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ORIGINAL ARTICLE

Development and Validation of a Questionnaire for Hearing Device Use Impact on Cognitive, Behavioral, and Psychological Buildup in Children

Soha Abdelraouf Mekki, Samar Ahmed Sherif, Norhan Ahmed Amer*, Mai Ragab Ghazaly
Audio-vestibular Medicine Unit, Department of Otolaryngology, Head & Neck Surgery, Faculty of Medicine, Zagazig University, Zagazig, Egypt.

*Corresponding Author:

Norhan Ahmed Amer

Email:

amernorhan372@gmail.com

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ABSTRACT

Background: Hearing-impaired children face many challenges and obstacles in the journey of their academic and social life, obligating them to cut off use of their hearing device. Since there is no Arabic questionnaire estimating the impact of hearing device use on cognitive, behavioral, and emotional aspects of children, we aimed to develop a new Arabic questionnaire that suits the Arabic culture and facilitates the expression of troubles parents and caregivers have because of the impact of hearing device use on children.

Methods: A new questionnaire was created for this cross-sectional study based on the grievances of a representative sample of 20 Arabic children who use hearing devices. History-taking involving hearing device use, otoscopic examination, basic audiological evaluation, administration of the new questionnaire, and the Arabic Spence Children's Anxiety Scale – Parent version. Two weeks separated the two administrations of the developed Arabic questionnaire. Construct validity and exploratory factor analysis were used to assess the scale's validity. Cronbach's alpha and split-half reliability coefficients were used to assess internal consistent reliability.

Results: Factor analysis validated 18 items and categorized them into three dimensions (with eigenvalues >1): cognitive, behavioral, and emotional. Adequate construct validity was indicated by the moderate to strong correlations between the total and subscale scores and the validation scale scores. Measures of reliability revealed high internal and external scale and subscales' reliability.

Conclusion: The developed Arabic questionnaire for hearing device use impact on children is valid and reliable in the assessment of cognitive, behavioral, and emotional performance of Arabic-speaking children using hearing devices.

Keywords: Arabic culture, development, questionnaire, validity, reliability.

INTRODUCTION

The acquisition of spoken language, academic achievement, and social interaction all depend on hearing. Hearing loss hinders children's education and social integration, which can have long-term negative consequences ranging from loneliness and fewer job opportunities to poor academic progress and interpersonal problems [1].

It is believed that the stigma, discrimination, and communication barriers in a hearing context are the reasons for the higher prevalence of depression among children with hearing impairment. Furthermore, hearing-impaired children still have difficulty in unfavorable listening conditions like reverberation and speech-in-noise, despite improvements in oral language and

speech development as well as better signal processing technology [2].

In children, hearing loss significantly interferes with the development of cognitive abilities by restricting access to auditory input that is essential for language acquisition, attention, memory, and executive functioning. Limited auditory stimulation during critical developmental periods can delay learning, impair academic achievement, and hinder social integration. These effects support the notion that auditory deprivation in early life not only hampers communication but also has long-term consequences on cognitive development [2].

Failure to get hearing rehabilitation can have detrimental effects on a child's speech, language, development, education, and cognitive capacities, particularly if the hearing loss is identified early in life or soon after birth [3]. On the other hand, some hearing device users may reject their device. The causes for rejecting hearing devices could be related to one or more of the following factors: [a] being unaware of their condition; [b] not seeing many benefits from wearing hearing device; [c] social stigma and other social factors; [d] having trouble understanding others; [e] experiencing discomfort or trouble using the device; [f] not having enough money; and [g] not having enough family or social support [4]. In general, refusing to wear a hearing device makes interacting with the outside world more difficult. In daily interactions, children with hearing loss need a great deal of attention. [5].

In this context, several questionnaires can be used to gauge children's emotional, behavioral, and cognitive health. The Preschool Behavioral Questionnaire (PBQ) [6] is commonly used to evaluate behavioral problems in young children, including hyperactivity, aggression, and emotional dysregulation. In addition, the Revised Child

Anxiety and Depression Scale-Child version (RCADS-Child) [7] is designed to assess symptoms of anxiety and depression in children across several domains such as separation anxiety, social phobia, and generalized anxiety disorder.

