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Behavioral And Emotional Difficulties In Hearing Impaired Children And Adolescents: A Systematic Review

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ABSTRACT
The current study aims to assemble and evaluate the data about the association between behavioural & emotional problems in hearing-impaired adolescents & children. A thorough search of electronic databases was carried out, including PubMed, Science Direct, PJER, Wiley Online Library, Research Gate, Oxford Academic and Google Scholar to identify relevant studies. Two unbiased reviewers carried out the screening, comparing the papers to the inclusion and exclusion criteria. Discussions were used to resolve conflicts, and a third reviewer was called in for final approval. Based on increased scores on measures such as the Strengths and Difficulties Questionnaire (SDQ), the systematic review found that adolescents & children with hearing loss have a higher prevalence of behavioural problems than their counterparts who do not have hearing loss. It has been discovered that numerous factors, including the age of diagnosis, communication skills, and the existence of additional disabilities, have an impact on the emergence of behavioural issues. Although early detection of hearing loss did not greatly lessen behavioural problems, it was linked to better language development. When compared to hearing aids, cochlear implant users often had higher social-emotional functioning. One important result was that communication skills play a supporting role in the psychological well-being of the population. This systematic study emphasizes the importance of understanding and resolving behavioural problems in adolescents & children with hearing loss. It emphasizes how crucial early diagnosis and treatment are for promoting language development and psychological health. The results point to the necessity of customized therapies, especially for people who have acquired hearing loss or other disabilities. For this demographic, it is critical to screen for behavioural & emotional problems as well as implement strategies to strengthen social and emotional competencies. The analysis emphasizes the necessity of comprehensive interventions to support children ' well-being who have hearing loss.

Keywords: emotional problems, behavioural problems, hearing loss, SDQ children.

INTRODUCTION

Hearing impairment (HI), is a condition in which a person's capacity to hear sounds is impaired partially or totally ((Zahnert, 2011)). Hearing loss is a prevalent sensory disability that affects millions of individuals worldwide. An estimated 4-18% of people worldwide are expected to have hearing loss (Masalski & Morawski, 2020). In addition, 4 out of 1,000 newborns have some degree of hearing impairment. Hearing impairment in adolescents & children has significant effects on behavioural, social and emotional development (Hogan et al., 2011; N.J Laugen et al., 2017). Communication challenges may hurt the emotional and social development of hearing-impaired children. (Desoky et al.,2021). The social development of children depends on communication (Vaccari & Marschark, 1997), and children often pick up language and social skills through listening to others and interacting with them [NIDA, 1952]. Different behavioural problems such as aggression, hyperactivity, oppositional defiant disorder, depression, anxiety and somatization have been associated with hearing impairment (Stevenson et al., 2015; Theunissen et al., 2014). Children with hearing impairment are also prone to show ADHD symptomatology, inattention and increased rate of hyperactivity (Mattingly et al., 2023;). Hearing-impaired children also confront distinct obstacles in navigating their surroundings. Frustration, loneliness, and low self-esteem can result from an inability to hear and speak well (Warner-Czyz et al., 2015). If these issues are not resolved, by appropriate and timely intervention, they may develop into behavioural problems (Nourbakhsh et al., 2021) that could impede a child's social, emotional, and cognitive growth. Hearing-impaired children usually have more behavioural problems than their normal-hearing peers (Mushtaq, N. H., 2023). Frustration and difficulties expressing or comprehending themselves or others might

