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The Effectiveness of Mindfulness-Based Therapy in Improving Well-Being: Autism Spectrum Disorder (ASD): A Systematic Literature Review

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Abstract
This study aims to systematically review the effectiveness of mindfulness-based therapy in improving the well-being of children with autism spectrum disorder (ASD) through a Systematic Literature Review (SLR) approach. Articles were collected from the Scopus database using the keywords "autism spectrum disorder AND mindfulness," "Mindfulness-Based Therapy AND Autism," and "Mindfulness Intervention AND Autism." The selection process followed the PRISMA guidelines, with inclusion criteria comprising quantitative studies with an experimental design involving mindfulness interventions for individuals with ASD, while exclusion criteria included non-empirical or qualitative-based research. The results indicate that mindfulness interventions, such as MBSR and Mymind, are effective in improving emotional regulation, reducing stress, enhancing social skills, and improving executive function and brain activity in children with ASD. Interventions involving families also strengthen the positive effects of therapy. These findings contribute to the development of psychological interventions that can support their application in clinical and special education settings, with recommendations for further research using randomized controlled trial (RCT) designs with a multilevel and collaborative approach across educational and clinical settings to test the long-term effectiveness of mindfulness, preferably with a sufficient number of participants to generalize the research findings.

Keywords: *Mindfulness, Autism Spectrum Disorder, Psychological Well-Being, psychological intervention*

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Introduction
Autism Spectrum Disorder (ASD) affects 1 in 54 children approximately 6 million adults in the US have been diagnosed with ASD. Many adults with ASD experience anxiety and depression, which impact their independence, employment, and increase their risk of suicide (Pagni et al., 2023). In Indonesia, the number of autism cases has been increasing year by year. According to the Central Statistics Agency, there are currently around 270.2 million children with autism in Indonesia, with a growth rate of approximately 3.2 million. while other data from the Statistics and Computing Center for Special Schools indicate that the number of autistic students in Indonesia in 2018 was 133,826, with an increase in 2019 to 144,102 (Lutfiah Hartadi et al., 2025). This clearly demonstrates that the prevalence of autism among children continues to increase significantly.

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Autism is a developmental disorder that affects social interaction, communication, and behavior (Dawson & Sterling, 2008). Individuals with autism typically have difficulty interacting with others, which can be a challenge for children with autism in social situations and in forming relationships. Additionally, autism is characterized by disrupted communication patterns, both verbal and nonverbal, which may manifest as delayed speech development, difficulty maintaining conversations, or unfamiliarity with typical speech patterns (Greenspan, 2018). Regarding behavior, autism is characterized by restricted or repetitive behaviors, which may include repetitive movements, strict adherence to routines, and intense focus on specific topics or activities (Greenspan, 2018).

Autism often manifests challenging behaviors such as self-injury, aggression, noncompliance, and stereotypical behaviors (repetitive movements), which are difficult for parents to control (Kim & Kim, 2024). These behaviors tend to be maintained by automatic gratification or other shared factors, distinguishing them from behaviors seen in other developmental disorders (O'Reilly et al., 2010). Additionally, individuals with ASD often struggle with social interaction and forming friendships. They struggle with social activities or playing together, which can hinder their social development (Silveira-Zaldivar et al., 2020). ASD also faces difficulties in speaking and understanding language, which can lead to frustration and even trigger behavioral issues (Hariharan et al., 2024). Furthermore, ASD individuals often face emotional challenges such as irritability, aggression, and difficulty controlling emotions. The severity of these emotional control difficulties varies depending on the severity of ASD and can significantly impact family life. This, in turn, affects the parents of ASD individuals, who often experience high stress and emotional pressure. They may also face stigma, financial difficulties, and a lack of social support, which can affect their overall well-being (al-Masa'deh et al., 2020).

Given the various challenges faced by children with ASD, therapy is necessary to help them control their behavior and emotions. One form of therapy for ASD is mindfulness therapy, which involves being fully aware of what is happening in the present moment, including thoughts, feelings, bodily sensations, and the environment, without judgment. This means intentionally focusing on the present moment, which can help maintain emotional balance and improve well-being (Mander & Blanck, 2018). Mindfulness has several techniques and therapy programs, including Mindfulness-Based Cognitive Therapy (MBCT), an 8-week group program that combines mindfulness exercises with cognitive therapy techniques. Originally designed to prevent recurrent depression, it is now also used to address various psychological disorders, including anxiety disorders (Pedulla, 2017). Next is Mindfulness-Based Stress Reduction (MBSR), a structured program aimed at reducing stress and improving overall psychological health. This program is beneficial in managing pain and psychological pressure (May & Maurin, 2021). Finally, there is Guided Respiration Mindfulness Therapy (GRMT), a therapy focused on breath regulation, mindfulness, and relaxation, which has been proven effective in addressing depression and anxiety (Lalande et al., 2017).

Mindfulness is increasingly supported empirically as an approach to improving emotional regulation in individuals with autism spectrum disorder (ASD). Mindfulness is developed through meditation practice. Assessing the role of mindfulness in improving emotional regulation is challenging because it often relies on self-report measures. Electroencephalography (EEG) has been successfully used to measure neural responses to emotional stimuli and meditation in other populations, making it an ideal tool for objectively measuring neural responses before and after mindfulness training (MF) in individuals with ASD. (Susam et al., 2022). According to Polyvagal theory, mindfulness can stabilize parasympathetic nervous system activity, reduce stress, and increase social engagement (Thompson, 2025). In addition, mindfulness also plays a role in increasing social motivation and emotional awareness, which are often challenges for individuals with ASD (Singha et al., 2024).

Several studies have shown that mindfulness interventions can help children with ASD. One of these is that psychological distress can be reduced, where mindfulness-based interventions (MBIs) have been shown to be significantly effective in reducing stress, anxiety, and depression experienced

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by parents of children with autism. The overall impact is positive on the child's behavior and family well-being (Rayan & Ahmad, 2017). Improvements in behavior, specifically MBIs designed for individuals with autism, such as the MInfulTEA program, have been demonstrated to reduce self-harming behavior and aggressive behavior in children with autism and intellectual disabilities (Gandía-Abellán et al., 2023). Meanwhile, parents of children with autism reported that participating in MBIs reduced stress, anxiety, and depression, along with increased mindfulness and psychological well-being (Cachia., et al 2016).

