REVIEW ARTICLE

Occupational Therapy Interventions for Auditory Processing Disorder in Children with Autism Spectrum Disorder: A Scoping Review

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ABSTRACT

Many children with ASD experience sensory processing challenges, such as difficulties with auditory processing disorders, affecting their occupational performance. Occupational therapists address these challenges through targeted interventions. This scoping review aimed to present available occupational therapy intervention strategies for auditory processing disorders in children with ASD. Relevant peer-reviewed articles from ScienceDirect, Web of Science, Scopus, Wiley Online Library and Cochrane Library were systematically searched from inception to May 2023. Eight studies that investigated occupational therapy intervention strategies focusing on auditory processing disorder for children with ASD were included based on eligibility criteria. Then, the studies were systematically extracted, organised and categorised according to themes. Three major themes emerged namely: 1) types of intervention, 2) approach of interventions and 3) dosage/intensity of intervention. This review highlights the unique role of occupational therapists in addressing sensory processing challenges, which is feasible to implement for children with ASD. *Malaysian Journal of Medicine and Health Sciences* (2025) 21(SUPP7): 265-271. doi:10.47836/mjmhs.21.s7.30

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INTRODUCTION

According to the Diagnostic and Statistical Manual (DSM-V-TR), autism spectrum disorder (ASD) is defined as a neurodevelopmental disorder characterised by a deficit in social interaction, social communication, and repetitive, restricted behaviour (1). Recently, it has been estimated that ASD affects one in a hundred children worldwide. This prevalence study considers the geographic, ethnic and socioeconomic factors in the estimation of the prevalence of autism worldwide. The estimated prevalence rose over time and changed greatly within and across sociodemographic groups (2). Behavioural or social deficits in children with ASD are commonly due to sensory dysregulation. The dysfunction of sensory processing is one of the important features in clinical descriptions of ASD (3). A study reported that 95% of children with ASD exhibit some degree of sensory processing dysfunction on the Short Sensory Profile (4). The result significantly differs in auditory filtering, underresponsive/seek sensation and tactile sensitivity as compared to neurotypical children. Because of these sensory dysfunctions, children with ASD may exhibit different behaviours compared to normal or neurotypical children.

According to DSM-V-TR, repetitive and restricted behaviour is one of the major diagnostic criteria for ASD. These ASD children may show behaviours like lining toys, sticking to the routine and stimming. The behaviour is usually present in the early developmental period (1). It is speculated that sensory processing issues in ASD are the root cause of behavioural and/or functional performance issues (5). According to Ornitz's theory, children with ASD exhibit stereotypical or repetitive behaviours that are an attempt by the child to either self-calm or raise arousal (sensory-seeking) and these behaviours are indicative of sensory modulation issues (6). Also, being hyperactive or hypoactive to sensory input or exhibiting unusual sensory responses to the environment is included in the criteria for repetitive

and restricted patterns of behaviour, interests, or activities (1).

Sensory processing dysfunction is grouped into three domains which are sensory over-responsivity, sensory under-responsivity and sensory seeking (7-8). Sensory over-responsivity is classified as the negative response to specific sensory stimuli. They may exhibit distress, avoidance, or hypervigilance to sensory stimuli such as light, sound and tactile experiences. Meanwhile, the tendency to be unaware or non-responsive to various sensory stimuli is a defining characteristic of under-responsivity (9). Sensory seeking is characterised by performing actions or movements that increase sensation. Out of all sensory processing dysfunctions, children with ASD frequently struggle with sensory processing disturbances in the auditory sensory system (4,10,11). A study reported that the problem of auditory processing predicted disruptive/concerned behaviours and difficulty with adaptive behaviours at three and nine years respectively (12). Therefore, there is a need for children with auditory processing disorders to receive effective intervention.

Occupational therapists play a vital role in supporting the development of children with ASD by enhancing their engagement in activities of daily living (ADL), play, education, and social participation. To support these occupational areas, therapists focus on improving underlying skills such as fine and gross motor abilities, problem-solving, behaviour regulation, and sensory processing. Occupational therapists frequently use sound-based interventions with children with ASD (11). However, there is not sufficient evidence to back up the use of a sound-based intervention in children with ASD who also have sensory processing challenges. To date, there is little literature on occupational therapy intervention for auditory processing disorders among children with ASD. Therefore, the study aimed to map the evidence on the occupational therapy interventions for children with ASD who have auditory processing disorders.