result in behavioural outbursts or withdrawal from social contacts. Furthermore, social isolation can be a serious problem since hearing-impaired children may find it difficult to participate fully in peer interactions, which can lead to feelings of exclusion and loneliness (Patel et al., 2021; Kirman & Yildirim, 2013). These issues can be made worse by delayed language development brought on by hearing loss, which can affect academic achievement and confidence (Mulat et al., 2019; Bess et al.,1998). Prior research has shown that children & adolescents with hearing loss have higher levels of emotional and behavioural issues (Paterson et al.,2020; Fiorillo et al., 2017; Bigler et al., 2019). Understanding the link between hearing loss and behavioural difficulties in children is critical for their development and well-being (Stika et al., 2015) and this understanding will help in developing effective interventions and support systems (Yoshinaga-Itano, 2004). However, a thorough review of this research exposes weaknesses such as inconsistency in findings, varied evaluation methods, and little exploration of particular factors driving these challenges, and as a result, these children and adolescents do not receive behavioural therapy. The objective of this systematic review study is to confirm and validate prior research and to see whether hearing-impaired children & adolescents have a higher prevalence of emotional and behavioural issues than children & adolescents with normal hearing. The current study aims to improve the well-being and behavioural health of hearing-impaired children & adolescents.

METHODOLOGY

The inclusion criteria of this systematic review contain peer-reviewed studies that used the SDQ as an evaluation tool to examine behavioural difficulties in children and adolescents (4 to 20 years) with hearing loss. For a study to be accepted, it is required to offer summary data for children and adults with hearing loss on any of the PTS (Parent, Teacher, or Self-rated) versions of the SDQ. There are 5 sub-scale scores for emotional symptoms and an overall Total Difficulties score in each of these three versions of the SDQ, which are Emotional Symptoms, Conduct Problems, Hyperactivity, Peer Problems and Prosocial Behavior. These results could be contrasted with demographic norms or with a control group that has normal hearing. A thorough search of electronic databases was carried out, including PubMed, Science Direct, Wiley Online Library, ijmhd, Research Gate, Oxford Academic and Google Scholar to identify relevant studies. On September 2, 2023, the research team conducted a comprehensive search. The search strategies contained controlled vocabulary, as well as appropriate keywords including emotional problems, behavioural problems, hearing loss, and SDQ children. Two reviewers separately assessed the titles and abstracts for each paper based on the inclusion criteria. A third author adjudicated disagreements. The search identified 19,916 possible studies for inclusion. After removing duplication, titles of 17,619 articles were screened and 13,198 articles were excluded. 4421 articles abstracts were screened and 3749 articles were excluded because they did not meet our research objective. 627 full-text articles were assessed for eligibility and 17 articles were selected that met inclusion criteria (Figure 1).

RESULTS

There were 17 SDQ studies which provided 12 Parents, 9 Teachers and 6 Self-rated estimates of effect size for Total Difficulties. In 8 studies Control group was added. The sample size in all studies ranged from 76 to 356. The ages of children and adults ranged from 4 to 20 years. The systematic analysis of all studies is given in Table 2. Children using HA and CI were included in these studies (Wong, et al., 2017; Alegre & Villar, 2021; Aanondsen et al., 2023; Michael et al., 2019; Agung et al., 2021). Wong, et al (2019) compared children using Cochlear implants, children with severe to profound hearing impairments who used hearing aids exhibited noticeably greater behavioural issues. The SDQ subscale that most set apart children with cochlear implants from those wearing hearing aids was conduct issues (Alegre & Villar, 2021). Michael et al (2019) Compared to parents of kids using HAs, parents of kids using CIs showed a higher score of pro-social conduct and lower levels of hyperactivity/inattention. Children's hyperactivity/inattention and behavioural issues were inversely connected with the age at which the cochlear implant was done. And the older age at which hearing loss was diagnosed was linked with higher pro-social behaviour. Lower social-emotional results were linked to earlier age at implantation. 54% of kids with cochlear implants and 90% of kids with hearing aids had borderline scores for behavioural and emotional problems (Agung et al. 2021). (Hintermair M, 2007; Huber et al. 2015; Niclasen & Dammeyer, 2016) included children using CI. The cochlear implant group showed more "Peer Problems" than the normal hearing group (Huber et al. 2015). (Niclasen & Dammeyer, 2016) Compared to their hearing peers, children with hearing loss had higher mean scores on SDQ problem subscales, suggesting a higher prevalence of mental health issues. Hearing control was added in studies (Stevenson et al. 2017; Wong, et al., 2017; Stevenson et al. 2011; Huber et al. 2015; Dammeyer J. 2010; Stevenson et al. 2019; Pinquart & Pfeiffer, 2018, Hameed N, 2023). These studies showed children with hearing impairment have poor QOL as compared with normal hearing fellows. According to Hameed N. (2023), Hearing-impaired children had higher Total difficulty scores than normally hearing peers. Mejstad et al. (2009) compared children in Special schools for hard of hearing and normal mainstream schools. It showed that in comparison to students in schools for the deaf, students in mainstream schools and students in special schools for the HOH reported greater scores of mental health and self-image. Fellinger et al. (2009) investigated the prevalence of psychological disorders, including depression, and their relationships with factors like the hearing-impaired child's capacity to be understood within the family, taunting, bullying by classmates, and isolation. The study found that children with hearing impairments had a higher incidence of mental health issues, particularly depression.