Although various studies have shown that mindfulness interventions are effective in reducing stress, anxiety, and depression in parents of children with ASD, several limitations in the research remain, such as the lack of home practice, data collected through self-reports that are prone to bias, and non-representative research samples. Additionally, there are short-term interventions without follow-up, which limit understanding of their long-term effects (Rayan & Ahmad, 2017). Therefore, further studies that are more contextual, comprehensive, and relevant to the needs on the ground—particularly in the educational environment in Indonesia—are needed.

This is also in line with the fact that the effectiveness of mindfulness therapy in improving the well-being of children with ASD has not yet been thoroughly examined in the form of a systematic review. This is evidenced by the author's search on the Scholar website using the keyword "effectiveness of mindfulness therapy in addressing autism spectrum disorder" between 2021 and 2025, which revealed no systematic reviews specifically evaluating the effectiveness of mindfulness in individuals with ASD within the context of formal or non-formal education in Indonesia. Therefore, this study aims to conduct a Systematic Literature Review (SLR) to evaluate whether mindfulness-based therapy can improve the well-being of children with autism. This aligns with the current situation in Indonesia, where non-pharmacological intervention approaches like mindfulness are still rarely applied, despite being proven effective in other countries, such as the study by Rayan & Ahmad (2017) with ASD children in Jordan, research by Susam et al. (2022) in the United States, and additional research conducted in Stockholm, Sweden, by Agius et al. (2023). Thus, this study is expected to provide a more comprehensive understanding of this therapeutic approach and serve as a foundation for developing more optimal interventions in the future.

Method

The research procedure used in this study consisted of three stages, as follows:

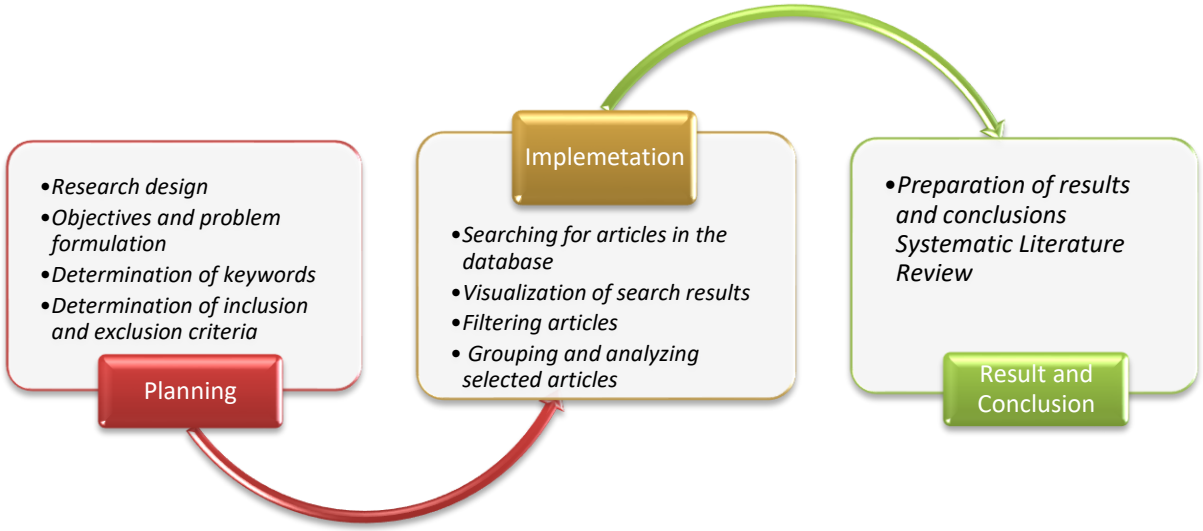

Figure 1. Stages of the systematic literature review procedure

This study uses a systematic literature review, which is a rigorous and structured method of combining research evidence to answer specific research questions, involving several steps and key methodologies to ensure that the process is comprehensive, objective, and transparent (Bigby, 2014).

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The type of systematic literature review used in this study is narrative synthesis, which is conducted narratively due to the heterogeneity of study designs and measurement tools across studies, with findings presented based on outcome categories. Furthermore, the procedure used in this study was a review protocol developed following the guidelines of the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2021) and the strategy in the study by Dyba and Dingsoyr (2008). The systematic literature review process consists of several stages: formulating the research question using PICO (Population, Intervention, Comparator, Outcome), developing a protocol that outlines the objectives, inclusion and exclusion criteria, and data extraction and analysis methods (Sadeghi & Treglia, 2017). Next, a comprehensive literature search is conducted across various databases (Scopus, PubMed), followed by selection using the previously determined inclusion and exclusion criteria (Liu et al., 2022). Data can then be extracted to evaluate the quality and reliability of the literature using PRISMA, followed by data analysis (Liu et al., 2022).

Objectives and Research Questions

The studies analyzed in this research are quantitative and qualitative studies that aim to evaluate the effectiveness of mindfulness-based therapy in improving the well-being of children with ASD. The research question (RQ) is defined based on the objectives of the systematic literature review, so the problem statement can be formulated as follows:

RQ: To what extent is mindfulness-based therapy effective in improving the well-being of children with autism spectrum disorder?

Inclusion and Exclusion Criteria

The inclusion and exclusion criteria for this study use the Participant Intervention Comparison Outcome (PICO) framework. The inclusion criteria include journal articles and conference papers (excluding books) from international journals that have undergone a review process, published in English, discussing mindfulness therapy in the title, abstract, or keywords, and the subject is autism spectrum disorder. The exclusion criteria include anything that does not meet the inclusion criteria.

