periods, by typical intervention agents, in typical physical and social contexts.

- All quality criteria are met = 3
- A majority of quality criteria are met = 2
- A limited amount of quality criteria is met = 1
- None of the quality criteria are met = 0

	Overall evidence rating (0-3)	Evidence descriptors
Description of participants and settings	1.3	Low
Dependent Variable	3	High
Independent Variable	3	High
Baseline	3	High
Experimental control/internal validity	2.3	Medium
External validity	3	High
Social validity	3	High

WoE A: 2.66 (High)

Coding Protocol: Ridderinkhof et al. (2018)

Coding Protocol: Quantitative Studies

Law, M. D. L. N. J., Stewart, D., Pollock, N., Letts, L., Bosch, J., & Westmorland, M. (1998).

Critical review form—quantitative studies. *McMaster University: Occupational Therapy Evidence-Based Practice Research Group.*

Critical Review Form – Quantitative Studies

Law, M., Stewart, D., Pollock, N., Letts, L. Bosch, J., & Westmorland, M.

<p>CITATION</p>	<p>Provide the full citation for this article in APA format:</p> <p>Ridderinkhof, A., de Bruin, E. I., Blom, R., & Bögels, S. M. (2018). Mindfulness-based program for children with autism spectrum disorder and their parents: Direct and long-term improvements. <i>Mindfulness</i>, 9(3), 773-791.</p>
<p>STUDY PURPOSE</p> <p>Was the purpose stated clearly?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p>	<p>Outline the purpose of the study. How does the study apply to your research question?</p> <p>To investigate whether a combined mindfulness-based program for children and their parents (MYmind) was beneficial for adolescents with ASD. The outcome measured investigated included behavioural outcomes. This is directly applicable to my review question which aims to investigate the effectiveness of MBIs on behavioural difficulties for children and adolescents with ASD.</p>
<p>LITERATURE</p> <p>Was relevant background literature reviewed?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p>	<p>Describe the justification of the need for this study:</p> <p>The study outlined relevant background literature. Additional literature could have been identified, including alternative MBIs.</p>
<p>DESIGN</p> <p>RCT = 3 Quasi-Experimental Design = 3 Case-Control = 2 Cohort Study = 2 Single Case Design = 2 Pre-post repeated measures = 2 Cross-Sectional = 2 Case study = 1 Unspecified/non-experimental = 0</p>	<p>Describe the study design. Was the design appropriate for the study question? (e.g., for knowledge level about this issue, outcomes, ethical issues, etc.):</p> <p>The design was appropriate – although stronger experimental design would be preferred.</p> <p>Specify any biases that may have been operating and the direction of their influence on the results:</p> <p>Some of the named authors on the paper were developers of the MYmind MBI. This could have resulted in bias, although none was evident.</p>
<p>SAMPLE</p> <p>N =</p> <p>Was the sample described in detail?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p> <p>Was sample size justified?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p>	<p>Sampling (who; characteristics; how many; how was sampling done?) If more than one group, was there similarity between the groups?:</p> <p>45 children with ASD (8-19), selective sampling was not undertaken. Sample size not justified</p> <p>Describe ethics procedures. Was informed consent obtained?:</p> <p>Limited description of ethics procedure.</p>