Both questionnaires have been translated into several languages, including Arabic, which makes them valuable tools in multicultural and multilingual contexts. Despite their usefulness, several limitations have been identified. First, these tools were developed primarily for general child populations and are not tailored to the specific psychosocial challenges faced by children with hearing loss, such as communication barriers, device-related stigma, and frustration from listening fatigue. Second, the language adaptations, while translated, may not always achieve full cultural and contextual validity, leading to reduced sensitivity in detecting the unique emotional and behavioral difficulties of hearing-impaired children. Third, the length and complexity of some scales (e.g., RCADS) can be burdensome for children with limited attention spans or language delays, which may compromise the accuracy of responses.

The development of a new, tailored questionnaire is necessary to address the existing gaps. The proposed tool aims to provide a more context-specific, culturally sensitive, and accessible measure of cognitive, behavioral, and emotional difficulties in children with hearing loss, thereby overcoming the shortcomings of existing instruments. Consequently, the current study was carried out to develop a questionnaire that evaluates the impact of hearing device usage on children's cognitive, behavioral, and psychological performance in Arabic. The questionnaire was intended to be brief, comprehensive, and easy to understand. Additionally, the study sought

to assess the validity and reliability of the developed questionnaire.

METHODS

Subjects

Twenty children who wear hearing devices and their parents took part in this cross-sectional study. They were selected at the primary care level from the Audio-Vestibular Medicine Unit of Zagazig University Hospitals.

The participants had an age range of 7 – 12 years with a mean of 9.33 ± 1.71 years. Also, 57.1% of the cases were males. The majority had pre-lingual hearing loss; this group consisted of 18 children, which was associated with delayed language acquisition, impaired cognitive development, and behavioral difficulties. The smaller group of only two with post-lingual hearing loss mainly showed problems with academic performance, reduced attention, and emotional distress related to the loss of previously acquired communication skills.

The children involved in this study had varying degrees of hearing loss, ranging from moderate to moderately severe. Their hearing thresholds ranged from 45 to 70 dB HL, with a median pure tone audiometry (PTA) of 50.83 dB HL in the right ear and a range of 45 to 65 dB HL, with a median PTA of 54.17 dB HL in the left ear. Among the children studied, 16 used behind-the-ear hearing aids, three used in-the-canal devices, and one had a cochlear implant. The duration of hearing device use varied from 0.16 to 6 years, with an average of 3.35 ± 1.63 years.

Moreover, participants showed variable psychological impacts that might be the cause of hearing device rejection. The psychological impact was determined through direct interviews with parents and children, as well as clinical observation during follow-up visits. Parents reported difficulties such as irritability,

embarrassment, and withdrawal behaviors when the child was asked to use the device. Similarly, children often expressed frustration, lack of motivation, or refusal related to communication challenges and feelings of being different from their peers.

Importantly, before attributing rejection to psychological causes, we excluded any technical problems related to the device itself and any physical conditions affecting the external or middle ear (such as cerumen impaction or otitis media). This ensured that the refusal to use hearing devices was primarily linked to emotional and behavioral factors, rather than medical or technical complications, which made them refuse to wear hearing devices and hampered their cognitive, behavioral, and language development.

Development of the scale for assessing the impact of hearing device use on children in two stages:

Item development

A total of eighteen items were developed and grouped into three domains: emotional, cognitive, and behavioral. The item pool was informed by a review of previous studies and established questionnaires, such as the Arabic version of the Spence Children's Anxiety Scale – Parent version (SCAS-P) and the Preschool Behavioral Questionnaire (PBQ) [6]. These instruments were carefully examined to identify the most relevant constructs, wording styles, and domains of child psychosocial functioning that could overlap with the challenges faced by children with hearing loss. From these questionnaires, we selected items that reflected common emotional and behavioral manifestations (e.g., anxiety, withdrawal, irritability, and aggression) as well as cognitive difficulties (e.g., poor attention and concentration). Items were then adapted and simplified to ensure cultural appropriateness and to specifically address the psychosocial challenges associated with

hearing device use and rejection. In this way, the previous tools served as a conceptual and structural framework, while the final pool of 18 items was tailored to the unique needs of our study population.

