ORIGINAL RESEARCH ORİJİNAL ARAŞTIRMA

Turkish Validity and Reliability Study of Pediatric Hyperacusis Questionnaire Parent Form: A Cross Sectional Adaptation Study

Pediatrik Hiperakuzi Anketi Ebeveyn Formu'nun Türkçe Geçerlilik ve Güvenilirlik Çalışması: Kesitsel Bir Adaptasyon Çalışması

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ABSTRACT Objective: Assessing hyperacusis in children is a critical step in detecting possible auditory sensitivity problems early. Valid and reliable self-report measures are needed to assess hyperacusis. This study aims to adapt the Pediatric Hyperacusis Questionnaire parent form (P-HQ) into Turkish and conducted a validity and reliability study. **Material and Methods:** The P-HQ parent form was adapted to Turkish. The P-HQ was then administered to parents who volunteered to participate in the study. The scale's reliability was evaluated using the Cronbach's alpha coefficient, and the validity was evaluated using confirmatory factor analysis (CFA). The obtained data were analyzed using IBM SPSS 21 and AMOS 23. The study included 110 adult parents with children aged 6-17 years. **Results:** In the reliability analysis, the Cronbach's alpha internal consistency coefficient showed that the scale was highly reliable. After the factor analysis, CFA fit statistics showed that the scale was perfectly and acceptably compatible with the data collected from Turkish participants. **Conclusion:** Statistical analyses revealed that the Turkish version of the 11-item and 2-factor P-HQ parent form is a valid and reliable scale. Children may have different auditory sensitivities, and this scale provides guidance for understanding their unique needs and taking appropriate measures.

Keywords: Child; hyperacusis; hyperacusis questionnaire; quality of life

ÖZET Amaç: Çocuklarda hiperakuzinin değerlendirilmesi, olası işitsel hassasiyet sorunlarının erken tespit edilmesinde kritik bir adımdır. Hiperakuziyi değerlendirmek için geçerli ve güvenilir öz bildirim ölçümlerine ihtiyaç vardır. Bu çalışmada, Pediatrik Hiperakuzi Anketi Ebeveyn Formu'nun [Pediatric Hyperacusis Questionnaire Parent Form (P-HQ)] Türkçeye uyarlanması, geçerlilik ve güvenilirlik çalışmasının yapılması amaçlanmıştır. **Gereç ve Yöntemler:** P-HQ Ebeveyn Formu Türkçeye uyarlandı. P-HQ daha sonra çalışmaya katılmaya gönüllü olan ebeveynlere uygulandı. Ölçeğin güvenilirliği Cronbach alfa katsayısı ile geçerliliği ise doğrulayıcı faktör analizi (DFA) ile değerlendirilmiştir. Elde edilen veriler IBM SPSS 21 ve AMOS 23 kullanılarak analiz edilmiştir. Çalışmaya 6-17 yaş arası çocukları olan 110 erişkin ebeveyn katılmıştır. **Bulgular:** Güvenilirlik analizinde, Cronbach alfa iç tutarlılık katsayısı ölçeğin yüksek derecede güvenilir olduğunu göstermiştir. Faktör analizinden sonra, DFA uyum istatistikleri ölçeğin Türk katılımcılardan toplanan verilerle mükemmel ve kabul edilebilir bir şekilde uyumlu olduğunu göstermiştir. **Sonuç:** İstatistiksel analizler, 11 maddelik ve 2 faktörlü P-HQ Ebeveyn Formu'nun Türkçe versiyonunun geçerli ve güvenilir bir ölçek olduğunu ortaya koymuştur. Çocuklar farklı işitsel hassasiyetlere sahip olabilir ve bu ölçek onların benzersiz ihtiyaçlarını anlamak ve uygun önlemleri almak için rehberlik sağlar.