MATERIAL AND METHODS

Study design

A scoping review research design was implemented according to the published guidelines by Arksey and O'Malley (13) and PRISMA Extension for Scoping Reviews (14) to map the evidence of the current topic. Both sets of guidelines were useful in providing a structured methodology and comprehensive documentation of this scoping review. The methodological framework is based on the five stages outlined as follows: 1) identifying the research question, 2) identifying relevant studies, 3) study selection, 4) charting the data, and 5) collating, summarising and reporting the results.

Stage 1: Identifying the research question

Occupational therapy may provide both bottom-up and top-down approaches to maximising the occupational performance of children with special needs. This scoping review aims to collect, gather and map the evidence of occupational therapy intervention for children with auditory processing disorder. In the context of evidence-based practice and research, this review aimed to answer the following PCC research question: What is the available evidence of occupational therapy intervention for auditory processing disorder among children with ASD? In this review, our population (P) focused was the children with ASD. Furthermore, the occupational therapy intervention was the concept (C), and the auditory processing disorder was the context (C). This review included all types of study design in achieving the following outcome of interest: identifying the available occupational therapy interventions for auditory processing disorder in children with ASD.

Stage 2: Identifying relevant studies

In May 2023, MDMY utilised multiple databases, including the Web of Science (WOS), Scopus, ScienceDirect, Wiley Online Library, and Cochrane Library, employing a specific search strategy using keyword combinations, which were ("autism" OR "autism spectrum disorder" OR "autistic") AND ("auditory sensory" OR "auditory processing" OR "auditory filtering") AND ("occupational therapy" OR "sound-based intervention" OR "auditory integration"). The Boolean operator "AND" and "OR" was included as part of the keyword combinations to ensure that the main terms are present in the articles. The process of screening and deciding the eligibility of the included articles was done collectively by MDMY, ANMB, IAMN, and BE. In addition, the search processes were reviewed and confirmed as valid by AZCD. Figure 1 depicts the article selection process. Cross-referencing and hand-searching yielded no new relevant articles.

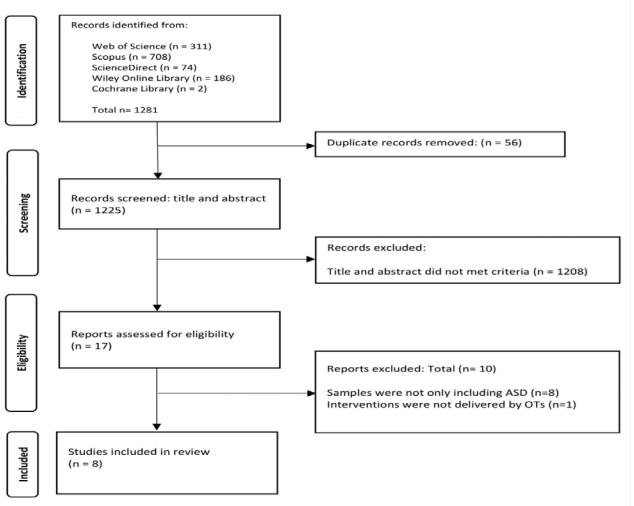

Figure 1: The search process

Stage 3: Study selection

The selection of studies was primarily based on screening the titles and abstracts of the articles, with eligibility determined according to pre-determined inclusion and exclusion criteria. Any studies were included if they met the following criteria: (i) intervention or treatment delivered by occupational therapists; (ii) samples included only from the population of children with ASD; (iii) intervention should be focusing on auditory processing disorder; (iv) published from inception until May 2023; and (v) full text available in English or Malay language. Any grey literature or evidence elaborated in the form of audit, book review, editorial, non-peer-reviewed studies, unpublished research, letters to the editorial, or opinion piece were excluded.

Stage 4: Charting the data

As summarised in Table I, the data from the 8 articles included in this review were extracted and charted based on the respective author, year of publication, aim of the study, population, country, types of intervention and summary of findings relevant to this review.