Table 1. Literature Review Inclusion and Exclusion

Inclusion criteria	1. Studies discussing the effectiveness of mindfulness-based therapy in improving the well-being of individuals with autism spectrum disorder 2. Studies using quantitative or mixed-method research methods involving measurement of therapy effectiveness 3. Studies published in the form of scientific articles (both in journals and conferences) 4. Studies indexed in Scopus Q1 and Q2 5. Studies in English or Indonesian 6. The study used participants with autism spectrum disorder or their families.
Exclusion criteria	1. Studies that focus solely on theory without providing empirical results 2. The study only discusses mindfulness interventions without any connection to children with ASD 3. Studies in the form of reviews, editorials, or commentaries that are not based on research

The limitations of the literature search include:
1.) English-language journals that have undergone peer review
2.) Published between 2015 and 2025

Article collection

The articles were collected using a relevant literature search method, which yielded 227 data points obtained from the Scopus database. The criteria used in the data search were keywords: (autism spectrum disorder AND mindfulness, Mindfulness-Based Therapy AND Autism, Mindfulness Intervention AND Autism). As explained in Table 2.

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Table 2. Article Collection

Criteria	*Keywords*	*Raw Data*
Start Year: 2015	*autism spectrum disorder AND mindfulness*	209
End Year: 2025	*Mindfulness-Based Therapy AND Autism*	4
Category: Q1, Q2, Q3, Q4	Mindfulness Intervention AND Autism	14

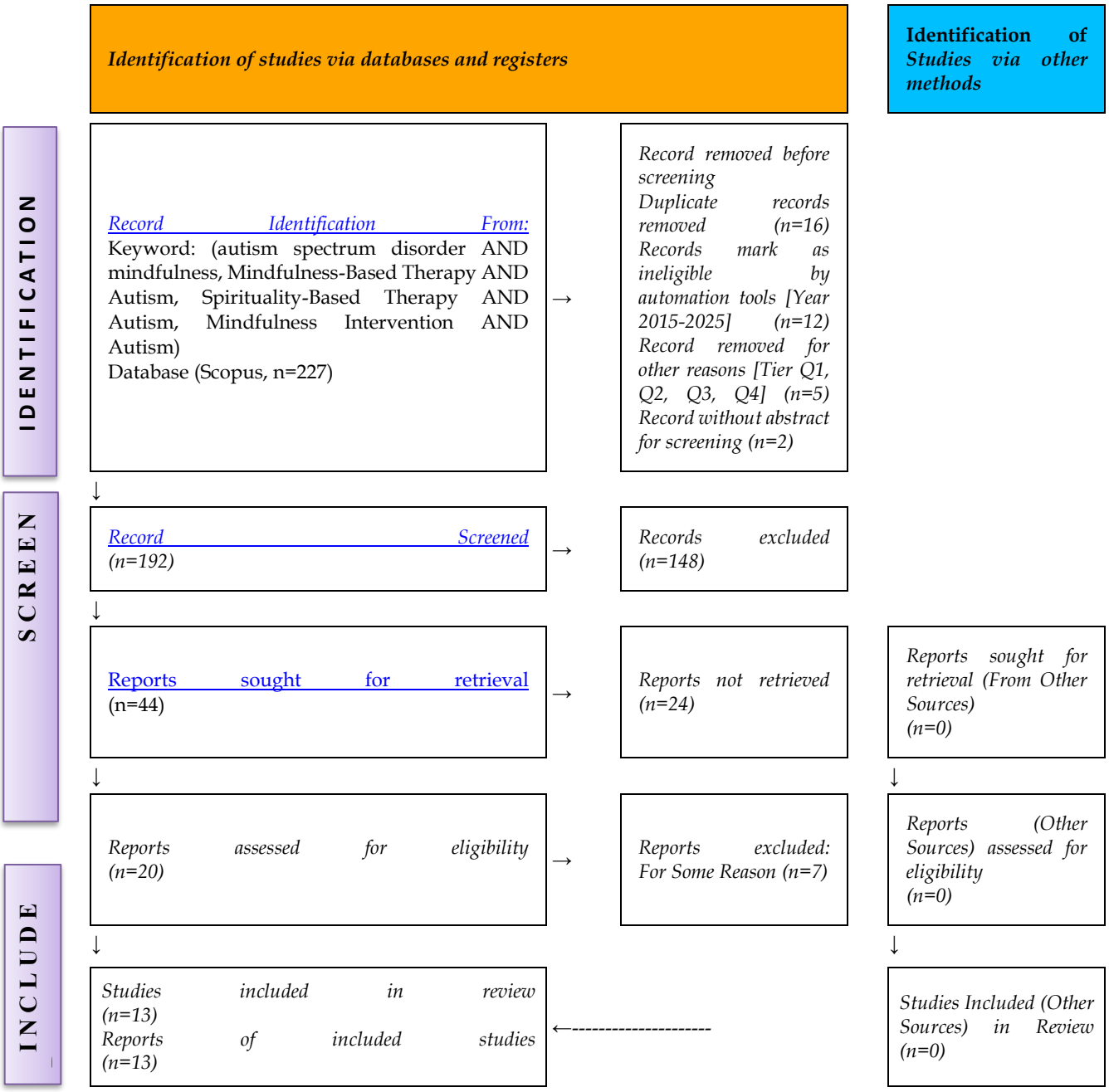

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Figure 1. Figure Systematic literature review process

After conducting a literature search using keywords, the next step is to perform retrieval by filtering articles based on specific criteria. As a result, several articles were deleted before the review stage because they were irrelevant or did not meet the criteria. Based on Watase's retrieval process, there were 16 articles that were identical copies of other documents. These documents were better deleted so that they would not be counted twice. Additionally, 12 articles were deemed to not meet the time criteria (their publication dates were outside the specified range of 2015–2025), so they were

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also removed. Additionally, 5 articles were deleted because they were not from journals of the desired quality (outside the Q1-Q4 tier). There were also 2 articles without abstracts (summaries of the content), making it difficult to determine their relevance to the research. As a result of this process, 35 articles were eliminated.

