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Original Research

Children's Auditory Performance Scale: Turkish Validity and Reliability

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Abstract

Objectives: Central auditory processing disorder (CAPD) is characterized by the difficulties in sound identification and discrimination although the hearing thresholds are in the normal limits. Children's Auditory Performance Scale (CHAPS) is a questionnaire to use as a support in diagnosis. The aim of the present study is to examine the reliability and the validity of the Children's Auditory Performance Scale
Materials and Methods: In total 150 children were included in the study and all children underwent hearing screening and children with normal hearing thresholds were included in the study. The children's ages ranged from 7 to 15 years old (mean age = 102.85 ± 34.47 months). Cross-sectional survey was used in the study. Demographic information was obtained from participants and parents or teachers of the children who fulfilled the questionnaire.
Results: The internal consistency of the questionnaire was examined with Cronbach's Alpha (α = 0.97). Factor analysis determined a six-factor structure which explained 77.75% of the variance in CHAPS scores.
Conclusion: The Turkish version of CHAPS can be considered as a reliable and valid instrument for clinical and research use.

Keywords: *Central auditory processing, central auditory processing disorders, reliability*

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H.Ü. Sağlık Bilimleri Fakültesi Dergisi
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Introduction

American Speech-Language and Hearing Association (ASHA) defines "*Central Auditory Processing Disorders (CAPD)*" as problems in the auditory processing throughout the central nervous system (CNS), in either one or more of the skills such as: "sound localization and lateralization; auditory discrimination; auditory pattern recognition; temporal aspects of temporal integration, temporal discrimination, temporal ordering, and temporal masking; auditory performance in competing acoustic signals (including dichotic listening); and auditory performance with distorted acoustic signals" (Development, 1996). ASHA also states that CAPD can be observed together with various disorders (e.g., attention-deficit / hyperactivity disorder (ADHD), autistic spectrum disorder, speech language deficit and learning disability) and may be related to difficulties in speech, reading and social functions of higher order cognitive abilities (Wilson et al., 2011).

In the search for effective screening tools for CAPD, behavioral questionnaires have been widely promoted. The advantages of behavioral questionnaires comprise simplicity of implementation, cost effectiveness, and qualification of the data to be provided by numerous informants (Wilson et al., 2011).

Children's Auditory Performance Scale (CHAPS) is a screening instrument for listening problems in daily life. In conditions such as 'Multiple Inputs', 'Ideal' or 'Noise' family members or teachers are asked to determine the child's listening abilities. The CHAPS displays the average scores in all conditions and a total score. It recommends referral for CAPD assessment if the average total score for each condition or any of the average scores is less than 0.05 (Dawes, Bishop, Sirimanna, & Bamiou, 2008).

CHAPS is one of the most widely used questionnaires used both in the United Kingdom and in the United States to assist diagnostic evaluation of children with listening difficulties (4-5). Using the observations of parents or teachers, CHAPS determines children's listening challenges in six conditions and associates them with their peers. There are many studies examining the relationship between CAPD tests and CHAPS questionnaire (Ahmmed & Ahmmed, 2016; Dawes et al., 2008).

The purpose of the study was to examine the reliability and validity of the Turkish version of the Children's Auditory Performance Scale. With this questionnaire, that the auditory performance of children in the early period can be screened in different listening environments according to their parents' observations and guiding them for further investigations.

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
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Materials and Methods

Ethical Statement

The study protocol was approved by Hacettepe University Ethical Committee (No: GO 17/242, 14.03.2017). Informed consent was obtained from the caregivers of all children. The approval to translate and validate the scale in Turkish was obtained from the author of the original version of the CHAPS.

