Research Article

Validity and Reliability of the Arabic Version of Children's Auditory Performance Scale

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Highlights

- Arabic version of children's auditory performance scale (CHAPS) is established
- The Arabic version of CHAPS is approved to be reliable and valid for clinical use
- The Arabic version of CHAPS can be used as a screening tool for CAPD

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ABSTRACT

Background and Aim: Central auditory processing disorder (CAPD) is seen in a wide array of populations, including children and adults. CAPD is characterized by deficits in one or more auditory abilities, causes difficulties in auditory discrimination, temporal and binaural processing although hearing thresholds are in the normal range. Children's auditory performance scale (CHAPS) is a screening instrument. This study examined the reliability and validity of the Arabic version of children's auditory performance scale.

Methods: In this cross-sectional study, 50 healthy children were included. The children's ages ranged from seven to nine years, and they passed the screening test using distortion product otoacoustic emissions before administering the scale in the translation process, the back-translation method was used, in addition to the face validity procedure. Teachers fulfilled the questionnaire in the presence of an audiologist. After two weeks, the scale was re-administrated, and then the statistical analysis was done to examine the reliability and validity of Arabic version of CHAPS (CHAPS-AR).

Results: The internal consistency was examined with Cronbach's α (α=0.997), for test-retest reliability, Pearson›s (r) was examined (r=0.994) and when executing the face validity, five experts agreed that the CHAPS-AR has a clear structure, syntax and it is easy to understand and use.

Conclusion: The Arabic version of CHAPS can be considered a reliable and valid screening instrument for clinical and research use

Keywords: Central auditory processing disorder; screening; children; auditory; Arabic; validity

Introduction

Central auditory processing is the function of hearing perception along the auditory pathway in the central auditory nervous system (CANS), starting from the cochlear nucleus (CN) in the brainstem to the auditory cortex. All these stations work together to achieve many functions such as auditory discrimination, auditory pattern recognition, temporal resolution, temporal integration, temporal masking, temporal ordering, sound localization, sound lateralization and auditory performance with competing or degraded acoustic signals [1]. Circumstances such as accidents, aging, genetic determinants, neurological diseases, neuro-maturational delay; in addition to many risk factors related to the prenatal and neonatal periods (like Cytomegalovirus, low birth weight, etc.) might lead to deficits in the auditory pathway's performance, causing auditory processing disorder (APD) or what is known as central auditory processing disorder (CAPD) [2]. CAPD reflects a reduction in the analyzing abilities of CANS structures when receiving a speech signal, which leads to many problems in speech comprehension. CAPD is considered a silent disorder according to its nature, symptoms, and characteristics. It has an estimated prevalence of 2%-3% in children and 23%-76% in adults (55 years and older) [1, 3].

Until now, CAPD's diagnostic tools still limited and the diagnosis process is complicated due to the similarities between CAPD and other disorders such as language disorders and school-learning difficulties [1, 4]. Also, some features of CAPD reflect the complicated functions of the brain, and play significant role in making the diagnosing process more difficult [4]. As a reason, there is a great need for a test battery consists of a group of screening, behavioral and electrophysiological tests, working together to establish for the right decision. Thus, the variety of assessment methods and diversity of diagnostic criteria have led to variations in the prevalence of these disorders among studies [5].

In general, a battery of auditory tests is needed for diagnosing CAPD. Screening tests are good in selecting the population who might be at risk of having auditory processing deficits, thus instruct the examiner to continue with CAPD assessment. Behavioral tests are also used in the assessment process such as dichotic speech tests and monaural low-redundancy speech tests. Additionally, the electrophysiological tests like auditory brainstem response (ABR), middle latency response (MLR), and cortical responses can also be used to complete the diagnostic procedure [1, 6]. The CAPD screening will provide early detection, thus selecting the probability of the disorder's presence; leading to an early diagnosis. Such an approach is the best way to intervene as soon as possible leading to reduce the psychological effects and improve the patient's lifestyle, social relationships, and academic development. As well, the screening tools are cost-effective, fast, and noninvasive [1].

Some of the widely used screening tests for CAPD are the SCAN test, Fisher checklist, and CHAPS questionnaire. Children's Auditory Performance Scale (CHAPS) is created by Smoski, et al. [7]. The CHAPS is a scaled questionnaire that can be used to estimate the observed listening behavior of children aged seven years and older, at different conditions (noise, quiet, ideal, and multiple inputs). It also provides information related to auditory memory, the sequence and auditory attention span [2, 7]. Furthermore, it can be used as a pre-post therapy evaluation test [1, 3]. Teachers or family members can complete the questionnaire by answering its 36 questions [7]. Audiologists worldwide have translated CHAPS to their tongues: Turkish [8], Russian [9], Persian [10], the Portuguese [11], and Polish [12].