Table I: Articles summary

Author(s)/Year	Study design	Aim	Population/ Country	Types of Intervention	Summary of findings
Brown (1999)	Case study	To identify the effects of auditory integration training (AIT) on two autistic children.	n= 2 Age = 5 years and 3.5 years old Ireland	Auditory integration training	Many different changes occurred as a result of the intervention.
Gee et al. (2015)	Case control study	To determine whether The Listening Program (TLP) reduces sensory over-responsivity to sensory stimuli.	n = 3 Age = 5-10 years old United States	The Listening Program	The results of this study are mixed. Improvement was variable and should be viewed with caution.
Gee et al. (2014)	Single-subject case-controlled design	To determine if a 10-week sound-based auditory stimulation method reduced SOR to auditory stimuli and decreased self-stimulatory behaviour in a child diagnosed with ASD.	n = 1 Age = 7 United States	The Listening Program	The participant demonstrated a significant reduction in the frequency and duration of self-stimulatory behaviours, suggesting positive effect of The Listening Program.
Rowe et al. (2011)	Single-subject experimental design	To examine the effects of using noise reduction headphones to reduce auditory stimulation and assess its impact on task attention in a child experiencing auditory defensiveness.	n = 1 Age = 11-year-old United States	Noise reduction headphone	The findings offer empirical evidence supporting the utilization of noise reduction headphones to enhance task attention.
Ikuta et al. (2016)	Pilot study	To evaluate the efficacy of conventional earmuffs and noise-cancelling (NC) headphones in managing behavioural issues associated with hyper-reactivity to auditory stimuli among children diagnosed with autism spectrum disorder (ASD).	n = 21 Age = 4-16 years old Japan	1. Earmuff 2. Noise-cancelling headphone	The utilization of sound-blocking earmuffs could prove beneficial for children with ASD who have auditory hyper-reactivity (ASD-AH), while the application of noise-cancelling (NC) headphones, which minimize ambient sounds, may also offer advantages for children with ASD-AH who are not specifically sensitive to human voices.
Nwora & Gee (2009)	Single-subject case study	To evaluate whether a sound-based intervention led to improvements in the child's overall sensory processing abilities and their receptive/expressive language skills, specifically in a case of pervasive developmental disorder-not otherwise specified (PDD-NOS).	n = 1 Age = 5 years old United States	The Listening Program	TLP intervention seemed to be effective in reducing sensory sensitivity, enhancing both expressive and receptive language skills, and improving functional behaviour.
Pfeiffer et al. (2019)	Ground theory approach	To understand the advantages and constraints associated with the utilization of noise-cancelling headphones for children diagnosed with autism spectrum disorder (ASD) in terms of their engagement in home, community, and school settings, as perceived by parents and teachers.	n = 15 Age = 6-12 years old United States	Noise-cancelling headphones, which are around-ear and in-ear headphones	Utilizing noise-reducing headphones is a potential approach to mitigate the effects of hyperacusis and auditory hypersensitivity, thereby improving performance and engagement in home and community environments.

CONTINUE

Table I: Articles summary (CONT.)

Author(s)/Year	Study design	Aim	Population/ Country	Types of Intervention	Summary of findings
Pfeiffer et al. (2019)	Single-subject multi-treatment design	To assess the feasibility of using two different types of noise-reducing headphones to alleviate physiological stress and anxiety in children with autism spectrum disorder (ASD) when exposed to natural environments where the noise is perceived as bothersome.	n = 6 Age = 8-16 years old United States	Noise-cancelling headphones, which are around-ear and in-ear headphones	Implementing noise-reducing headphones among children diagnosed with autism spectrum disorder (ASD) and hyperacusis could potentially result in a decrease in sympathetic activation.

Stage 5: Collating, summarising and reporting the results

The authors used thematic analysis to generate themes in response to several face-to-face and online discussions regarding the data presented in Table I. Thematic analysis was carried out manually without using any qualitative software. The themes generated in this scoping review covered a wide range to include as many articles as possible while also maintaining the integrity to accurately reflect the study objectives. Subsequently, all authors participated in the review, refinement and finalisation of the themes, as outlined in the results section.

RESULTS

A total of eight research articles were selected and analysed based on the criteria chosen and three themes were derived from these studies. The three major themes generated were 1) types of intervention, 2) approach of intervention, and 3) dosage/intensity of intervention. Most of the research articles showed a positive finding that may indicate the effectiveness of the interventions. Figure 2 shows the summary findings of the research articles based on each theme.