Assessment of the validity and reliability

The newly developed scale was compared to the Arabic SCAS-P in order to assess its validity and reliability. The SCAS-P questionnaire seeks to ascertain how parents perceive their children's anxiety. It has eight items; two measure social anxiety, one measures panic/agoraphobia, two measure separation anxiety, and three measure generalized anxiety. The final score ranges from 0 to 24 and is recorded using a four-point Likert scale that goes from never = 0 to always = 3 (0–3; never-always). Anxiety is higher in kids who score higher [8].

Final form of the newly developed questionnaire:

Eighteen items make up the final version of the questionnaire, which is divided into three subscales: emotional (Q1–Q4), behavioral (Q5–Q12), and cognitive (Q13–Q18). Each subscale has three possible answers: yes (=2), sometimes (=1), or no (=0). In addition to the overall score out of 36 (**Appendix S1**), a score can be obtained for each subscale. Two bilingual native English speakers translated the questionnaire into English, and qualified experts reviewed it (**Appendix S2**).

The Likert scale, one of the key rating scales used as a measurement tool in social sciences research, particularly in the qualitative approach, was used in this study to grade the degree of impact of children's use of hearing devices based on the total score. The grades are as follows: 0-9 (0-25%) = mild, 10-18 (26-50%) = moderate, 19-27 (51-75%) = severe, and 28-36 (>75%) = profound [9]. A patient's comment column on the questionnaire served as an open-ended response space to accommodate

further details regarding the effects of using a hearing device, as explained by each question. This could direct future studies employing the recently created questionnaires and the treatment strategy.

Procedure

From October 2024 to February 2025, participants were assessed in the Audio-Vestibular Medicine Unit, ENT Department, Faculty of Medicine, Zagazig University. After being informed of the study's methodology, parents or guardians provided their signed agreement to participate.

The participants were examined over two visits. They had been subjected to 1) a thorough history taking that included specific information about hearing loss and the use of hearing devices; 2) an otoscopic examination; 3) a basic audiological evaluation that included PTA across 0.5-4.0 kHz for bone conduction and 0.25-8 kHz for air conduction, as well as immittance meter measures involving tympanometry and acoustic reflex testing to evaluate middle ear function; and 4) the administration of the Arabic questionnaire for the impact of hearing device use on children's cognitive, behavioral, and psychological development, with the Arabic SCAS-P used to estimate the validity of the questionnaire. A second visit was set up to administer the Arabic questionnaire a second time, two weeks later, in order to evaluate test-retest reliability.

Ethical approval

The study was approved by the ethical committee of the Faculty of Medicine, Zagazig University (IRB number: 590, 25-8-2024).

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS), version 25.0, was used to gather and analyze the data (IBM, 2017). After floor and ceiling effects were confirmed, forms with typical responses that were concentrated in the lowest or highest

scale score were eliminated from the study [10]. The mean $\pm$ standard deviation (SD), median, and range were computed for quantitative variables. The association between the variables was examined using Pearson's correlation coefficient. A number between -1 and 1 is usually the correlation coefficient (r). Whereas negative r values show negative associations, positive r values show a positive relationship between the variables. According to its r -value, a relationship's strength was interpreted as follows: a weak correlation is indicated by an r -value of less than 0.3, a moderate correlation is indicated by an r -value between 0.3 and 0.7, and a strong correlation is indicated by an r -value greater than 0.7. The level of statistical significance was set at $p < 0.05$. Validity and reliability measures were applied to the newly developed Arabic questionnaire as follows:

Validity measures:

- A. Kaiser-Meyer-Olkin test of sampling adequacy for confirmation of the sufficiency of the sample size.
- B. Bartlett's test of sphericity for confirmation of a statistically significant association between items.
- C. Exploratory factor analysis (EFA) was done using Principal Component Analysis, and the Rotation Method was Varimax with Kaiser Normalization. It presented three factors, which were confirmed by varimax rotation with eigenvalues greater than 1 [11]. A rotated matrix through varimax rotation is an orthogonal rotation method that simplifies interpretation by maximizing the variance of loadings on each factor [11].
- D. The scale's convergent validity was employed to confirm the relationships between the items and the total scale as stated by Fayers and Machin [12].
- E. Construct validity was assessed by performing Pearson's Correlation Coefficients between the validation scale

(SCAS-P) and the newly developed Questionnaire among the studied participants.