Children's Auditory Performance Scale

The CHAPS (Smoski, Brunt, & Tannahill, 1998) consists of a total of 36 items and 6 subscales: listening condition - noise subscale (7 items), listening condition - quiet subscale (7 items), listening condition - ideal subscale (3 items), listening condition – multiple inputs subscale, listening condition – auditory memory/sequencing subscale (8 items) and listening condition – auditory attention span subscale (8 items). Possible responses to each item are "less difficulty", "same amount difficulty"; "slightly more difficulty"; "more difficulty"; "considerably more difficulty"; "significantly more difficulty" or "cannot function at all". A "less difficulty" response is scored +1 points; a "same amount difficulty" response; 0 points, "slightly more difficulty" response; -1 point, "more difficulty" response; -2 points, "considerably more difficulty" response; -3 points, "significantly more difficulty" response; -4 points and a "cannot function at all" response, -5 points. For each child, the CHAPS includes ratings and an average auditory performance rating. Total scores for both the CHAPS-Total scale and the six subscales are determined.

Translation procedure

In the translation process of the CHAPS, the translation-back translation method was used. After the translation into Turkish, this version was translated into English by a fluent English-speaking person who was totally ignorant of the original version. The individual items were determined based on the original and the back translated versions.

Subjects

The final version of the CHAPS-TR was administered to children's parents or teachers after screening the child's hearing. 150 children (73 males, 77 females, aged 5 to 15 years) were included in the study. The age range was determined according to original scale. Before administration of the scale, pure-tone audiometry was conducted in order to rule out hearing loss and children's medical history was gathered from patient medical records. Children diagnosed with hearing loss and additional handicaps such as attention deficit hyperactivity disorder, intellectual disability or vision loss were excluded from the study.

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:7, Sayı:1, 2020
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Statistical Analysis

In the reliability analysis the internal consistency was examined with Cronbach's alpha and the values are acceptable between ≥0.7 and ≥0.9. The exploratory factor analysis was performed using principle component analysis (PCA) with varimax rotation. PCA was performed to examine the dimensionality of the item set measuring the construct validity. The data were statistically analyzed using the SPSS 23.0 version (IBM Corp. (2016). IBM SPSS statistics: Version 23.0).

Results

Descriptive Statistics

The study sample comprised of 150 children (73 males and 77 females) age ranged 5 from 15 year-old (mean age: 102.85 ± 34.47 months). 113 mothers and 37 fathers were responded the questionnaire.

Reliability of the CHAPS

Table 1 shows mean scores of the items and the correlations of item-to-item, subscales, and internal consistency. The internal consistency value of the total score was found excellent ($\alpha = 0.97$).

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:7, Sayı:1, 2020
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Table 1. Item, subscale, and scale descriptive and reliability measurements (N = 150)