DISCUSSION

The objective of this systematic review was to compile and assess information regarding the relationship between behavioural and emotional issues in adolescents and children with hearing impairments. A thorough search of several databases was done to locate studies addressing emotional and behavioural issues in this population. A total of 17 types of research were chosen for their relevance and focus on behavioural concerns in children with hearing loss. This systematic

review found that hearing-impaired children & adolescents had a higher prevalence of behavioural difficulties than their typically hearing (TH) peers. The studies revealed various elements that contribute to the appearance of behavioural issues. Important influencing factors included the age of diagnosis, the kind of communication (spoken, sign, or a combination), and the existence of other disabilities. Language development was positively benefited by early identification of hearing loss, although behavioural problems were not always resolved. When compared to hearing aids, cochlear implants have been shown to improve social-emotional performance. The degree of this benefit, however, may differ from person to person, highlighting the necessity for customized interventions (based on unique needs and assistive device responses). HH children reported a much higher prevalence of clinical difficulties; they assessed their mental health comparable to their normally hearing (TH) peers. The findings highlighted the need for early detection, thorough evaluations, and customized interventions to address the various issues that children and teenagers with hearing loss encounter. To mitigate behavioural difficulties, holistic approaches that emphasize language development, emotional regulation, and social skills are crucial. The systematic review underscored the significance of regular screening for emotional and behavioural problems in this population. It also emphasized the significance of programs meant to improve emotional intelligence, encourage constructive peer relationships, and offer sufficient assistance for mental health issues. The review's focus was limited to available literature, emphasizing the need for additional research [as others have highlighted it (Moeller, 2007; Van et al., 2004; Wake et al, 2004) to fully understand and create effective intervention options for behavioural issues in hearing impaired children & adolescents.

CONCLUSION AND RECOMMENDATIONS

Finally, more extensive study is needed to have a better knowledge of psychopathological development in hearing impairment (HI) children & adolescents. This increased understanding will allow for more targeted counselling and treatment options that address the specific requirements of this vulnerable population. Such activities will raise awareness and help professionals better support and assist each individual with hearing loss. Research that follows deaf people from infancy to adulthood could provide valuable information about the course of behavioural problems as they develop and how early interventions, communication styles, and social settings affect long-term psychological consequences.

ABBREVIATIONS

SDQ - Strengths and Difficulties Questionnaire
PCHL - Permanent Childhood Hearing Loss
PCHI- Permanent Childhood Hearing impairment
HCG - Hearing Comparison Group
CIs - Cochlear Implants
HAs - Hearing Aids
ITPA - Illinois Test of Psycholinguistic Abilities
VABS - Vineland Adaptive Behaviour Scales
NH - Normal Hearing
EBD - Emotional and Behavioural Difficulties
IQ - Intelligence Quotient
QoL - Quality of Life
DHH - Deaf or Hard of Hearing
LC - Language Comprehension
RC - Reading Comprehension
EBD - Emotional and Behavioral Difficulties
ZNA- Zürich Neuromotor Assessment

DECLARATIONS

STATEMENT OF ETHICS

An ethics statement is not applicable because this study is based exclusively on published literature.