Reliability measures:

- A. Internal consistent reliability (ICR) of the validated final scale was measured using Cronbach's alpha coefficients and split-half reliability coefficients.
- B. The external consistency of the scale was analyzed by test-retest reliability, which estimates the relationship between each item and the total score and between participant answers in the first and second visits.

RESULTS

Floor and ceiling effect:

The ceiling and floor effects were estimated to confirm that the test is suitable and not too easy or too difficult to be applied to the children and their caregivers (**Table 1**). A floor or ceiling effect is considered acceptable if it is less than 15% of respondents' lowest or highest possible score, respectively [13].

Validity measures:

The EFA revealed three components, each of which has eigenvalues greater than one, and no factors need to be excluded (**Table 2**). Moreover, **Table 3** shows the rotated component matrix of each question through varimax rotation, which classifies the 18 questions into the three components. The bold numbers in this table are the factor loadings — i.e., the correlation between each item (question) and the extracted factor (component). A higher loading means that the item is more strongly associated with that factor.

Furthermore, **Table 4** shows the Pearson's Correlation Coefficients of each item and subscale score with the total score of the scale. Every question has an r -value greater than 0.3, which is considered an acceptable correlation. To estimate construct validity, Pearson's correlation between the SCAS-P and the new scale was performed (**Table 5**).

The test demonstrates a strong statistical correlation between the validation scale and the newly developed scale.

Reliability measures:

The internal consistency reliability of the scale was evaluated using Cronbach's alpha test (**Table 6**). Item analysis showed that Cronbach's alpha coefficients for individual items, if excluded, remained within an acceptable range. The total Cronbach's alpha values for the three subscales were 0.852 (emotional domain), 0.845 (behavioral domain), and 0.841 (cognitive domain),

while the total scale demonstrated excellent internal consistency with a Cronbach's alpha of 0.907. According to established guidelines, a Cronbach's alpha coefficient of ≥ 0.70 is considered acceptable, ≥ 0.80 is good, and ≥ 0.90 indicates excellent reliability [14]. On the other hand, the external consistency of the scale was evaluated through Pearson's correlation between participants' answers in 1st and 2nd visits (**Table 7**). This test-retest reliability ensured the external consistency of the scale.

Table (1): Outcomes of each of the new scale and the floor and ceiling effects of answers in the scales.

Variable		(n=21)	
<i>Total score of the scale</i>	Mean $\pm$ SD	13.67 $\pm$ 9.78	
	Median	10	
	Range	0 – 36	
Variable		No	%
<i>Floor</i>	answers in the minimum score	1	4.8
<i>Ceiling</i>	answers in the maximum score	1	4.8

Abbreviations: SD: standard deviation

Table (2): Result of the extraction of the component factor via Principal Component Analysis.

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	8.354	46.411	46.411
2	2.167	12.040	58.451
3	1.815	10.083	68.534
Extraction Method: Principal Component Analysis			

Table (3): Rotated component matrix of each question of the newly developed scale.

	Component		
	1	2	3
Q1	0.859	0.165	-0.092
Q2	0.708	0.405	0.247
Q3	0.836	0.236	0.052
Q4	0.709	0.130	0.263
Q5	0.130	0.789	0.202
Q6	0.146	0.742	0.102
Q7	0.243	0.844	0.114
Q8	-0.065	0.689	0.344
Q9	0.142	0.839	.100
Q10	0.506	0.603	0.223
Q11	0.504	0.687	0.154
Q12	-0.151	0.853	0.209

	Component		
	1	2	3
Q13	0.161	0.254	0.738
Q14	0.433	-0.031	0.661
Q15	0.270	0.012	0.843
Q16	0.287	0.133	0.758
Q17	0.4100	0.480	0.550
Q18	-0.015	0.074	0.516
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.			

Table (4): Pearson's Correlation Coefficients of each item and subscale score with the total score of the scale.