<p>OUTCOMES</p> <p>Were the outcome measures reliable?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p> <p>Were the outcome measures valid?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p>	<p>Specify the frequency of outcome measurement (i.e., pre, post, follow-up): Pre-test, post-test, 2 months follow-up, 1 year follow-up</p> <table border="1" data-bbox="499 286 1396 611"> <tr> <td data-bbox="499 286 954 611"> <p>Outcome areas:</p> <p>For behavioural outcomes:</p> <ul style="list-style-type: none"> Internalising symptoms Externalising symptoms </td> <td data-bbox="954 286 1396 611"> <p>List measures used.:</p> <p>CBCL (Child Behaviour Checklist) YSR (Youth Self Report)</p> </td> </tr> </table>	<p>Outcome areas:</p> <p>For behavioural outcomes:</p> <ul style="list-style-type: none"> Internalising symptoms Externalising symptoms 	<p>List measures used.:</p> <p>CBCL (Child Behaviour Checklist) YSR (Youth Self Report)</p>
<p>Outcome areas:</p> <p>For behavioural outcomes:</p> <ul style="list-style-type: none"> Internalising symptoms Externalising symptoms 	<p>List measures used.:</p> <p>CBCL (Child Behaviour Checklist) YSR (Youth Self Report)</p>		
<p>INTERVENTION</p> <p>Intervention was described in detail?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p> <p>Contamination was avoided?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p> <p>Cointervention was avoided?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p>	<p>Provide a short description of the intervention (focus, who delivered it, how often, setting). Could the intervention be replicated in practice?</p> <p>MYmind, a mindfulness-based program for families with parallel sessions for children and parents. MYmind for families with ASD consists of nine weekly group sessions for children and parents separately, lasting 1.5 h. Children and parents together follow an additional booster session nine weeks after the final session, to encourage continuing with meditation practices. The intervention is provided in a group in a designated setting.</p> <p>Cointervention – Medication was used by some children during the study and other intervention had been provided. These points were acknowledged but not accounted for.</p>		
<p>RESULTS</p> <p>Results were reported in terms of statistical significance?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p> <p>Were the analysis method(s) appropriate?</p> <p>All quality criteria met = 3 Majority of quality criteria met = 2 Limited amount of criteria met = 1 No quality criteria met = 0</p>	<p>What were the results? Were they statistically significant (i.e., $p < 0.05$)? If not statistically significant, was study big enough to show an important difference if it should occur? If there were multiple outcomes, was that taken into account for the statistical analysis?</p> <p>Due to the nature of the study, the authors report effects over time. It is also indicated whether the effect sizes are statistically significant.</p> <p>Statistics compared to a control group would have allowed for further analysis regarding the effectiveness of the intervention.</p>		

	Overall evidence rating (0-3)	Evidence Descriptors
Study Purpose	3	High
Literature	2	Medium
Design	2	Medium
Sample	1.5	Medium
Outcomes	2	Medium
Intervention	2.33	Medium
Results	2.5	Medium
WoE A: 2.19 (Medium)		

Appendix D: Overview of the WoE A Calculations

Table D1. An overview of the calculated WoE A scores and descriptors for each category identified in the Horner et al. (2005) protocol

Study	Description of Participants and Settings	Dependent Variable	Independent Variable	Category from the WoE Protocol			Social Validity
				Baseline	Experimental Control/Internal Validity	External Validity	
Ahemaitijiang et al. (2020)	1.3	3	3	3	2.3	3	3
Singh et al. (2011A)	1.3	2.6	3	2.5	2.3	3	3
Singh et al. (2011B)	2	3	3	2.5	2.75	3	3
Singh et al. (2019)	1.6	2.8	3	2.5	2.6	2	2.75
Singh et al. (2021)	2.3	3	3	2.5	2.75	3	2.75

Note. <1.4 is low; 1.5-2.4 is medium; >2.5 is high

Table D2. An overview of the calculated WoE A scores and descriptors for each category identified in the Law et al. (1998) protocol

Category of the WoE Protocol							
Study	Study Purpose	Literature	Design	Sample	Outcomes	Intervention	Results
Ridderinkhof et al. (2018)	3	2	2	1.5	2	2.33	2.5

Note. <1.4 is low; 1.5-2.4 is medium; >2.5 is high

Appendix E: WoE B Coding Protocol

Table E1. *Weight of Evidence B (WoE B): Methodological Relevance*

WoE B Rating (Qualitative Descriptor)	Criteria	Rational
3 (High)	Randomised Control Trails	
2 (Medium)	Cohort studies, quasi-experimental studies, single-case experimental designs, repeated measures design	Petticrew & Roberts (2003) constructed a typology of evidence to outline the appropriateness of different methodological designs to explore the effectiveness of a particular intervention
1 (Low)	Qualitative research, survey, non- experimental evaluation	