Next, the data collected in Table 1.2 above was selected by reading each abstract to facilitate the systematic literature review process, resulting in 148 articles being eliminated because, based on their abstracts, they did not meet the inclusion criteria, such as research methods that were not based on quantitative studies or mixed methods involving the measurement of therapy effectiveness, or studies that did not use children with ASD as the main subjects. Next, using the more comprehensive inclusion and exclusion criteria in Table 1.1 described above—Scopus Q1 and Q2 indexed journals, using experimental methods, in the form of journal articles, using English, and covering mindfulness therapy in autism spectrum disorder—24 articles were eliminated. Additionally, the accuracy of the articles was assessed by examining whether the research design aligned with the research objectives, whether the methods and sample were adequately described, whether the data collection methods were appropriate, and whether the data analysis was adequate and based on the data. Finally, the credibility of the articles was evaluated based on their findings and conclusions. As a result, 13 articles that had undergone the selection process were deemed acceptable.

Results and Discussion

Autism is a neurodevelopmental disorder characterized by challenges in social interaction, communication, and repetitive behaviors. Autism encompasses a wide range of symptoms and skills, leading to the term "spectrum" being used to describe the varying degrees of severity and types of challenges faced. The exact causes of autism are not yet fully understood, but are believed to involve a combination of genetic and environmental factors. Individuals with autism may exhibit unique strengths and abilities alongside their challenges, which can vary greatly from one person to another (Braden et al., 2022).

Based on the results of the literature review, various studies have been identified to determine the effectiveness of mindfulness-based therapy in improving the well-being of children with autism. The following table summarizes the results of the journal collection, which includes information about the author, title, year, research method, and journal ranking.

Table 3. Table Summarizes the Results of The Journal Collection

Author (Year) and Journal Rangking/Citattion	Research Tittle	Method/ Sample	Strength	Weaknesses
Ridderinkhof et al. (2024) and Q1/25	*Attention in Children with Autism Spectrum Disorder and The Effects of a Mindfulness-Based Program*	Quasi-experimental longitudinal, pre–post test, with a comparison group.	There were quite a number of participants in this study, and the control group was measured twice, making the results more valid. This study provides an objective assessment of mindfulness programs for children with ASD, adding important insights to this developing field of research. The use of multilevel data analysis helped to handle the interrelated data within the participants, making the analysis of the	The assessment of the effectiveness of the mindfulness program was based solely on the children's self-reports and their parents' reports, which may have exaggerated the benefits because after participating in the program, the participants may have become

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			attention system more comprehensive.	more aware of their problems. In addition, the research design did not consider the possibility of a learning effect between the initial (pretest) and final (posttest) measurements.
Agius et al. (2023) and Q1/3	*Mindfulness-Based Stress Reduction for Autistic Adults: A Feasibility Study in An Outpatient Context*	Using the open feasibility study method with MBSR intervention	Participant engagement in the study was quite high, with 86% of participants attending at least one session and 79% completing the entire program. This certainly shows that the mindfulness program (MBSR) is quite easy to implement and well received by ASD. Statistically, this program has been proven to reduce stress symptoms and improve stress coping skills, making it effective.	The self-assessment questionnaire used has not been specifically adapted for ASD, so it may be less accurate and less sensitive to change. In addition, participants' compliance in completing homework assignments is not systematically evaluated, which may affect the research results.
Pagni et al. (2023) and q1/2	*Neurophysiological Signatures of Mindfulness-Based Stress Reduction in Adults with Autism: Putative Mechanism of Anxiety Alleviation*	Performing MBSR for 8 weeks, with SE as the active control group, measurements using resting-state EEG.	This study uses a randomized controlled trial design, which makes the results regarding the effects of MBSR on ASD more reliable. Additionally, this study employs two types of measurements: brain activity recordings (EGG) and self-administered questionnaires completed by participants, thereby providing a comprehensive overview of the intervention's impact on anxiety and depression. Furthermore, this study compares MBSR with an active control group, thereby clearly demonstrating changes that are truly	No clear relationship was found between some EGG data and symptoms of depression, indicating that there are still parts of the brain's functioning that are not fully understood. In addition, this study did not examine the long-term effects of the MBSR program after 8 weeks, so it is not yet known whether mindfulness can

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			caused by mindfulness. The study also focuses on the "default mode network" (DMN), which helps explain how mindfulness can reduce symptoms in individuals with ASD from a brain function perspective.	be sustained over time.
Pagni et al. (2022) and Q1/9	*Distinct and shared therapeutic neural mechanisms of mindfulness-based and social support stress reduction groups in adults with autism spectrum disorder*	This study involved 78 adults with Autism Spectrum Disorder (ASD) who were randomly divided into two groups: MBSR and SE	The statistical analysis method used is very rigorous, resulting in strong and reliable research findings. In addition, MBSR can improve thinking and self-regulation skills in ASD, as well as reduce levels of depression and anxiety.	The small sample size meant that the results of the study could not be widely generalized, and the use of questionnaires or self-reports had limitations, requiring a more objective cognitive assessment. Future studies should consider demographic factors and how they influence clinical outcomes.
Shah et al. (2022) and Q1/3	*Soles of the Feet Mindfulness-Based Program for Students with Autism Spectrum Disorder and Challenging Behavior*	Multiple-baseline design	This study proves that the SoF (Sitting on the Floor) program is an effective evidence-based program for children with ASD, making the results of research on mindfulness programs for disruptive behavior more generally applicable. Teacher evaluations indicate that the SoF program is acceptable, easy to implement, and effective in a school setting, as it has been adapted for use in classrooms with structured sessions. Additionally, this program demonstrates a strong impact in reducing challenging behavior in specific situations.	There were only three students participating in this study, so the results cannot represent the entire population of children with ASD. The effectiveness of this program varied among individuals based on teacher assessments, as not all students showed a reduction in challenging behaviors. In addition, this study did not evaluate the long-term effects of the