Items and subscales scores of the new scale	<i>r</i>	<i>p</i>
Q1	0.625	0.002*
Q2	0.883	<0.001**
Q3	0.535	0.012*
Q4	0.833	<0.001*
Total emotional	0.854	<0.001**
Q5	0.623	0.003*
Q6	0.677	<0.001**
Q7	0.619	0.003*
Q8	0.453	0.04*
Q9	0.640	0.002*
Q10	0.824	<0.001**
Q11	0.740	<0.001**
Q12	0.449	0.04*
Total behavioral	0.904	<0.001**
Q13	0.786	<0.001**
Q14	0.605	0.004*
Q15	0.697	<0.001**
Q16	0.590	0.005*
Q17	0.839	<0.001**
Q18	0.673	<0.001**
Total Cognitive	0.949	<.001**

r: Pearson's correlation coefficient

*: Significant ($p < 0.05$)

**: highly significant ($p < 0.001$).

Table (5): Pearson's correlation between the SCAS-P and the new scale's subscales and total score among the studied participants.

The SCAS-P scale	The newly developed scale			
	Total emotional	Total behavioral	Total cognitive	Total score
	<i>r</i>	<i>r</i>	<i>r</i>	<i>r</i>
	<i>p</i>	<i>p</i>	<i>p</i>	<i>p</i>
Social anxiety	0.718	0.704	0.651	0.760

The SCAS-P scale	The newly developed scale			
	Total emotional	Total behavioral	Total cognitive	Total score
	<0.001**	<0.001**	0.001*	<0.001**
Separation anxiety	0.636 0.002*	0.708 <0.001**	0.685 <0.001**	0.751 <0.001**
Panic/agoraphobia	0.452 0.041*	0.412 0.045*	0.315 0.064 NS	0.431 0.044*
Generalized anxiety	0.661 <0.001**	0.592 0.005*	0.632 0.002*	0.687 <0.001**
Total score	0.667 <0.001**	0.697 <0.001**	0.658 0.001*	0.743 <0.001**

r: Pearson's correlation coefficient. *: Significant (P<0.05); **: highly significant (P<0.001).

Table (6): Cronbach's alpha coefficients if excluding the item and the total alpha of the dimensions.

Items, subscales, and total score of the new scale	Cronbach's alpha
Q1	0.867
Q2	0.865
Q3	0.868
Q4	0.864
Total emotional	0.852
Q5	0.866
Q6	0.866
Q7	0.867
Q8	0.870
Q9	0.866
Q10	0.865
Q11	0.866
Q12	0.868
Total behavioral	0.845
Q13	0.864
Q14	0.867
Q15	0.866
Q16	0.868
Q17	0.866
Q18	0.865
Total Cognitive	0.841
Total score	0.907

Table (7): Pearson's correlation between participants' answers in the 1st and 2nd times.

Items, subscales, and total score of the new scale	<i>r</i>	<i>p</i>
Q1	0.915	<0.001**
Q2	0.788	<0.001**
Q3	0.884	0.012*
Q4	0.967	<0.001*
Total emotional	0.943	<0.001**
Q5	0.860	<0.001**
Q6	0.969	<0.001**
Q7	1	<0.001**
Q8	1	<0.001**
Q9	0.467	0.033*
Q10	0.962	<0.001**
Q11	0.999	<0.001**
Q12	1	<0.001**
Total behavioral	0.988	<0.001**
Q13	0.886	<0.001**
Q14	0.999	0.004*
Q15	0.989	<0.001**
Q16	1	<0.001**
Q17	0.998	<0.001**
Q18	0.887	<0.001**
Total Cognitive	0.989	<0.001**
Total score	0.991	<0.001**

r: Pearson's correlation coefficient *: Significant (P<0.05); **: highly significant (P<0.001).

DISCUSSION

Although many studies examined the prevalence of hearing device usage and refusal, there is no Arabic questionnaire to explore the reasons behind hearing device refusal and subsequent hearing deprivation in children. Therefore, the current study aims to develop a new, easy-to-understand Arabic questionnaire for parents and children with hearing impairments who are undergoing various hearing device rehabilitations.

Another key goal is to evaluate the validity and reliability of the questionnaire and use it as a tool to determine the effects of using hearing devices and the causes of Arabic children's refusal to wear them. Eighteen subjects in all were selected and formulated as brief, uncomplicated, lucid, and literary Arabic inquiries. To ensure consistency and

usefulness for patients who understand Arabic, formal language was utilized, despite the fact that the Arabic dialect varies greatly among Arabic-speaking countries.