Anahtar Kelimeler: Çocuk; hiperakuzi; hiperakuzi anket; yaşam kalitesi

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Hyperacusis is an increased sensitivity to ordinary environmental sounds that do not disturb most individuals. Although data on the prevalence of hyperacusis in children are inconclusive, it reportedly occurs in 3.2-17.1% of the general pediatric population.[1,2] Hyperacusis can affect different aspects of a child's life, including academic performance and social development.[3]

Many studies have reported that children with hyperacusis, especially those attending school, feel uncomfortable or anxious due to stimuli, such as classroom noise, physical education class sounds, and fire alarms.[4,5] This may cause children to avoid situations or environments in which they perceive loud noises.[6] In one study, a child with hyperacusis disrupted the other students' concentration during exams due to noise disturbance.[7] Another study included reports from families that they were restricted from social environments.[8] From this, it is understood that individuals in the child's immediate environment (family members, schoolmates, etc.) are also negatively affected by hyperacusis.

Hyperacusis is emphasized as a subjective phenomenon that cannot be easily defined or assessed using quantitative measures, and there is currently no gold standard method for diagnosing hyperacusis in adults or children.[9] However, the literature shows the use of detailed anamnesis, neurological assessment, measurement of annoying loudness levels, and hyperacusis self-report measures.[1,10-13]

Since hyperacusis is a subjectively experienced symptom, valid and reliable self-report criteria are required to assess it.[14] When the self-report measures developed for hyperacusis assessment are examined, it is evident that there are very few assessment tools. The only hyperacusis scale for the pediatric group developed in Turkish was conducted by Yılmaztürk as a master's thesis. The scale, called the Hyperacusis Scale for Children, was developed to identify children aged 4-11 years with suspected hyperacusis and a validity and reliability study was conducted *(Yılmaztürk N. Development of scale for hyperacusis in the children, Master thesis, İstanbul, Turkey: İstanbul Aydın University 2021)*. The scale includes 3 subscales and a total of 33 items directed to the child.

Although asking comprehensive questions is useful for obtaining detailed information, the long duration of the application in clinical practice and the possibility of boredom of the child may affect accurate information. The Hyperacusis Questionnaire, a 14-item self-report measure, is the most frequently used questionnaire for research purposes and has been validated in different languages for adult populations.[9,15,16] Carson et al. adapted the pediatric population parent version of the same questionnaire to English and conducted a validity and reliability study.[2] In the development of the scale, 64 parents with children diagnosed with autism spectrum disorder (ASD) and 37 parents with children without ASD (children ages 2-17 years) took part in the study. The questionnaire was developed to be used in the diagnostic process of children with suspected hyperacusis.

New studies are needed due to the limited availability of a hyperacusis scale for children in the literature and the need for a scale for the diagnosis and rehabilitation/treatment of hyperacusis. The objective of this study was to translate and adapt the Pediatric Hyperacusis Questionnaire Parent Form (P-HQ) into Turkish, followed by a validity and reliability assessment.

MATERIAL AND METHODS

In this study, the parent form of the P-HQ was first adapted into the Turkish language. No items were removed from the questionnaire. Next, the Turkish version of the P-HQ was administered as an online Google Form (Google ULL, USA) questionnaire to 110 adult parents aged between 20-65 (mean 56.37, SD 12.15) who volunteered to participate in the study. The participants consisted of parents who applied to the Ankara University Audiology Clinic for audiological evaluations of their children. One child of each parent was included and the 110 children whose data were collected were aged between 6 and 17 years (mean 10.73, SD 3.75). A consent form was added to the online form. The data of the participants who completed the anamnesis form and the Turkish version of the P-HQ were statistically analyzed, and the validity and reliability study were completed. Ethical approval (date: July 13, 2023, no: 12/106) was

granted by the Ankara University Rectorate Ethics Committee. The study adhered to the principles outlined in the Declaration of Helsinki.

PEDIATRIC HYPERACUSIS QUESTIONNAIRE

The 11-item scale adapted from the Khalfa Hyperacusis Questionnaire by Carson et al. was adapted to the Turkish language and a validity and reliability study was conducted.[2] The design is a three-point Likert scale that includes yes (2 points), sometimes (1 point), and no (0 points) options. The score on the scale is between 0-22. The higher the score on the questionnaire, the more likely hyperacusis is. There are no reverse-scoring questions in the scale.