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				mindfulness program after the school year ended, so it is not yet known whether the benefits are lasting.
Susam et al. (2022) and Q1/8	*Quantitative EGG change in youth with ASD following brief mindfulness meditation exercise*	Analysis of resting state EEG pre and post mindfulness using machine learning classifiers.	This study uses electroencephalography (EEG) to objectively measure brain responses, making it the most effective method for assessing the impact of mindfulness on emotional regulation in ASD. Researchers developed a machine learning-based classification tool that achieved an average accuracy of 80.76%, indicating that the method is effective in distinguishing brain states before and after mindfulness meditation. Additionally, the mindfulness exercises used in this study were specifically designed for individuals with ASD, making the results more relevant and tailored to their needs. This study employed rigorous statistical methods, including the Wilcoxon test, to ensure that the results were truly significant.	This study relies heavily on self-report measures to assess mindfulness, which may introduce bias and reduce the objectivity of the results. The sample size of 35 ASD participants may not be sufficient to represent a broader population, making the results difficult to generalize. The EEG data collection methods differed across the two research locations, which could lead to inconsistencies in the data results. Additionally, this study does not address the long-term effects of mindfulness meditation on emotional regulation abilities in individuals with ASD.
Ridderinkhof et al. (2021) and Q1/0	*A Person-Centered Approach in Investigating a Mindfulness-Based Program for Adolescents with Autism Spectrum Disorder*	Using the multiple baseline method with a person-centered approach.	The researchers monitored each participant over time, providing insight into the relationships within individuals and the possible causes of change. The study showed a	The research design, which used groups, made it difficult to apply the results to each individual, making it

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			moderate improvement in achieving personal ASD goals, indicating that the MYmind program is quite effective.	difficult to understand the differences between individuals and the causes of change. External factors such as differences in mindfulness trainers and program locations may have influenced the research results. In addition, some adolescents did not show improvement in symptoms related to negative feelings such as anxiety or sadness, and one even worsened during the program.
Beck et al. (2020) and Q1/22	*Mindfulness-Based Stress Reduction for Adults with Autism Spectrum Disorder: Feasibility and Estimated Effects*	Using a quasi-experimental method with pre-tests and post-tests.	The Heal positive outlook scale showed very high consistency in its measurements, with r=0.96. Participants were satisfied with the intervention program, with an average satisfaction score of 27.92. All participants completed the research process, and the MBSR program was implemented in accordance with the predetermined curriculum guidelines.	The number of participants was small, making it difficult to generalize the results of the study. The results were based solely on participants' self-reports, so it is possible that participants did not capture all of the benefits of the program.
Juliano et al. (2020) and Q2/18	*Feasibility of A School-Based Mindfulness Program for Improving Inhibitory Skills in Children with Autism Spectrum Disorder*	Using a quasi-experimental method, with a pre-post design without a control group.	This study shows a significant improvement in the functional abilities of children with ASD, particularly in terms of controlling impulsive reactions, coping with distractions, and focusing attention after participating in mindfulness therapy. The	The number of participants in this study was relatively small, involving only 27 students with ASD, making it difficult to generalize the results. This study used a

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			use of a quasi-experimental design with pre- and post-measurements can strengthen the research findings. The intervention was conducted over eight weeks, allowing participants sufficient time to continue practicing and engaging in mindfulness techniques. Additionally, this study is an initial investigation into a school-based mindfulness program specifically designed for children with ASD, thereby addressing a gap in existing research.	quasi-experimental design, which may introduce bias or other factors that influence the results. Additionally, there was no control group in this study, making it difficult to confirm whether the observed improvements were truly caused by the mindfulness intervention. Furthermore, data collection relied on self-reports and subjective assessments, which could lead to varying results.
Singh et al. (2019) and Q1/45	*Effects of Mindfulness-Based Positive Behavior Support (MBPBS) Training Are Equally Beneficial for Mothers Their Children with Autism Apectrum Disorder or with Intellectual Disabilities*	Using a quasi-experimental method designed with two groups with a control intervention phase.	This study uses robust statistical analysis (mixed-model ANOVA) to measure stress levels at several stages of assessment, thereby providing more comprehensive results. In addition, the high degree of consistency between parents' reports of their children's behavior indicates that the data collection process is reliable.	Mothers of children with ASD tend to experience much higher levels of stress than mothers of children with ID. They also face ethical challenges in parenting, such as the possibility that harsh words or shouting could negatively impact their child's development.
Guirgis et al. (2019) and Q1/40	*MYmind: a Concurrent Group-Based Mindfulness Intervention for Youth with Autism and Their Parents*	Using a pre-experimental method with multi-time measurements (baseline, post, follow-up)	This study used the same repeated measurement design so that changes in participants over time could be observed more accurately and the results were more reliable. Positive feedback from	This study did not have a control group, making it difficult to determine with certainty whether the

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			participants showed that the MYmind program was a useful form of intervention, and this study contributed to a new field that develops mindfulness programs for families with members with ASD.	MYmind program was truly effective. There were no significant changes in the levels of mindfulness reported by parents or ASD, suggesting that the program may not have had an impact on how they assessed themselves. In addition, some of the improvements observed were only trends and were not statistically significant, requiring further rigorous and controlled research.
Conner et al. (2017) and Q1/59	*Brief Report: Feasibility and Preliminary Efficacy of Individual Mindfulness Therapy for Adults with Autism Spectrum Disorder*	Using an experimental quantitative method (with a single-group repeated measures approach).	MABIs is an effective mindfulness- and acceptance-based intervention for overcoming difficulties in regulating emotions in ASD and helping ASD individuals become more self-aware and recognize their strengths. The measurement tools used in this study are highly consistent, meaning that the measurement results are reliable.	The participants who took part were those who voluntarily registered, so the results may not be representative of all individuals with similar conditions. There were very small changes in scores, indicating a floor effect.
Ridderinkhof et al. (2017)	*Mindfulness-Based Program for Children with Autism Spectrum Disorder and Their Parents: Direct and Long-Term Improvements*	This study used a quasi-experimental method with a repeated measures design.	This study included a 1-year follow-up to assess the long-term effects of the mindfulness program. In addition, data was obtained from several sources (multiple informants) to strengthen the evidence regarding the program's impact on children. The qualitative analysis used provided a	Participants did not complete the assessment, possibly because they felt that the program was of little benefit to them, which could have affected the results of the study. In

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		deeper understanding of mindfulness practices. This study also evaluated the quality of therapy implementation, which is often overlooked in mindfulness research.	addition, this study did not have a control group, making it difficult to understand the changes that occurred over time. Furthermore, not all participants completed the questionnaire, which could have affected the results obtained.