Individual survey responses tend to cluster around a certain value, a phenomenon known as the "ceiling effect" or "floor effect.". To be more specific, ceiling effects happen when a large percentage of questions receive the greatest possible score, while floor effects happen when a large percentage of questions receive the lowest possible score [10]. This is evident, for example, when a test is too easy (ceiling effect) or too difficult (floor effect). As a result, the test cannot be used by researchers to rank individuals at either extreme of the spectrum [12].

Averages, medians, standard deviations, minimum and maximum scores (13.67, 10,

9.78, 0, and 36, respectively) were calculated for the scale's score. The mean scores are below 50%. As found in the Hearing and Functioning in Everyday Life Questionnaire, which also lacks the floor and ceiling effects [15], the scale is responsive, as evidenced by the fact that no answer concentrations higher than 15% were found at either the top or bottom of the scale [13] (**Table 1**).

Assessment of the scale's validity

The degree to which the instrument can accurately measure the concept or constructs under consideration is known as validity. The validity of the scale was evaluated through content validity that was established through expert review to ensure that all items adequately represented the construct, and construct validity that was assessed by examining correlations with established standardized tools [16].

A. Bartlett's test: assesses the notion that our samples' variances are equal. A *p*-value of less than 0.001 for Bartlett's test of sphericity suggested a very statistically significant connection between items, which is congruent with the Arabic Questionnaire for Tinnitus Reaction (QTR) ($p < 0.001$) [17].

B. The Kaiser-Meyer-Olkin (KMO): One statistic that shows the percentage of variance in variables that may be due to underlying causes is the Measure of Sampling Adequacy. High results (around 1.0) typically suggest that the data may benefit from a factor analysis [18]. Our study yielded a KMO value of 0.9, which indicates an excellent sampling adequacy. For comparison, the Arabic QTR reported a KMO of 0.7, which is considered acceptable, though lower than the adequacy demonstrated in our newly developed instrument [17].

C. The scale's convergent validity was verified using the convergent validity of the scale and Pearson's correlation. The

convergent validity coefficients ranged from 0.449 (Q12) to 0.949 (total cognitive score) (**Table 4**) [8, 12].

D. EFA:

- *Component factor extraction*: By applying the principal component analysis on commonality values, three factors with eigenvalues greater than one were extracted. The first factor explained 46.41% of the total variance, the second factor explained 12.04%, and the third factor explained 10.08%, accounting for a total of 68.53% of the variance (**Table 2**).

- *Rotated component matrix*: Based on varimax rotation, items were distributed across the three factors as follows: Factor 1 included items 1, 2, 3, and 4 (emotional domain); Factor 2 included items 5–12 (behavioral domain); and Factor 3 included items 13–18 (cognitive domain). Since all items showed factor loadings above 0.30, none of them needed to be excluded (**Table 3**).

E. Construct validity:

Pearson's Correlation Coefficient revealed a statistically significant positive correlation between the Arabic SCAS-P scale and the new scale's subscales and total score (**Table 5**). This significant positive correlation reflected good convergent validity of the newly developed scale, indicating that it measures psychological constructs consistent with those assessed by the Arabic SCAS-P.

Assessment of the scale's reliability

The ability of measuring devices (e.g., questionnaires) to produce consistent findings over time is known as reliability, and it also denotes a high degree of positive correlation between the devices [19].

A. The scale's external consistency (test-retest reliability): The external consistency of the scale was assessed using test-retest reliability. Pearson's correlation was used to compare the "items, subscales, and total score of the new scale in the

patients' first and second responses. The total score's correlation coefficient was 0.991, with the range being 0.467 (Q9) to 1 (Q7,8,12,16). All of the items in the study had correlation coefficients more than 0.30, which is considered to be a respectable value (**Table 7**) [14]. This information aligned with the Arabic-QTR. Strong links were found in test-retest correlations between individual subscales; the somatic, awareness, emotional, and anxiety subscales had corresponding correlations of 0.96, 0.95, 0.94, and 0.97 [17].