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CONFLICT OF INTEREST / COMPETING INTERESTS

The article and its authors have no conflict of interest.

CONSENT FOR PUBLICATION

Since the article and its data do not contain any material that gives away the identity of our participants so it is Not Applicable

AVAILABILITY OF DATA AND MATERIALS

All the data and materials have been properly stored and shall be available on demand.

CODE AVAILABILITY

Not applicable

AUTHORS CONTRIBUTIONS

Nukhbat Ullah Awan: Substantial contributions to the conception; or the acquisition, analysis, or interpretation of data for the work; AND Final approval of the version to be published
Uzma Malik: Drafting the work or reviewing it critically for important intellectual content; AND Final approval of the version to be published.
Malaika Azam: Conception or design of the work; or the acquisition, analysis, or interpretation of data for the work
Anum Nasrullah: Substantial contributions to the conception or design of the work; or the acquisition.
Fatima Tahir: Drafting the work or reviewing it critically for important intellectual content.

Rabia Zulfiqar: Drafting the work or reviewing it critically for important intellectual content; Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
Amna Awais: Drafting the work or reviewing it critically for important intellectual content.

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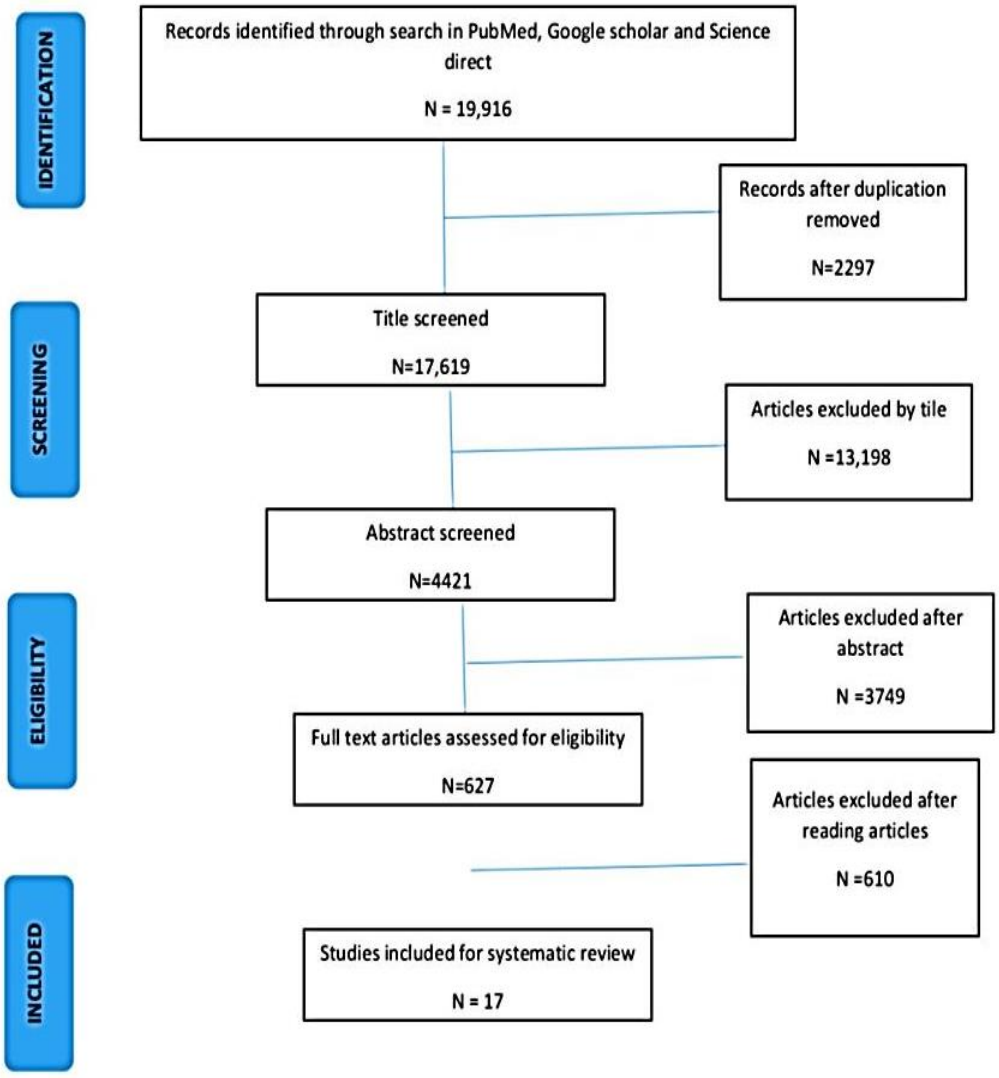