Appendix F: WoE C Coding Protocol

Table F1. *Weight of Evidence (WoE C): Topic Relevance*

Criteria	WoE Rating and descriptor	Rationale
Implementation of intervention	<p>3) Mindfulness training provided to participants by trained professional over a recommended time period/training provided by a professional</p> <p>2) Training delivered over a recommended time period but not by a trained professional/training delivered by author</p> <p>1) Training delivered for less than the recommended time period/training self-taught or unspecified</p>	<p>For a study to be relevant to the ‘question how effective is mindfulness-based intervention?’, the mindfulness intervention needs to have been implemented effectively (i.e high fidelity of training).</p>
Modification of Intervention	<p>3) Mindfulness-based intervention is implemented as intended – no modifications made to the intervention itself</p> <p>2) Some minor modifications were made</p> <p>1) Major modifications were made to the intervention</p>	<p>No modification is required in order to show that the intervention is effective when delivered in its intended form.</p>

Definition of behavioural difficulties	<p>3) A broad range of observable behavioural difficulties was assessed. This means two or more 'paradigms' of behaviour (i.e 'physical aggression' is classed as one paradigm of behaviour. This category of behaviour would include sub-categories such as hitting, kicking etc.) was assessed.</p> <p>2) A narrow range of observable behaviour is assessed. This means one paradigm (i.e 'verbal aggression') is assessed only.</p> <p>1) A limited range of individual behaviours are assessed (i.e hitting measured only)</p>	<p>The broader the range of observable behaviour measured, the higher the relevance. This is because, in order to know if the intervention is effective at reducing behavioural difficulties, then the evidence will need to look at a broad range of behavioural difficulties as outcome measures.</p>
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Confidence in diagnosis	<p>3) Diagnosis from medical professional confirmed by study-based screening</p> <p>2) Diagnosis from medical professional pre-study only</p>	<p>In order to know the relevance of the study to the topic, we need to know if there is confidence in the diagnosis of ASD so we can accurately attribute the effects of MBIs in ASD population .</p>
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	1) Unspecified	
Long term efficacy	<p>3) Effects maintained for 6 months or more after intervention</p> <p>2) Effects maintained for between 3 months and 6 months after</p> <p>1) Effect maintenance unspecified or maintained for less than 3 months</p>	<p>For the intervention to be effective there needs to be long term effects in reducing Behaviour difficulties. For studies to be relevant to question they need to show long term effectiveness.</p>
Monitoring of intervention	<p>3)The mindfulness technique used and applied by participants is monitored for its accuracy of implementation (e.g it is used at the right time and when using mindfulness, it is the mindfulness technique taught to them) frequently</p> <p>2) It's monitored on occasion</p> <p>1) It is not monitored/unspecified so assumed no monitoring has taken place</p>	<p>To ensure topic relevance, confidence that the MBI is being implemented by individuals at the appropriate times (i.e when angry) is important. Therefore, the correct implementation of the MBI by individuals should be monitored by researchers.</p>

Appendix G: Overview of the WoE C Calculations

Table G1. An overview of the WoE C scores across the different categories on the studies relevance to the topic

Study	Category from the WoE C Protocol					
	Implementation of Intervention	Modification of Intervention	Definition of behavioural difficulties	Confidence in Diagnosis	Long Term Efficacy	Monitoring of Intervention
Singh et al. (2011A)	2	3	1	2	2	3
Singh et al. (2011B)	3	3	1	2	1	3
Ahemitijiang et al. (2020)	3	3	3	3	2	3
Ridderinkhof et al. (2017)	3	2	3	3	3	3
Singh et al. (2021)	3	3	3	2	1	1
Singh et al. (2019)	3	3	2	3	1	2

Note. <1.4 low; 1.5-2.4 is medium; >2.5 is high

Appendix H: Training Protocols for Sole of Feet Mindfulness

Table H1. *An overview of the training protocols carried out in the studies implementing the Soles of Feet Mindfulness program*

Study	Soles of Feet Training Protocol
Singh et al. (2011A)	30-minute training sessions delivered by a trained professional for 5 consecutive days
Singh et al. (2021)	30-minute training sessions were delivered by a trained professional three times in the first week and for three, 15-minute sessions in the second week
Singh et al. (2011B)	Mothers were taught by a trained mindfulness practitioner to consequently deliver mindfulness training to their children
Ahemitijiang et al. (2020)	Mothers were trained to provide mindfulness training to their children. Mothers taught their children in 15-minute sessions twice a day for the first seven days before a gradual reduction in training in weeks two and three, for 6 hours total training