B. The scale's internal consistency (also known as the split-half reliability coefficient) is a test splitting, or dividing the test's elements in half, such that the two subtests run parallel [20]. In comparison to the SCAS-P scale, the reliability value was 0.904 and the correlation coefficient was 0.826, both of which are thought to be suitable for the scale's internal consistency [14]. The p-value displayed a reliability value of 0.9 and high internal consistency [8].

C. Cronbach's alpha coefficient compares the degree of covariance, or shared variance, to evaluate reliability. According to the theory, there should be a significant amount of covariance between the items in relation to the variance for the overall score if the scale is dependable. The Cronbach's alpha was considered excellent since each item had an alpha higher than 0.70 [8, 14]. The ICR was examined and assessed using the Cronbach's alpha coefficient. The scale dimensions' overall alpha is displayed in **Table (6)**, along with the coefficients in the event that the item is left out. The total alpha coefficient of the scale dimensions, which varied from 0.841 (total cognition) to 0.870 (Q8) and 0.907 for the overall score, changed when each item was removed. The Cronbach's alpha was considered good since all of the items had alphas higher than 0.70 [14] (**Table 6**).

Our study's findings aligned with the Arabic SCAS-P, which had a total alpha coefficient of 0.9 [8].

Limitations

The recently created questionnaire offers a useful tool for identifying issues that may need attention and targeted intervention due to the effects of children's use of hearing devices. It is advised that future research employ a more representative sample that includes participants from other Arabic nations in order to identify any possible variance in the influence of their hearing devices. Examining whether the Arabic questionnaire is a sensitive instrument capable of tracking modifications in clinical trials is also crucial. A questionnaire that illustrates the effects of adult hearing device use must also be created. Additionally, the current study did not evaluate the impact of socioeconomic status on the use of hearing devices. Factors such as family income, parental education, and access to healthcare resources can greatly influence adherence to rehabilitation programs. Future research should take these variables into account to provide a more comprehensive assessment and to better customize interventions to meet the needs of children.

CONCLUSIONS

The recently created questionnaire is valid, dependable, and satisfies practical requirements; it is quick, simple, clear, and easy to use. Moreover, it offers a means of evaluating any changes in the cognitive, behavioral, and emotional domains that may result from the use of a hearing device by Arabic-speaking children.

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Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Supplementary files: Appendix (S1), Appendix (S2).

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SUPPLEMENTARY FILES

Appendix (S1)

الاسم:	النوع: ذكر / انثى	التاريخ: / /	اسم ولي الامر:
نوع السماع:	مدة ارتداء السماع:		

هذا الاستبيان يهدف الى تحديد المشاكل الناتجة عن استخدام معينات السمع لدى الأطفال. الاجابة ستكون "نعم" أو "أحيانا" أو "لا" كما هو موضح بجانب كل سؤال.