LINGUISTIC AND CULTURAL ADAPTATION

To adapt the questionnaire, the statements in the questionnaire were translated into Turkish by two translators with expertise in English, and then translated into English by two other translators. The translations were compared, and the consistencies between them were examined. After the necessary corrections were made, the statements were translated into Turkish again. Next, the patient applicability of the statements in this scale was presented to four expert audiologists. The Turkish version was created to align with this information.

Inclusion Criteria for Study Participants

- Adults with children between the ages of 6-17 who can read and write

- Children without known neurological diseases or cognitive problems or syndromes

- Children who have not been diagnosed with hearing loss

- Children who can read and write

Exclusion Criteria for Study Participants

- People who are illiterate

- People with cognitive problems

- People with children with hearing loss

- Children with other diagnosed permanent diseases

In the original study, individuals between the ages of 2-17 years were included in the study. However, since one of the questions in the questionnaire inquired about literacy skills, it was deemed appropriate not to include this age group in the study after contacting the authors of the original study, as it could provide false information in the evaluation of young children who could not read and write.

SAMPLE SIZE

When calculating the appropriate sample size for studies on validity and reliability, it is advisable to target figures that are 5 to 10 times greater than the total quantity of items in the scale, and 10 times larger than the sample size.[17-19] The P-HQ created by Carson et al. consists of 11 items. Hence, 110 participants, which is 10 times the number of items, were included in the study.[2]

STATISTICAL ANALYSIS

First, obtained data were evaluated using SPSS and AMOS 23 (International Business Machines, USA). $p<0.05$ was taken into account as the significance level. Frequency, percentages, and mean±standard deviation (SD) values were used to show the data. Validity and reliability assessments were conducted for the Turkish version of the scale. In the reliability analysis, Cronbach's alpha (CA) coefficients and item total correlation values were calculated. Furthermore, explanatory factor analysis (EFA) using varimax rotation was utilized to determine the factor structure of the scale. Factors with an eigenvalue >1 were considered as a separate factor. The confirmatory factor analysis (CFA) was performed to confirm these factors.

In CFA, commonly employed fit indices to assess the adequacy of the tested model encompass the root mean square residuals (RMR or RMS), and root mean square error of approximation (RMSEA), chi-square goodness test, Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Normed Fit Index (NFI). The acceptable and excellent ranges for these fit indices are delineated alongside the obtained values from the study.

RESULTS

The average age of the parents was 56.37±12.15 (mean±SD). Of the participating children, 60 (54.5%) were male and 50 (45.5%) were female. The mean age of the participating children was 10.73±3.75 years. The mean age of males is 10.40±3.75, and that of female is 11.14±3.75. The average score on the scale was 7.27±4.79, ranging from a minimum of 0 to a maximum of 21.

Table 1 displays descriptive statistics of the items, total item correlations (TIC), and the CA coefficients representations. Item 11 has the highest average and Item 3 has the lowest. The TICs in Factor 1 representations varied from r=0.40 to r=0.62, while in Factor 2, they ranged from r=0.40 to r=0.66. The CA coefficient of Factor 1 is 0.79 and that of Factor 2 is 0.75. The CA coefficients for Factor 1 and Factor 2 are 0.79 and 0.75, respectively, while the CA coefficient for the total scale was 0.82.

EXPLORATORY AND CONFIRMATORY FACTOR ANALYSIS

In this study, EFA was used to determine the factor structure of the scale. The results of the EFA are shown in Table 2. Principal component analysis was conducted with varimax axis rotation using an eigenvalue of 1 for the 11 items. The Bartlett's sphericity test yielded a χ^2 value of 472.019 (p<0.001), and the Kaiser-Meyer-Olkin coefficient was found to be 0.86. The results of the EFA, utilizing an eigenvalue of 1, suggest that the scale consists of two factors, as illustrated in the scree plot (Figure 1). The EFA produced a two-factor structure, explaining 50.067% of the total variance.