The above study shows that mindfulness-based therapy is effective in improving well-being for autism, such as using the MYmind intervention of 9 sessions + 1 booster (mindfulness for children & parents) with 49 ASD children and 51 TD children (similar age & IQ) as subjects, which can improve executive attention on a small scale, but not significantly for alerting and orienting (Ridderinkhof et al. 2021). Furthermore, the MBSR intervention adapted by trained instructors, with adult autism subjects, can reduce stress, anxiety, and depression, and increase mindfulness and acceptance of diagnosis. However, the self-assessment questionnaire was not specifically tailored for ASD, and participants' adherence to homework tasks was not systematically evaluated, resulting in less accurate outcomes (Agius et al. 2023).

In addition, the study used a Randomized Controlled Trial (RCT) with two groups: MBSR vs Social Support & Relaxation Education (SE). Electroencephalography (EEG) was used to assess brain activity (Default Mode Network) before and after an 8-week intervention, with 96 adult participants with ASD divided into MBSR and SE groups. Both groups showed a decrease in beta-2 and central gamma power (indicating a reduction in symptoms). Only the MBSR group showed a decrease in parietal gamma power, which correlated with reduced anxiety. MBSR produced specific neurophysiological changes (particularly in the DMN) that may serve as the mechanism for anxiety reduction in adults with ASD. The use of EEG and questionnaires provides a comprehensive overview of the intervention's impact on anxiety and depression, and the presence of two active control groups further clarifies changes genuinely caused by mindfulness. Additionally, the use of the DMN helps explain how mindfulness can reduce ASD symptoms from a brain function perspective. Since this study used a randomized controlled trial design, the results of MBSR therapy in ASD are more reliable. However, no clear relationship was found between EEG data and depression symptoms, indicating that the brain's working processes are not yet fully understood. Furthermore, this study did not investigate the long-term effects of MBSR, so it is unknown whether mindfulness can sustain its effects over time (Pagni et al. 2023).

The next study used mindfulness-based stress reduction (MBSR) therapy and social support/education (SE). Participants completed questionnaires to assess depression, anxiety, mindfulness, autistic traits, and executive function. They also underwent self-reflection tasks in fMRI. Data analysis used repeated-measures ANCOVA for behavior and gPPI for brain connectivity during the task. The results showed that both groups (MBSR and SE) experienced significant reductions in symptoms of depression, anxiety, and autistic traits. However, only the MBSR group showed significant improvements in executive function and trait mindfulness. The reduction in insula-thalamus connectivity specifically in the MBSR group was associated with reduced anxiety. This study suggests the presence of distinct and overlapping therapeutic neural mechanisms between MBSR and SE. Social support was also found to be effective in reducing psychiatric symptoms in adults with ASD. MBSR could serve as a potential therapeutic approach for addressing anxiety in adults with ASD, grounded in identified neurophysiological mechanisms, where the

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statistical analysis methods used were rigorous, ensuring the study's results are robust and reliable. However, due to the small sample size, the results cannot be generalized. Additionally, the use of questionnaires or self-reports has limitations, necessitating more objective assessments. Future research should consider demographic factors and their influence on clinical outcomes (Pagni et al. 2022).

Furthermore, there is also research that uses a multiple-baseline design between participants, with the intervention being applied after the baseline phase has stabilized. The sessions included emotion recognition and self-monitoring strategies, with the intervention carried out by trained Mental Health Counselors (MHCs), and special education teachers also involved. The subjects were three students (Ed, Jian, Gil) aged 9–10 years, with FSIQ scores of 89–127 identified using the SESBI-R. The study results showed that all students demonstrated a decrease in challenging behavior based on direct observation. For example, Ed's challenging behavior decreased from 17.5% to 6.2%, Jian's from 33.3% to 14.3%, and Gil's from 44.3% to 19.4%. However, teachers reported an increase in behavioral issues for two students after the program ended, indicating a discrepancy between teacher observations and objective observation results. Overall, school staff evaluated the SoF program as a positive and easy-to-implement intervention, although student responses varied. This study concludes that SoF has the potential to be a useful emotional regulation tool for students with ASD, but further research with a larger sample size and long-term monitoring is needed. Thus, this study demonstrates that SoF is acceptable, easy to implement, and effective when used in structured classroom sessions; however, the study only included three participants, so the results cannot represent the entire population of children with ASD. Additionally, the effectiveness of this study varies among individuals because not all challenging behaviors decreased, and the long-term effects are unknown—it is unclear whether the benefits will persist over time (Shah et al. 2022).

Next, an intervention using brief mindfulness exercises with 35 adolescents with ASD showed classification accuracy results of 80.76%, with total alpha and total power increasing after mindfulness. Additionally, total and relative beta were higher before mindfulness, with the frontal and temporal channels being the most informative, and there was potential for improved emotional regulation (Susam et al. 2022). Another study using a person-centered approach involved 5 adolescents with ASD and internalizing disorders, with parental participation, over a 9-week intervention period, followed by 2-month and 1-year follow-ups. Researchers monitored each participant over time, providing additional insights into the relationships within individuals and the potential causes of their changes. The study results showed that four out of five adolescents experienced moderate improvement toward their goals, particularly in terms of reduced anxiety, indicating that the Mymind program is quite effective. However, one participant experienced a decline in condition during and after the program. These differing outcomes may be influenced by external factors such as differences in mindfulness trainers and research locations. Additionally, the study design using a group setting makes it difficult to apply the results to individual participants, making it challenging to understand individual differences and the causes of change (Ridderinkhof et al. 2021).