السؤال	الإجابة	التعليق
***	نعم ☐ لا ☐	هل يعاني الطفل من مشاكل في ارتداء أو خلع المعينات السمعية أو تسبب له التهابات، ألم، حكة أو تصدر المعينات السمعية اصوات غريبه في اذنه؟
1	نعم ☐ أحيانا ☐ لا ☐	هل يبدو الطفل قلق، متوتر أو عصبي عند ارتداء المعينة السمعية؟
2	نعم ☐ أحيانا ☐ لا ☐	هل يشكو الطفل غالبا من الشعور بالوحدة بعد ارتداء المعينة السمعية؟
3	نعم ☐ أحيانا ☐ لا ☐	هل يعاني الطفل من ضعف الثقة بالنفس؟
4	نعم ☐ أحيانا ☐ لا ☐	هل يبدو الطفل حزين، تعيس أو مكتئب بعد ارتداء المعينات السمعية؟
5	نعم ☐ أحيانا ☐ لا ☐	هل تمت ملاحظه اي تغيير في سلوك الطفل بعد ارتدائه المعينات السمعية؟
6	نعم ☐ أحيانا ☐ لا ☐	هل يجد الطفل صعوبة في المشاركة مع الاطفال في اللعب بعد ارتداء المعينات السمعية؟
7	نعم ☐ أحيانا ☐ لا ☐	هل يتفاعل الطفل مع اقاربه بعد ارتداء المعينات السمعية بصعوبة؟
8	نعم ☐ أحيانا ☐ لا ☐	هل يجد الطفل صعوبة في تكوين صداقات جديدة بعد ارتداء المعينات السمعية؟
9	نعم ☐ أحيانا ☐ لا ☐	هل تسبب الطفل في اصابه نفسه عمدا مثل عض يده او اصبعه او ضرب راسه منذ ارتدائه المعينات السمعية؟
10	نعم ☐ أحيانا ☐ لا ☐	هل يتجارب الطفل مع اي طفل اخر مقارب له في السن ولا يعرفه وهو مرتدبا المعينات السمعية بصعوبة؟
11	نعم ☐ أحيانا ☐ لا ☐	هل يجد الطفل صعوبة في التعبير شفويا عن مشاعره كالشعور بالوحدة، والملل بعد ارتداء المعينات السمعية؟
12	نعم ☐ أحيانا ☐ لا ☐	هل يجد الطفل صعوبة في التعبير عن المشاعر والانفعالات بتعبيرات الوجه ولغة الجسد بعد ارتداء المعينات السمعية؟
13	نعم ☐ أحيانا ☐ لا ☐	هل يعبر الطفل عن الشعور بانه لا قيمه له او انه اقل من الاخرين؟
14	نعم ☐ أحيانا ☐ لا ☐	هل يعاني الطفل من صعوبة في تفهم مشاعر الاخرين بعد ارتداء المعينات السمعية؟
15	نعم ☐ أحيانا ☐ لا ☐	هل يكرهه ييغض الطفل ارتداء المعينات السمعية؟
16	نعم ☐ أحيانا ☐ لا ☐	هل يشعر الطفل بانه اسوا بعد ارتداء المعينات السمعية؟
17	نعم ☐ أحيانا ☐ لا ☐	هل يفهم الطفل الاشارات الاجتماعية مثل تعبيرات الوجه وضع الجسد، نبره الصوت، او لغة الجسد منذ ارتداء المعينات السمعية بصعوبة؟
18	نعم ☐ أحيانا ☐ لا ☐	هل يعتقد الطفل ان شكله قبيح بالمعينات السمعية؟

الاجابة بنعم = 2 الاجابة بأحيانا = 1 لا = صفر

***هذا السؤال ليس جزءاً من الاستبيان، وإنما الغرض منه استبعاد المرضى الذين لديهم مشكلات تقنية أو في الأذن الخارجية أو الوسطى، للتأكد من أن اسباب رفض المعينة السمعية اسباب نفسيه فقط دون غيرها

Mild		0-9	
Moderate		10-18	
Severe		19-27	
Profound		28-36	
Total	Cognitive domain (13-18)	Behavioral domain (5-12)	Emotional domain (1-4)

Appendix (S2)

This questionnaire aims to identify problems resulting from hearing device use in children. The answer will be "yes," "sometimes," or "no," as indicated next to each question.

- 1-Does the child appear anxious, tense, or nervous when wearing the hearing device?
- 2-Does the child often complain of feeling lonely after wearing the hearing device?
- 3-Does the child suffer from low self-esteem?
- 4-Does the child appear sad, unhappy, or depressed after wearing the hearing device?
- 5- Have you noticed any changes in the child's behavior after wearing the hearing device?
- 6-Does the child have difficulty participating in play with other children after wearing the hearing device?
- 7-Does the child have difficulty interacting with peers after wearing the hearing device?
- 8-Does the child have difficulty making new friends after wearing the hearing device?
- 9-Has the child intentionally injured themselves, such as biting their hand or finger, or banging their head, since wearing the hearing device?

10-Does the child have difficulty interacting with other children of similar age whom they don't know while wearing the hearing device?

11-Does the child have difficulty verbally expressing feelings, such as loneliness or boredom, after wearing the hearing device?

12- Does the child have difficulty expressing feelings and emotions through facial expressions and body language after wearing hearing aids?

13-Does the child express feelings of worthlessness or inferiority to others?

14-Does the child have difficulty understanding others' feelings after wearing hearing aids?

15-Does the child hate/dislike wear their hearing aids?

16-Does the child feel worse after wearing their hearing aids?

17-Does the child have difficulty understanding social cues such as facial expressions, body posture, tone of voice, or body language since wearing their hearing aids?

18-Does the child believe they look ugly with their hearing aids?

Citation

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