Figure 1: PRISMA flowchart that summarizes the selection procedure for the SDQ studies

Table 1: Characteristics of study on Emotional problems in children with hearing loss using SDQ

Source	No. of participants	Age	Degree Of Hearing Loss	SDQ Rating	Hearing controls
Stevenson et al. (2017)	114	13 To 20	Moderate 33 Severe/Profound 43	PTS	YES 36
Wong et al. (2017)	356(HA=236,CI=120)	Ha(58-73 Months) CI (59-67 Months)	Ha, Ci Mild=60,0 Modearte=120,2 Severe=48,9 Profound=8,109	P	YES
Alegre & Villar(2021)	300(HA=113,CI=187)	HA, CI 4-5 Years=0,15 6-9 Years=34,64 10-11 Years=41,33 13 To 16 Years=38,71	Ha, Ci Mild=32/25,17/16 Moderate To Severe=57/63,42/29 Profound=24/25,128/142	P, T, S	NO
Hintermair M. (2007)	213(HARD OF HEARING=163,CI=50)	4-6 Years=20 7-10 Years=88 11-13 Years=105	Mild To Moderate=80 Severe=74 Profound=59	P	-
Mejstad et al. (2009)	111 28=Special School 23=Special School For Hard Of Hearing 60=Normal School Where Hard Of Hearing Children Were Mainstreamed	11-18 Years	-	P, T, S	-
Stevenson et al. (2011)	120	5-11 Years	Moderate=65 Severe=29 Profound=26	P, T	YES 63
Huber et al. (2015)	140	12-17 Years	-	P, T, S	YES 140
Dammeyer J. (2010)	334(Hard Of Hearing=116,Deaf=119,Ci=92)	6-19 Years	-	T	YES
Aanondsen et al. (2023)	106(Deaf And Hard Of Hearing=59,Hard Of Hearing=47)	6-19 Years	HA, CI DHH(33/8,19/22)Hoh(38/7,3/42)	S, P	-
Michael et al. (2019)	63(HA=32,CI=31)	Ha=12-18 Months Ci=12-180 Months	HA, CI Moderate=10,0 Severe=19,28 Profound=3,8	P	-
Stevenson et al. (2019)	57	6-10 Years	Moderate=30 Severe=13 Profound=14	P, T	YES 38
Niclasen & Dammeyer (2016)	2007(N=3340)CI=91 2014(N=233)CI=194	4-19 Years	Severe To Profound	P, T	-
Agung et al. (2021)	50(HA=28,CI=22)	6-12 Years	Deaf	-	-
Pinquart & Pfeiffer (2018)	HI=181	6 To 10 Grade School	Hi Mild=41 Moderate=55 Severe=37 Profound=48	S	YES 260
Fellinger et al. (2009)	95	6-16 Years	Moderate=44 Severe=23 Profound=25	P, T	-
Hameed N. (2023)	150	4-16 Years	-	S	YES 75
Fellinger et al. (2015)	93	6-16 Years	-	P	-