The subsequent study used MBSR intervention delivered in a group format. The subjects consisted of 12 adults with ASD (out of 25 who registered), aged 22–63 years, with a gender ratio of 1:4 (female:male), and 75% had previously received mental health care (25% specifically for ASD). The intervention procedure consisted of 8 weekly MBSR sessions + 1 full-day silent meditation session, following the standard MBSR curriculum without specific ASD modifications, led by experienced instructors supervised by senior trainers. Based on the MBSR intervention, the results showed that the Mindfulness-Based Stress Reduction (MBSR) program was successfully implemented among adults with autism spectrum disorder (ASD). Participants demonstrated high satisfaction with the program, with an average satisfaction score of 27.92, and most attended sessions regularly, actively engaging and understanding the material presented. During the program, participants experienced several positive changes, such as greater emotional calmness, fewer "meltdowns" or emotional outbursts, increased self-confidence and self-esteem, a more positive outlook on life, and an overall improvement in quality of life. Additionally, mindfulness skills

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improved, specifically the ability to be more aware and focused in the present moment. Furthermore, most participants were able to participate well in the meditation sessions, including the full-day meditation retreat. Despite challenges such as transportation issues and difficulties accessing audio recordings or completing homework assignments, participants generally demonstrated commitment and enthusiasm. Thus, data analysis indicates that these changes have a significant impact, particularly in terms of life happiness and positive outlook. These positive effects also emerged in improved emotional regulation skills; however, due to the small number of participants, the research findings are difficult to generalize, and the results are based solely on participants' self-reports, meaning participants may not have fully captured all the benefits of the program (Beck et al. 2020).

The study used the Mindful Schools Program intervention, consisting of 16 sessions (focus: awareness of breathing, body, and mind). The subjects were 27 children with ASD (aged 10–17 years) from a private special school, 77.8% of whom were male; most of whom had comorbid diagnoses. The intervention was conducted over eight weeks, allowing participants sufficient time to continue practicing and engaging in mindfulness techniques. Additionally, the use of a quasi-experimental design with pre- and post-measurements enhanced the study's results, which showed significant improvements in impulsive reactions, interference control, response inhibition, selective attention, and focused attention following mindfulness therapy. This study is an initial investigation into a school-based mindfulness program specifically designed for children with ASD, thereby filling a gap in existing research. However, the number of participants in this study is relatively small, making it difficult to generalize the results. Furthermore, the study uses a quasi-experimental design, which may introduce bias, and there is no control group, making it challenging to confirm whether the observed improvements are truly attributable to the mindfulness intervention (Juliano et al., 2020). Additionally, there is research that used a 3-day MBPBS training intervention and daily meditation practice, with 145 mothers of children with ASD participating in the 3-day MBPBS training and a 40-week intervention phase. The results showed a significant reduction in maternal stress post-training, and the same was observed in children with autism, where MBPBS led to a decrease in aggressive behavior, increased compliance, with consistent results in both the ASD and ID groups. No different interventions were required for the two diagnoses, and the program was deemed effective and applicable in real-life settings (Singh et al. 2019).

The study included interventions involving mindfulness techniques, cognitive behavioral therapy (CBT), and emotion regulation exercises. The subjects consisted of 23 pairs of parents and adolescents with autism spectrum disorder (ASD) in the Toronto area. The children were between 12 and 23 years old, mostly male, while the majority of parents were mothers aged 40 to 59 years. This study used a repeated measures design, allowing for more accurate observations over time and more reliable results. Adolescents with ASD showed improvements in adaptive skills and emotional regulation, as well as a reduction in behavioral symptoms, although there were no significant changes in self-reported mindfulness. Meanwhile, parents reported improvements in mindfulness and more mindful interaction with their children, as well as a reduction in autism symptoms in their children that persisted through the follow-up period. Overall, the program was deemed beneficial and helpful in managing stress and improving quality of life. However, this study lacked a control group, making it difficult to definitively determine whether the Mymind program is truly effective. Additionally, some of the observed improvements were merely trends and not statistically significant, necessitating further rigorous and controlled studies (Ridderinkhof et al., 2021).

The study used a single-group repeated measures approach, with no control group, making it a feasibility study with preliminary efficacy evaluation. The subjects consisted of 9 young adults with ASD (7 males, 2 females), aged 18–25 years, with verbal IQ > 80, and no severe psychopathology. The pre-test/post-test study design included a 3–4 week baseline period, 6 weekly individual therapy sessions, and a 6-week follow-up. The results showed that some participants demonstrated a significant reduction in emotional regulation difficulties after undergoing therapy. Additionally, 2 out of 9 participants experienced significant improvement in overall emotional regulation, while 3 participants showed greater ability to accept their emotions after therapy.

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However, 2 participants experienced a decline in this area during the follow-up period. Regarding impulse control and emotional clarity, 4 participants showed improvement in impulse control, and only 1 participant demonstrated improved emotional clarity. Regarding access to emotional regulation strategies, 4 participants felt more comfortable using emotional management strategies. However, 1 participant felt that this ability had decreased. Regarding mental health and quality of life, some participants experienced a decrease in stress and an improvement in interpersonal relationships, but there were also participants who experienced an increase in stress and social difficulties. Regarding participant satisfaction, all participants completed the therapy without any issues, and the majority felt that the therapy was helpful and provided real benefits (Conner et al. 2017).

Next, a study using family-based mindfulness intervention (MYmind) and a combination of quantitative and qualitative measurements to evaluate the effectiveness of the program on children with ASD and their parents. A repeated measures design with five measurement points: waiting list, pre-intervention, post-intervention, 2-month follow-up, and 1-year follow-up. The MYmind program was found to have a positive impact on children with autism spectrum disorder (ASD) and their parents, with children showing reductions in social communication issues, emotional functioning, and behavior, with changes persisting up to one year after the program. Although there was no significant increase in reported mindful awareness among children, most showed emotional improvement. Parents also experienced reduced stress, increased self-awareness, and self-compassion, with consistent participation in the program associated with better outcomes. However, this study lacked a control group, making it difficult to understand changes over time, and not all participants completed the questionnaire, which may have influenced the results obtained (Ridderinkhof et al. 2018).

Several studies have shown that mindfulness-based interventions such as MYmind and Mindful Schools have a positive impact on executive functions such as selective attention, intervention control, response inhibition, and emotional and behavioral regulation. In addition, a reduction in challenging behavior was also noted in interventions such as SoF (Strategies of Focus), although teacher reports showed inconsistencies with objective observation results. Furthermore, MYmind demonstrates the sustainability of benefits in children's social communication and emotional functioning, which are clearly part of the long-term effects (up to one year).