Table 2 displays the factors, factor loadings, eigenvalues, and explained variances obtained from EFA. It was determined that this scale was satisfactory, as the factor loadings of the items ranged from 0.511 to 0.783 for Factor 1 and from 0.571 to 0.794 for Factor 2. Factor 1 explained 34.031% of the total variance, Factor 2 explained 16.036% of the total variance. The path diagram in Figure 2 shows the standardized scores of the two-factor scale and all standardized values have to be smaller than 1.

Upon examining Table 3, CFA was conducted on the data. The fit index values obtained were as follows: χ^2/sd=1.220, RMSEA=0.045, RMR=0.033, NFI=0.912, CFI=0.971, Incremental Fit Index= 0.972, Relative Fit Index=0.914, GFI=0.926, and AGFI=0.880. These fit index values reveal that the

TABLE 1: Descriptives statistics, total item correlations and Cronbach's alpha values.				
Factors and items	Mean	Standart deviation	Total item correlation	Cronbach's alpha without the item
Factor 1				
Item 1	1.05	0.75	0.62	0.73
Item 2	1.11	0.82	0.61	0.73
Item 4	0.65	0.75	0.55	0.75
Item 5	0.61	0.77	0.40	0.78
Item 10	0.63	0.74	0.42	0.78
Item 11	1.12	0.76	0.60	0.74
Cronbach's alpha=0.79				
Factor 2				
Item 3	0.21	0.53	0.40	0.74
Item 6	0.35	0.63	0.66	0.65
Item 7	0.47	0.73	0.59	0.67
Item 8	0.45	0.72	0.40	0.74
Item 9	0.65	0.8	0.55	0.69
Cronbach's alpha=0.75				

TABLE 2: Explanatory factor analysis results.

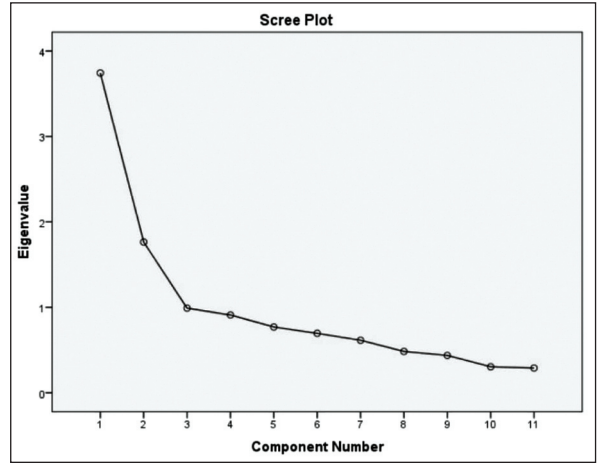| Items	Factor loads	Eigenvalues	Variance	Cumulative variance
Factor 1		3.743	34.031	34.031
Item 1-Çocuğunuz gürültülü veya yüksek seslerin olduğu bir ortamda dikkatini toplamakta zorlanıyor mu?	0.778			
Item 2-Çocuğunuz gürültülü veya yüksek seslerin olduğu bir ortamda okumakta zorlanıyor mu?	0.756			
Item 4-Çocuğunuz günlük hayatta etrafındaki sesleri görmezden gelmeyi daha zor bulur mu?	0.682			
Item 5-Çocuğunuz sokak gürültüsüne karşı özellikle hassas mı veya bundan rahatsız mıdır?	0.511			
Item 10-Çocuğunuzun günün sonuna doğru gürültüde dikkatini toplama yeteneği azalır mı?	0.551			
Item 11-Stres ve yorgunluk, çocuğunuzun gürültüde dikkatini toplama yeteneğini azaltır mı?	0.783			
Factor 2		1.764	16.036	50.067
Item 3-Çocuğunuz gürültü algısını azaltmak için kulak tıkacı veya kulaklık kullanır mı?	0.571			
Item 6-Çocuğunuzun bir aktiviteye katılma davetini, karşılaşacağı gürültü nedeniyle geri çevirdiği olur mu?	0.794			
Item 7-Çocuğunuz belirli sosyal durumlarda gürültüyü rahatsız edici buluyor mu?	0.748			
Item 8-Çocuğunuza tanıdığı biri tarafından gürültüye veya belirli türden seslere tahammül edemediği söylendi mi?	0.649			
Item 9-Gürültü ve belirli türden sesler çocuğunuzda strese ve rahatsızlığa neden olur mu?	0.632			

FIGURE 1: Scree plot of two-factor structure.