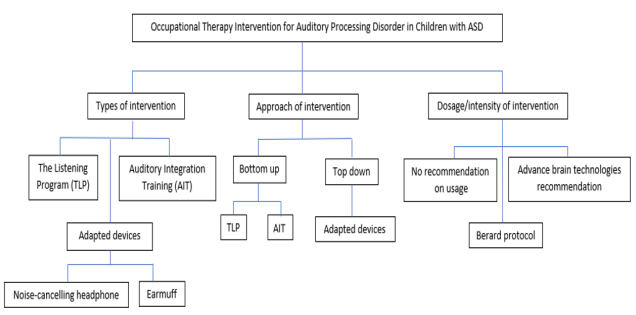

Figure 2: The themes emerged from the selected articles

Theme 1: Types of Intervention

Out of 17 articles that were included for eligibility based on the inclusion and exclusion criteria, eight studies were included in this review. Based on the data analysis, three types of interventions were used to treat auditory sensitivity or hyperacusis among children with ASD that were delivered by occupational therapists. The first intervention method (n=1) is Auditory Integration Training (AIT), which utilises specialised devised machines with a form of specific sensory stimulation that modulates specific sounds of pop music. The sound waves were modulated by randomly increasing and decreasing the volume (15).

Secondly, three articles (n=3) also included The Listening Program (TLP) as one of the interventions in treating the symptoms of hyperacusis. The period of the TLP intervention implementation varies among the studies which are 10 weeks (11), 20 weeks (16), and 28 weeks (10). These researchers used a personal CD player with Sennheiser HD 515 headphones (Sennheiser Electronic Corporation, Connecticut). Gee et al. (11) used a CD player with a bone conductor as their equipment for the sound-based intervention. Before the intervention started, the participants were screened and assessed by a licensed audiologist (11,16). The results of the interventions are also varying among the studies. The study by Nwora et al. (16) showed the participant could tolerate the multi-stimuli activities and improve in receptive listening and language.

Thirdly, adaptive devices (n=4) were also utilised and included in this study that employed the usage of noise-cancelling/reduction headphones and earmuffs. Noise-cancelling headphones may be employed around-ear and in-ear headphones(17,18).

Theme 2: Approach of Intervention

The intervention approach was divided into two parts: top-down and bottom-up. Four studies (n=4) utilised the top-down approach that used the usage of earmuffs or/ and noise-cancelling/reduction headphones. Positive findings were achieved based on four studies that indicate this adapted device's use was beneficial for children with ASD, thereby enhancing their performance and engagement (17–20).

For the bottom-up approach, two methods were identified to manage the hyperacusis symptoms among the children with ASD which are the utilisation of AIT (n=1) and TLP (n=3). One study in the context of the bottom-up approach showed mixed results but the authors in the other three research articles concluded on the positive part of their findings.

Theme 3: Dosage and Intensity of Intervention

The intervention dosages were described by the researchers in the included studies. AIT follows the Berard protocol, in which the participant listens to the modulated music for half an hour in the morning and half

an hour in the evening, with a four-hour gap in between for 10 consecutive days. Meanwhile, TLP follows the Advance Brain Technologies recommendation, in which the participants listened to 15-minute sessions of psychoacoustically modified classical music twice a day, five days per week for 20 weeks in their home environment. There was no literature that provide recommended wearing times for headphones (17), but papers included in this scoping review implemented around 2 to 4 weeks of participants wearing their earmuffs or noise-cancelling headphones.

DISCUSSION

This scoping review aimed to collect and map the available evidence regarding occupational therapy intervention, specifically for auditory processing disorder in children with ASD. Limited studies included in this review suggest that the current topic has not been explored enough. However, occupational therapists would still have the responsibility to provide intervention for auditory processing disorder in children with ASD as this deficit can have a major impact on children's performance in ADL, play, and education. More than half of the articles reviewed reported positive outcomes of the intervention both at body function and daily functional level. These findings are coherent with a previous scoping review, in which the application of many types of sound-based intervention for children with ASD may or may not improve their functional outcomes (21). Nevertheless, further randomized-controlled trials (RCT) and systematic reviews (SR) are warranted as these interventions are still evolving.

The shreds of evidence included in this review reflect three available interventions practised by occupational therapists in the management of auditory processing disorder for children with ASD. Only one study deliberates on AIT as one of the treatment approaches within the current concept and context (15). The authors claimed that their intervention resulted in positive changes in the two case samples. However, this study was published more than two decades ago, and the outcome measures used were questionable. Changes were also not significant in several components of the functional areas investigated, which affected the effectiveness of AIT.