Table 2: Systematic Analysis of Included Studies

Source	Included Studies Findings	Conclusion
Stevenson et al. (2017)	The PCHL group outscored the HCG significantly in Total Difficulties on the parent-rated SDQ (SMD = +0.39). Parent-rated EBD was significantly impacted by disabilities other than hearing loss (SMD = +1.68). Receptive language abilities and EBD were negatively correlated in the PCHL and HCG groups. Receptive language was a non-significant covariate that changed the significance of PCHL's influence on EBD. The EBD scores were not considerably impacted by the early confirmation of hearing loss (before to the age of nine months).	In this study, the association between PCHL and EBD was evaluated using statistical analysis, which included correlation analysis and standardized mean differences (SMD).
Wong et al. (2017)	Parent-reported SDQ scores for emotional and behavioural issues were, at most, one standard deviation out of the norm. Social skills scores on the Child Development Inventory were more than one standard deviation below the norm, indicating difficulties in this domain. In comparison to children who used CIs, children with severe-to-profound hearing impairments who used HAs had much more behavioural difficulties. For children with HAs, functioning auditory behaviour, language, and nonverbal cognitive capacity were all substantially correlated with psychosocial outcomes. Children with CIs had various outcomes depending on whether they exhibited functional auditory behaviour or had other problems.	The study evaluated the relationships between language, psychosocial outcomes, and hearing status using multivariable-adjusted methods.
Alegre & Villar(2021)	The SDQ ratings obtained from student self-reports varied from those obtained from parent and teacher reports, indicating discrepancies in perception. Ten covariates affected student oral and written linguistic abilities. There were variations between the groups investigated in terms of mental health and talents, particularly in the ability to recall difficult sums from memory.	The study investigates differences in perceptions of mental health and abilities between students, parents, and teachers.
Hintermair M. (2007)	It has been demonstrated that the SDQ German version is useful in identifying socio-emotional problems in children who are hard of hearing or deaf. The prevalence of socio-emotional issues was substantially greater in hard-of-hearing and deaf children than in the German standardization sample.	The incidence of socio-emotional disorders among the children in the study population who were hard of hearing or deaf was compared to the German standards sample using statistical analysis.
Mejstad et al. (2009)	Children who are hard of hearing appear to same as other young people in the Swedish population in aspects of mental health and self-image. Mainstreamed children as well as those attending special schools for the hard of hearing reported better degrees of self-image & mental health than students attending learning institutions for the deaf.	The study compared mean SDQ and "I Think I Am" questionnaire scores between groups and assessed the participants' self-image & mental health.
Stevenson et al. (2011)	The VABS's Socialization and Daily Living Skills assessments yielded lower standard scores for PCHI children. Based on ratings from parents and teachers, they had significantly greater Total Behavior Problem scores on the SDQ. There were no discernible behavioural changes between children with PCHI verified before 9 months of age and those confirmed beyond that age, according to the study.	The study examined SDQ and VABS scores between PCHI children and hearing children to investigate the influence of early detection of hearing impairment.
Huber et al. (2015)	CI users demonstrated much more "Peer Problems" than their normal hearing peers. The group of CI users was separated further into a "risk group" with potential extra handicaps and a "non-risk group." In comparison to the normal hearing group, both subgroups reported more peer problems. Users of CI who could comprehend speech in noise encountered fewer problems than those CI users who could not comprehend speech in noise.	This study evaluated associations between mental health issues and hearing variables as well as the severity of mental health issues among CI users and normal hearing peers.
Dammeyer J. (2010)	Children with extra disabilities had a greater prevalence of psychosocial issues than children without additional impairments. When compared to a group of hearing children, children with hearing loss experienced a much higher frequency of psychosocial issues. Children with strong sign language skills and/or oral language did not have significantly greater levels of psychosocial issues than hearing children.	The incidence of psychosocial problems in children with hearing loss was examined, and the effects of communication style, hearing loss severity, and extra handicap were examined.
Aanondsen et al. (2023)	(D)HH and parents gave comparable ratings to TH peers for mental health on the SDQ scale. Children from (D)HH rated their quality of life (QoL) similarly to their TH mates. QoL was assessed substantially lower in parents of (D)HH children than by (D)HH self-reports. The severity of hearing loss, as reported by parents, exhibited no significant relationship with mental health or QoL.	The study compared the QoL & mental health among DHH, HH, and TH groups. The relationships between mental health, communication skills, quality of life, and hearing loss degree were examined using statistical methods.
Michael et al. (2019)	Parents of children with CIs reported reduced levels of hyperactivity/inattention and higher levels of pro-social conduct in comparison with parents of children with HAs. Among CI users, children's hyperactivity/inattention and behavioural difficulties were inversely related to age at implantation, and older age of hearing loss identification was associated with higher pro-social behaviour.	The study investigated the social-emotional functioning of CIs and Has users, as well as the effects of age at implantation and the age at which hearing loss was discovered.
Stevenson et al. (2019)	The relationships between LC and RC scores and EBD scores were negative throughout middle childhood and adolescence. According to cross-lagged latent variable models, the behaviour was more significantly impacted by LC and RC than the other way around.	The study looked at the relationships between LC, RC, and EBD. SDQ evaluations from parents and teachers were used to assess EBD.