Chi-square = 50,023, P=0.158, df=41, Chi-square/df=1.22, RMSEA=0.045
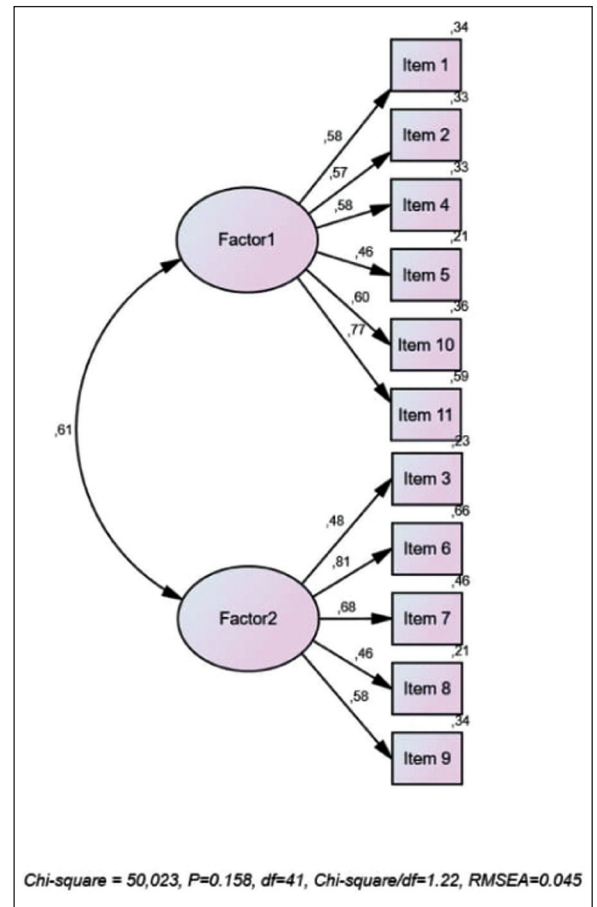
FIGURE 2: Confirmatory factor analysis path diagram of the scale.

model have perfect ve acceptable fitness. Hence, based on the results of CA coefficient, explanatory and CFA, the validity and reliability integrity of the scale are affirmed.

TABLE 3: The fit index values of the confirmatory factor analysis model.				
Indices	Perfect goodness of fit	Acceptable goodness of fit	Finding	Decision
χ^2/sd	0.0-0.25	2.5-3.0	1.221	Perfect
RMSEA	≤0.005	≤0.008	0.045	Perfect
RMR	≤0.005	≤0.008	0.033	Perfect
NFI	≥0.95	≥0.90	0.912	Acceptable
CFI	≥0.95	≥0.90	0.971	Perfect
IFI	≥0.95	≥0.90	0.972	Perfect
RFI	≥0.95	≥0.90	0.914	Acceptable
GFI	≥0.90	≥0.85	0.926	Perfect
AGFI	≥0.90	≥0.85	0.881	Acceptable

RMSEA: Root mean square error of approximation; RMR: Root mean square residuals; NFI: Normed Fit Index; CFI: Comparative Fit Index; IFI: Incremental Fit Index; RFI: Relative Fit Index; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index.