In addition, mindfulness-based therapy is also effective in improving adaptive skills and emotional regulation in adolescents, although not all participants showed subjective improvements in mindfulness. This was demonstrated by research using EEG and machine learning classification, which showed changes in brain activity that supported improvements in emotional regulation after brief mindfulness training. These results certainly strengthen the neurological evidence for the effectiveness of the intervention.

Furthermore, in adults who used MBSR (Mindfulness-Based Stress Reduction) interventions in various designs, including RCTs and quasi-experimental designs, a reduction in stress, anxiety, and depression was found. Additionally, research using EEG also demonstrated that MBSR can produce specific neurophysiological changes, particularly in the Default Mode Network (DMN), which correlates with reduced anxiety. This further strengthens the potential of MBSR as a neurologically based therapeutic approach. Furthermore, programs involving parents, such as MYmind and MBPBS, have shown very positive results. Where reduced parental stress and increased self-awareness contribute to a more supportive family environment, which in turn reinforces the intervention outcomes for children. Additionally, more trained parents demonstrate improvements in mindful interaction and emotional regulation with their children.

The majority of these studies used quasi-experimental designs, multiple baselines, or pre-post tests without control groups. Only a few used RCTs or experimental methods with EGG. Studies with small sample sizes and no control groups still provide initial indications that mindfulness interventions are promising, but further studies with more rigorous designs and larger numbers of participants are needed.

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Discussion

Based on the results of a systematic literature review of 13 selected articles, it was found that mindfulness-based interventions show positive effectiveness in improving executive function, emotional regulation, and reducing stress in individuals with ASD. Most studies indicate that children and adolescents with ASD experience improved concentration, reduced aggression, and enhanced emotional regulation skills after participating in mindfulness interventions such as the Mymind program and Mindfulness-based positive behavior support (MBPBS) (Ridderinkhof et al., 2021). These findings are supported by research (Wulandari & Cahyanti., 2022) and (Boby et al., 2024), which state that parental involvement in mindfulness interventions can reduce caregiver stress levels and significantly improve children's social interactions. These findings offer an alternative for mothers to develop mindfulness practices that are hoped to reduce parenting stress (Wulandari & Cahyanti., 2022).

However, these positive results did not appear uniformly across all age groups and intervention designs. Several studies involving adult ASD participants conducted by (Beck et al., 2020) and (Ridderinkhof et al., 2021) showed that the reduction in stress and anxiety and the improvement in social skills and emotional control were not very significant. This suggests that the age and developmental status of participants influence the effectiveness of interventions, with children and adolescents with ASD tending to show more noticeable progress, especially when interventions are delivered in a structured manner and involve active family participation.

Differences in effectiveness can also be seen from the methodological design used in the research. Some studies, such as those conducted by (Pagni et al., 2023) using randomized controlled trials (RCTs), provide higher inferential power and support the internal validity of the research. Meanwhile, most other studies use quasi-experimental designs, which, although practical and flexible for ASD participants, face limitations in terms of generalizing results, such as the studies conducted by (Juliano et al., 2020) (Beck et al., 2020) (Ridderinkhof et al., 2020) (Guirgis et al., 2019). The quality of this methodology plays a role in strengthening or weakening claims about the effectiveness of mindfulness as a psychological intervention for individuals with ASD.

The duration and frequency of interventions are also important factors in determining the success of mindfulness programs. Short-term studies, lasting less than eight weeks, generally fail to produce long-term changes (Pagni et al., 2023). Meanwhile, interventions lasting more than eight weeks, such as in the study by Singh et al. (2006), demonstrate more stable effects in reducing aggressive behavior and improving attention. Additionally, the small sample sizes in many studies limit the statistical power and external validity of the research findings (Shah et al., 2022).

One limitation in this literature is the lack of use of objective measurements such as neurophysiological data. Only a few studies have used measurement tools such as EEG to assess the neurological impact of mindfulness, for example in the studies by Pagni et al. (2023) and Susam et al. (2022). However, the use of biological data is crucial in verifying changes in neural function related to attention, self-regulation, and impulse control in individuals with ASD. Most studies still rely on self-reports from parents and teachers, which are susceptible to bias and perception.

From a cultural perspective, most of the reviewed studies were conducted in Western countries, such as the United States (Susam et al., 2022), and there were also studies conducted in Stockholm, Sweden (Agius et al., 2023). The mindfulness approach used is typically secular and individualistic, so it may not be entirely suitable when applied directly in countries with collective cultures like Indonesia. In Indonesia, research on mindfulness therapy for children with ASD is still limited. Based on a literature review conducted by the researchers, most studies focus on the role of mindfulness therapy in reducing parenting stress among mothers of children with ASD, as seen in studies such as (Wulandari & Cahyanti, 2022) and (Boby et al., 2024).

Given the varying research results, methodological limitations, and cultural context differences, it is important to develop a more comprehensive theoretical framework and understand the effectiveness of mindfulness on individuals with ASD. Based on the analysis, three main mechanisms for the effective use of mindfulness in individuals with ASD can be identified: neuroregulation through changes in the default mode network and prefrontal cortex; enhanced self-

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awareness, which helps individuals manage impulses and anxiety independently; and emotional co-regulation, which involves family members or teachers during the intervention.

Conclusion

The objective of this systematic review was to evaluate the effectiveness of mindfulness-based interventions for individuals with ASD and their families. The results of the study indicate that mindfulness positively contributes to the development of social skills, emotional regulation, stress reduction, and improved executive function in children, adolescents, and adults with ASD. These results are supported by neurological studies showing changes in brain activity following the interventions, as well as by family-based programs that foster an emotional climate conducive to child development.

This review makes theoretical and practical contributions to the development of adaptive and relevant mindfulness-based intervention models for individuals with ASD. The results underscore the importance of incorporating mindfulness interventions into clinical psychology and special education practices. They also open up opportunities for developing new theories about the relationship between self-awareness, brain function, and adaptive behavior in individuals with ASD.

Further research using a multilevel randomized controlled trial (RCT) design with a larger sample size is recommended to increase the external validity of the findings. Additionally, collaboration between educational institutions and healthcare services is needed to more broadly and contextually test the program's effectiveness.

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