Item	Mean	SD	α if item deleted	Item/scale correlation	Cronbach's α
CHAPS – Total	18.75	21.40			0.97
CHAPS – Noise					0.870
Q1. When paying attention	0.76	0.49	0.973	0.493	
Q2. When being asked question	0.60	0.58	0.972	0.534	
Q3. When being given simple instructions	0.63	0.60	0.972	0.589	
Q4. When being given complicated, multiple instructions	0.36	0.99	0.971	0.814	
Q5. When not paying attention	0.21	1.12	0.972	0.749	
Q6. When involved with other activities	0.42	0.84	0.972	0.629	
Q7. When listening with a group of children	0.24	1.10	0.972	0.682	
CHAPS – Quiet					0.909
Q8. When paying attention	0.74	0.63	0.973	0.444	
Q9. When being asked question	0.66	0.65	0.973	0.520	
Q10. When being given simple instructions	0.63	0.67	0.973	0.468	
Q11. When being given complicated, multiple instructions	0.50	0.91	0.972	0.757	
Q12. When not paying attention	0.37	1.03	0.971	0.806	
Q13. When involved with other activities	0.37	1.03	0.972	0.708	
Q14. When listening with a group of children	0.52	0.77	0.972	0.760	
CHAPS - Ideal					0.794
Q15. When paying attention	0.80	0.45	0.973	0.428	
Q16. When being asked question	0.78	0.51	0.972	0.546	
Q17. When being given simple instructions	0.67	0.72	0.972	0.745	
CHAPS – Multiple Inputs					0.881
Q18. When listening and watching the speaker's face	0.66	0.58	0.972	0.666	
Q19. When listening and reading material that is also being read out loud by another	0.58	0.74	0.971	0.787	
Q20. When listening and watching someone provide an illustration	0.43	0.92	0.971	0.800	
CHAPS –Auditory Memory / Sequencing					0.962
Q21. Immediately recalling information	0.56	0.88	0.971	0.766	
Q22. Immediately recalling simple instructions	0.58	0.77	0.971	0.780	
Q23. Immediately recalling multiple instructions	0.46	0.87	0.971	0.805	
Q24. Not only recalling information, but also the order or sequence of the information	0.38	0.98	0.971	0.785	
Q25. When delayed recollection (1 hour or more) of words, word spelling, numbers, etc. is required	0.40	0.98	0.971	0.787	
Q26. When delayed recollection (1 hour or more) of simple instructions is required	0.47	091	0.971	0.796	
Q27. When delayed recollection (1 hour or more) of multiple instructions is required	0.37	1.05	0.971	0.781	
Q28. When delayed recollection (24 hours or more) is required	0.72	0.49	0.971	0.772	
CHAPS – Auditory Attention Span					0.922
Q29. When the listening time is less than 5 minutes	0.57	0.66	0.972	0.656	
Q30. When the listening time is 5 to 10 minutes	0.32	0.94	0.971	0.802	
Q31. When the listening time is over 10 minutes	0.62	0.74	0.972	0.758	
Q32. When listening in a quiet room	0.46	0.80	0.972	0.644	
Q33. When listening in a noisy room	0.48	0.79	0.972	0.663	
Q34. When listening first thing in the morning	0.48	0.89	0.972	0.761	
Q35. When listening near the end of the day, before supper time	0.48	0.89	0.972	0.757	
Q36. When listening in a room where there are also visual distractions	0.42	0.94	0.971	0.800	

SD: Standard Deviation; α : Alpha; Q : Question

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
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Construct Validity of the CHAPS

The construct validity of CHAPS was evaluated with Varimax rotation in factor analysis. The rotation's applicability was assessed by the initial factor analysis assumptions. The sampling adequacy in Kaiser-Meyer-Olkin measure was found 0.912, while Barlett's test of sphericity was 6033.161 with p = 0.0001. These results indicate that the sample number was appropriate for the factor analysis.

The factor analysis showed that CHAPS -TR has 6 factors similar to the original version. All 6 factors explained the total of 77.75% of the variance. The factor distribution of items is given in Table 2.

Table 2. Factor analysis of the CHAPS (N=150)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Question 1 (Noise)					0.63	
Question 2 (Noise)					0.81	
Question 3 (Noise)					0.76	
Question 4 (Noise)					0.36	
Question 5 (Noise)		0.67				
Question 6 (Noise)		0.71				
Question 7 (Noise)		0.79				
Question 8 (Quiet)			0.84			
Question 9 (Quiet)			0.80			
Question 10 (Quiet)			0.80			
Question 11 (Quiet)			0.49			
Question 12 (Quiet)			0.41			
Question 13 (Quiet)			0.60			
Question 14 (Quiet)			0.44			
Question 15 (Ideal)						0.82
Question 16 (Ideal)						0.80
Question 17 (Ideal)						0.51
Question 18 (Multiple Inputs)					0.47	
Question 19 (Multiple Inputs)		0.59				
Question 20 (Multiple Inputs)		0.60				
Question 21 (Auditory Memory / Sequencing)	0.67					
Question 22 (Auditory Memory / Sequencing)	0.69					
Question 23 (Auditory Memory / Sequencing)	0.75					
Question 24 (Auditory Memory / Sequencing)	0.82					
Question 25 (Auditory Memory / Sequencing)	0.83					
Question 26 (Auditory Memory / Sequencing)	0.80					
Question 27 (Auditory Memory / Sequencing)	0.86					
Question 28 (Auditory Memory / Sequencing)	0.86					
Question 29 (Auditory Attention / Span)				0.44		
Question 30 (Auditory Attention / Span)				0.59		
Question 31 (Auditory Attention / Span)				0.58		
Question 32 (Auditory Attention / Span)	0.61					
Question 33 (Auditory Attention / Span)				0.31		
Question 34 (Auditory Attention / Span)				0.55		
Question 35 (Auditory Attention / Span)				0.66		
Question 36 (Auditory Attention / Span)				0.59		
Eigenvalue after rotation	18.821	3.652	1.680	1.582	1.214	1.043
% variance explained after rotation	52.28	10.14	4.66	4.39	3.37	2.89