DISCUSSION

Assessing hyperacusis in children is critical for ensuring that appropriate support is provided in the early years of their development. Although there is no gold standard method for assessing hyperacusis, self-report scales, frequency-specific measures of loudness discomfort levels (LDL), and psychoacoustic tests are used for adults.[20,21] However, assessment tools for children are limited. In particular, the reliability of LDL assessment is unclear for this group. Thus, new tools are needed to reliably evaluate this condition and differentiate it from other auditory complaints. P-HQ parent form is one of the first tools developed for this purpose, from Khalfa Hyperacusis Questionnaire was adapted into Turkish in our study. Following this, the validity and reliability of the questionnaire were assessed.[9]

According to Nunnally and Bernstein, for a new self-report instrument to be deemed reliable, it should attain a CA value of at least 0.7.[22] The CA internal consistency coefficient for the Turkish version of the questionnaire demonstrated high reliability (αC: 0.82). Likewise, the internal consistency coefficients of the adult versions of the scale in various languages indicated a high level of reliability.[15,16,23,24] In the original version, the person separation index used to measure reliability was 0.89, and the scale was reported to have sufficient

reliability. Given these results, there was no need to remove any questions.

After reliability was established, factor analysis revealed two sub-dimensions: Factor 1 was defined as the effects of hyperacusis and Factor 2 as coping and social relations. CA was calculated for each sub-dimension to ensure that they preserve the main concept of the subject. The internal consistencies of the sub-dimensions were high (Factor 1: 0.79, Factor 2: 0.75).

The total variance of the two sub-dimensions was found to be 50.06%. Regarding the validity of an instrument, 50% explanatory power is relatively low. The researchers who adapted the original questionnaire into a pediatric version did not provide total variance information in their study; however, total variances of 46-48% have been reported for the adult versions.[9,24] For the adult Turkish version, 63% total variance was reported.[23] In our study, the sole use of information provided by parents observing their children may be a factor in the variance results. After the factor analysis, CFA showed that the questionnaire was compatible with actual data collected from Turkish participants. Thus, it was determined that the structure obtained because of the factor analysis was valid.

The mean and SD of the scale score was 7.27±4.79, while it was 3.38±3.17 in its original form.[2] Developed using 34 normal-hearing participants, the

P-HQ parent form has a cut-off point of 10 points, which is two SDs above the mean in the original study. Two SDs above the mean was also suggested as the cut-off point in the original adult version and in the adult Turkish version of the hyperacusis questionnaire.[9,23] In line with this information, 17 points and above is an acceptable cut-off value for the parent form of the P-HQ. However, further research should be conducted to evaluate the accuracy of this information.

Statistical analyses revealed that the Turkish version of the 11-item, 2-factor P-HQ parent form is valid and reliable. The P-HQ parent form is important as it is one of the few questionnaires adapted into Turkish to determine the presence of hyperacusis. In addition, the questionnaire's short and clear questions ensure its ease of use. The sound sensitivity of children with hyperacusis varies, and this scale can provide the guidance necessary to fulfill the unique needs of each child.

LIMITATIONS OF THE STUDY

The limitations of our study are that the presence of hearing loss in the participants was evaluated only with a question asked before completion of the questionnaire, and an audiologic evaluation was not performed. In addition, the test-retest reliability of the scale was not evaluated. These issues should be considered in future studies.

CONCLUSION

In conclusion, the early detection and intervention of hyperacusis in children can be used to address auditory sensitivity problems, improve their quality of life, and contribute positively to educational processes more effectively. The P-HQ, which this study found to be valid and reliable, can be used to develop individualized approaches to hyperacusis diagnosis, treatment, and rehabilitation.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: Nazife Öztürk Özdeş, Kübra Binay Bolat, Sevgi Kutlu, Zehra Aydoğan; Design: Nazife Öztürk Özdeş, Kübra Binay Bolat, Sevgi Kutlu, Zehra Aydoğan; Control/Supervision: Zehra Aydoğan; Data Collection and/or Processing: Nazife Öztürk Özdeş, Kübra Binay Bolat, Sevgi Kutlu, Zehra Aydoğan; Analysis and/or Interpretation: Kübra Binay Bolat, Nazife Öztürk Özdeş; Literature Review: Nazife Öztürk Özdeş, Kübra Binay Bolat, Sevgi Kutlu, Zehra Aydoğan; Writing the Article: Nazife Öztürk Özdeş, Zehra Aydoğan; Critical Review: Zehra Aydoğan; Materials: Nazife Öztürk Özdeş, Kübra Binay Bolat, Sevgi Kutlu, Zehra Aydoğan.

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