The interventions for auditory processing disorder use different protocols and fidelity measures. Three studies discuss TLP as a more recent and updated occupational therapy intervention for auditory processing disorder in children with ASD (10,11,16). All three articles apply the same TLP protocol but with three different treatment durations to their samples. Two studies outlined significant positive outcomes by applying a 10-20-week treatment duration, while one other study applying a 28-week treatment duration suggested mixed results. TLP is a sound-based intervention that is currently expanding in its frequency of practice among occupational therapists. Nevertheless, at present, there is insufficient understanding and a lack of suitable models to elucidate the connection between ASD and sound. As a result, there is a lack of established interventions tailored to specific sounds or models (21).

The use of adaptive devices such as earmuffs and noise-cancelling headphones is also one of the available occupational therapy interventions for children with ASD who experience auditory processing disorder. Although different brands and models of adaptive devices were mentioned in four of the included articles, the modalities of these devices are promising and proven effective in improving occupational engagement at home and in the community (17–20). Their findings are in line with a systematic review that suggests moderate support for the use of frequency modulation devices to improve the occupational engagement of children with auditory processing disorders in the classroom (9).

The occupational therapy approach to interventions includes both a bottom-up and top-down approach. In our point of view, the bottom-up approach of AIT was regarded as questionable in terms of its effectiveness due to the poor presentation of evidence and the lack of rigorous study design. This conclusion was drawn from descriptive case reports and required further exploration (15). The bottom-up approach of the TLP intervention provided some promising outcomes. However, all three related studies regarding TLP recruited a small sample size of not more than three children with ASD (10,11,16). This is a drawback because a small number of subjects are prone to exhibit differences from the overall population, thereby limiting the generalizability of the findings (22). The included articles in this review for the top-down occupational therapy approach did not establish any gold standard intervention because no studies use RCT as their study design. However, a summary of findings reported positive outcomes from the use of both earmuffs and noise-cancelling headphones. Unlike the bottom-up approach, no studies focusing on the top-down approach conveyed any mixed results. This review highlights that the top-down approach is more beneficial in improving functional activity engagement and occupational performance, as this approach was also said to be the forte of occupational therapists (23).

This scoping review has several limitations. First, the study selection process was conducted collectively by four reviewers rather than independently, which may introduce potential bias. Although agreement on study inclusion was guaranteed by this consensus-based approach, independent screening by several reviewers could improve its methodological rigor. Second, this review did not include grey literature, non-peer-reviewed studies, and unpublished research, which may have provided larger data regarding the reviewed population, context, and concept. Third, a methodological quality

assessment of the included studies was not carried out. Incorporating a structured quality appraisal tool like the Joanna Briggs Institute (JBI) checklist could have strengthened the findings. Despite these limitations, this review contributes valuable insights into the landscape of occupational therapy interventions for auditory processing disorder in children with ASD.

CONCLUSION

This scoping review found three occupational therapy interventions used to treat auditory processing disorder that were delivered by the occupational therapists, which are AIT, TLP and adapted devices (earmuffs and noise-cancelling headphones). Two interventions were classified as bottom-up approaches, which are AIT and TLP, while one intervention was classified as the top-down approach, which is the usage of adaptive devices. Generally, all three types of intervention discovered through this review are feasible to be applied to children with ASD. However, future research should establish RCT studies to produce a gold-standard occupational therapy intervention for the current population, context and concept.