Niclasen & Dammeyer (2016)	The SDQ's five-factor structure was discovered for the samples from 2014 and 2007. Danish children with hearing loss had greater mean scores on all SDQ problem subscales when juxtaposed to a group of typically hearing children.	The study evaluated the internal consistency of the scale and looked at the SDQ's factor structure. The SDQ scores of hearing-impaired children and typically hearing children were also compared.
Agung et al. (2021)	Difficulty Subscale: Borderline scores for behavioural and emotional problems were found in 54% of cochlear implant users and 90% of hearing aid users. Power Subscale: Children with cochlear implants scored borderline comparably at 32%, whereas children with hearing aids scored similarly at 50%.	The study employed a descriptive observational design to assess children with sensorineural hearing loss, with data collected via the Strengths and Difficulties Questionnaire. The information gathered was interpreted using descriptive analysis.
Pinquart & Pfeiffer (2018)	Hearing-impaired adolescents had higher Total Issues Score, more behavioural issues, and greater degrees of prosocial behaviour compared to hearing peers. Adolescents who are deaf reported higher levels of peer problems & emotional symptoms than their hearing peers. Compared to adolescents with acquired hearing loss, adolescents with congenital hearing impairment displayed reduced levels of hyperactivity-inattention.	The study compared the total Difficulties Score, conduct problems, emotional symptoms, peer problems, and hyperactivity-inattention in adolescents with and without hearing impairment.
Fellinger et al. (2009)	The child's capability to be understood inside the family was associated with having a lifetime diagnosis. Psychiatric disorders and depression were higher in hearing-impaired children than in general population samples. Individuals who experienced bullying, mistreatment from peers, or social isolation were more likely to develop internalizing mental health illnesses.	The study investigated the prevalence of psychological disorders, including depression, and their relationships with factors such as the potential of hearing-impaired children to be understood within the family, taunting, bullying by classmates, and isolation.
Hameed N. (2023)	Hearing-impaired children had greater Total difficulty scores as compared to their normally hearing peers.	The study compared emotional and behavioural issues in hearing-impaired children and normal-hearing peers using SDQ.
Fellinger et al. (2015)	Hearing-impaired children scored lower on all four ZNA subscales as compared to ZNA norms (*z*-scores ranging from -1.42 to -2.67). Pure motor performance and the SDQ overall problems score showed negative associations after correcting for nonverbal IQ. There were correlations found between several ZNA subscales and particular characteristics of mental health: The skills of dynamic balance, pegboard, and pure motor were negatively connected with peer-relationship issues. Emotional issues have a negative correlation with dynamic balance. The relationship between age and pure motor and dynamic balancing skills was negative. Aside from static balancing, no significant relationship between hearing impairment and motor performance was discovered.	Using ZNA and SDQ, this study evaluated the link between motor function and mental health in children with hearing impairments.