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
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Discussion

This study aimed to construct and evaluate the reliability and validity of the Turkish version of the CHAPS questionnaire. For this purpose, data were collected for 150 children from their parents. We found that the CHAPS-TR was a six-factor scale with excellent internal consistency and good construct validity. Internal reliabilities of the Noise (= 0.87), Quiet (= 0.90), Ideal (= 0.79), Multiple Input (= 0.88), Auditory Memory/Sequencing (= 0.96) and Auditory Attention/Span (= 0.92) response subscales were excellent. The factor analysis indicated that there are six dimensions to the items explaining 52%, 10%, 4%, 4%, 3%, 2% of variance respectively. These results suggest that CHAPS-TR is adequate tool for clinical and research use. The correlation of each item with the listening condition was varied between Noise, Multiple Inputs, Auditory Memory/Sequencing and Auditory Memory/Span conditions. This may be due to the uncertainty of the answer format. It might have been possible to achieve greater precision if a more standardized format had been used.

Although a diagnostic gold standard has not been established yet, a test battery which includes auditory discrimination test, auditory temporal processing and patterning test, dichotic speech test, binaural interaction test etc. is recommended in the diagnosis of CAPD ((ASHA)). Considering the CAPD symptoms show similarities with other disorders such as ADHD, it is difficult to diagnose CAPD and therefore the screening tools like questionnaires and checklists are essential for pre-diagnosis.

The main purpose of screening for CAPD is to distinguish between children who are potential candidates and who are not for a more comprehensive central auditory test battery. Possible tests for this purpose are: Screening Test for Auditory Processing Disorder (SCAN) (Keith, 2000), the Auditory Processing Domains Questionnaire (APDQ) (O'Hara), Fisher's Auditory Problems Checklist (Fisher, 1976), the Screening Instrument for Targeting Educational Risk (SIFTER) (Anderson, 1989), Children Auditory Performance Scale (CHAPS) (Smoski et al., 1998).

According to Ahmmed et al. (2014)'s study, among 110 children with suspected APD, average condition scores of -1 or lower in the CHAPS, may imply a risk for APD. In their study, the findings suggested a risk of APD in 83 (75%), 90 (82%) and 71 (65%) children in the domains for listening in noise, auditory memory, and attention respectively (Ahmmed et al., 2014). Dawes and Bishop (2010) found that children with auditory processing disorders have worse scores on the CHAPS compared to dyslexia group (Dawes & Bishop, 2010). Volpatto et al. (2018) reviewed questionnaires and checklists for central auditory processing screening used

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
Cilt:7, Sayı:1, 2020
doi: 10.21020/husbfd.635851

in Brazil and stated that the CHAPS covers all central auditory processing abilities (Volpatto et al., 2019). Downs et al. (2005) investigated the listening difficulties in children and adolescents with pervasive developmental disorders (PDD) and revealed that the CHAPS is valuable for identifying specific listening problems in this group of children and enabling the intervention (Downs, Schmidt, & Stephens, 2005). Ahmmed and Ahmmed (2016) showed that, three domains of the CHAPS Ideal, Memory and Attention correlated with the APD tests (Ahmmed & Ahmmed, 2016).

The Turkish validity and reliability study of the CHAPS-TR was performed for the first time. On the basis of the advantages of CHAPS-TR, the current version will be available for Turkish children and will prove to be reliable tool to identify auditory processing difficulties. It is thought that this scale can be used in future studies especially in children with auditory processing disorder, attention deficit and auditory neuropathy.

Conflict of Interest Statement

The authors whose names are listed immediately certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

H.Ü. Sağlık Bilimleri Fakültesi Dergisi
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