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REFERENCES

1. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders Text Revision DSM-5-TR. American Psychiatric Association.; 2022.
2. Zeidan J, Fombonne E, Scorah J, et al. Global prevalence of autism: A systematic review update. Autism research. 2022;15(5):778-790. doi:10.1002/aur.2696
3. Thye MD, Bednarz HM, Herringshaw AJ, Sartin EB, Kana RK. The impact of atypical sensory processing on social impairments in autism spectrum disorder. Dev Cogn Neurosci. 2018;29:151-167. doi:10.1016/j.dcn.2017.04.010
4. Tomchek SD, Dunn W. Sensory processing in children with and without autism: a comparative study using the short sensory profile. The American journal of occupational therapy. 2007;61(2):190-200. doi:10.5014/ ajot.61.2.190
5. Case-Smith J, Weaver LL, Fristad MA. A systematic review of sensory processing interventions for children with autism spectrum disorders. Autism. 2015;19(2):133-148. doi:10.1177/1362361313517762
6. Ornitz EM. The modulation of sensory input and motor output in autistic children. J Autism Child Schizophr. 1974;4(3):197-215. doi:10.1007/BF02115226
7. Dunn W. The impact of sensory processing abilities on the daily lives of young children and their families: A conceptual model. Infants Young Child. 1997;9(4):23-35. doi:10.1097/00001163-199704000-00005
8. Mazurek MO, Vasa RA, Kalb LG, et al. Anxiety, sensory over-responsivity, and gastrointestinal problems in children with autism spectrum disorders. J Abnorm Child Psychol. 2013;41:165-176. doi:10.1007/s10802-012-9668-x
9. Reynolds S, Miller Kuhaneck H, Pfeiffer B. Systematic review of the effectiveness of frequency modulation devices in improving academic outcomes in children with auditory processing difficulties. The American Journal of Occupational Therapy. 2016;70(1):7001220030p1-7001220030p11. doi:10.5014/ajot.2016.016832
10. Gee B, Thompson K, Pierce A, Toupin M, Holst J. The effectiveness of auditory stimulation in children with autism spectrum disorders: A case–control study. Int J Ther Rehabil. 2015;22(1):36-46. doi:10.12968/ijtr.2015.22.1.36
11. Gee BM, Thompson K, St John H. Efficacy of a sound-based intervention with a child with an autism spectrum disorder and auditory sensory over-responsivity. Occup Ther Int. 2014;21(1):12-20. doi:10.1002/oti.1359
12. Lau BK, Emmons KA, Lee AKC, Munson J, Dager SR, Estes AM. The prevalence and developmental course of auditory processing differences in autistic children. Autism Research. 2023;16(7):1413-1424. doi:10.1002/aur.2961
13. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19-32. doi:10.1080/1364557032000119616
14. Tricco AC, Lillie E, Zarin W, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. Ann Intern Med. 2018;169(7):467-473. doi:10.7326/m18-0850
15. Brown MM. Auditory integration training and autism: Two case studies. British Journal of Occupational Therapy. 1999;62(1):13-18. doi:10.1177/030802269906200105
16. Nwora AJ, Gee BM. A case study of a five-year-old child with pervasive developmental disorder-not otherwise specified using sound-based interventions. Occup Ther Int. 2009;16(1):25-43. doi:10.1002/oti.263
17. Pfeiffer B, Erb SR, Slugg L. Impact of noise-attenuating headphones on participation in the home, community, and school for children with autism spectrum disorder. Phys Occup Ther Pediatr. 2019;39(1):60-76. doi:10.1080/01942638.2018.1496963

18. Pfeiffer B, Stein Duker L, Murphy A, Shui C. Effectiveness of noise-attenuating headphones on physiological responses for children with autism spectrum disorders. Front Integr Neurosci. Published online 2019:65. doi:10.3389/fnint.2019.00065
19. Ikuta N, Iwanaga R, Tokunaga A, Nakane H, Tanaka K, Tanaka G. Effectiveness of earmuffs and noise-cancelling headphones for coping with hyper-reactivity to auditory stimuli in children with autism spectrum disorder: A preliminary study. Hong Kong Journal of Occupational Therapy. 2016;28(1):24-32. doi:10.1016/j.hkjot.2016.09.001
20. Rowe C, Candler C, Neville M. Noise reduction headphones and autism: A single case study. J Occup Ther Sch Early Interv. 2011;4(3-4):229-235. doi:10.1080/19411243.2011.629551
21. Shahrudin FA, Dzulkarnain AAA, Hanafi AM, et al. Music and Sound-Based Intervention in Autism Spectrum Disorder: A Scoping Review. Psychiatry Investig. 2022;19(8):626. doi:10.30773/pi.2021.0382
22. Tipton E, Hallberg K, Hedges LV, Chan W. Implications of small samples for generalization: Adjustments and rules of thumb. Eval Rev. 2017;41(5):472-505. doi:10.1177/0193841x16655665
23. Novak I, Honan I. Effectiveness of paediatric occupational therapy for children with disabilities: A systematic review. Aust Occup Ther J. 2019;66(3):258-273. doi:10.1111/1440-1630.12573