Until now, there is no screening or diagnostic tool for CAPD in Arabic. Besides, CAPD still undefined and there is a lack of awareness about it in Syrian society, despite the horrible increment of war-wounded, brain trauma patients and the general condition, which results in a massive number of children with learning difficulties, undefined issues, suffering every single day in schools. Therefore, this study aimed to translate and validate the CHAPS as a screening questionnaire for Arabic speakers hoping to establish behavioral and electrophysiological tests in Arabic later, as a turning point at CAPD assessment in Arabic speakers.

Methods

This is a cross-sectional study translated and examined the reliability and validity of the Arabic version of children's auditory performance scale in a governmental elementary school in Damascus, Syria in winter 2020. After giving the necessary explanations, all parents of the children signed the informed consent. The approval to translate and validate the scale in Arabic was obtained from the author of the original version of the CHAPS.

Implementation and scoring of the questionnaire

The CHAPS is a scaled questionnaire consists of 36 questions, classified into six groups representing different listening conditions: noise subscale (7 items), quiet

subscale (7 items), ideal subscale (3 items), multiple inputs subscale, auditory memory/sequencing subscale (8 items) and auditory attention span subscale (8 items). Each question has a score according to the Likert scale: A "less difficulty" response is scored +1 points; the [same amount difficulty; 0], [slightly more difficulty; –1], [more difficulty; –2], [considerably more difficulty; –3], [significantly more difficulty; –4] and [cannot function at all, –5]. Then, an average is calculated to determine whether the child is at risk of having CAPD or not [2, 7].

Translation procedure

After obtaining the needed permission from the author, we proceeded with the design of the Arabic version of the questionnaire, which was performed in two phases. The first phase was the translation of the original version of CHAPS into Arabic, and the second one involved the standardization and establishing the reliability and validity of this Arabic version. The questionnaire was translated using international quality of life assessment (IQOLA) method. In the first stage of translation, two specialized Arabic translators performed forward translation of the questionnaire (from English to Arabic). By accomplishing the translation, the two translators have rated level of difficulty of their translation from 0–100. The mean difficulty scores of less than 25 were labeled as easy, whereas mean scores of 25-30 and higher than 35 were considered relatively easy and difficult, respectively. After that, the translation with acceptable level of difficulty was selected. Then, two other expert bilingual translators (English-Arabic) retranslated the Arabic version of CHAPS into its original language. Before that, the two translators had to estimate the quality of the Arabic translation according to its clarity, use of the same language, and similarity in meaning within the range of 0–100 score (unfavorable-favorable). Items scored 90 or above were favorable, whereas those within the range of 80–90 and lower than 80 were considered as, relatively favorable and unfavorable, respectively. After obtaining an acceptable Arabic version of CHAPS, bilingual translators were asked to retranslate the primary translations to the original language (English). The translation of each item was separately discussed by the authors who applied the needed modifications. The final version was emailed to the original developer of the questionnaire (as he requested) to obtain his approval. Thereafter, the Arabic version of CHAPS, which had an acceptable translation, was considered to determine its reliability and face validity.

Validation of the Arabic children's auditory performance scale

To determine the face validity, the Arabic version of the questionnaire was assessed to confirm its clarity and comprehensiveness by three audiologists and two speech pathologists. For this purpose, a 6-point grading scale (1 very low, 2 low, 3 medium, 4 high, 5 very high, and 6 excellent) was used. Validity of the questionnaire was confirmed if more than 80% of the individuals assigned scores four or higher to each item [13].

Reliability

The reliability of the CHAPS was determined through assessing the internal consistency and test retest reliability. Moreover, that internal consistency was obtained by evaluating the Cronbach's alpha. Test-retest reliability was calculated using Pearson's correlation coefficient between the two phases of administering the questionnaire.

For content validity, CHAPS was administrated on 53 healthy children (30 males, 23 females, aged seven to nine years (Mean age 8.13±0.447 months). All children were selected from the third-grade classrooms in public elementary school in Damascus city. The schools were chosen using the convenience sampling methods. Damascus city was divided into four regions; region number two was selected by draw. The selected region contains fourteen elementary schools, three of them were drawn by lottery, although one school approved to participate in the study due to Coronavirus precautionary measures. However, the students were selected by the same lottery way. The entry criteria were the age of 8-10 because this is the appropriate age for screening CAPD and the age CAPD testing referral. The chosen students had no risk factors, no learning difficulties; did not have any behavioral disorders, hearing loss, physical illness or mental disorders. Before administering the questionnaire, all children have passed the hearing-screening test including otoscopy, tympanometry and distortion product otoacoustic emission (DPOAE). All children had a normal tympanometry (Type A) with a normal otoscopy test. DPOAE test was conducted at 35 dB HL in frequencies 2 to 5 kHz. Children diagnosed with hearing loss, learning difficulties, vision loss or any handicaps were excluded from the study. The exclusion criteria were the lack of full completion of the questionnaire and lack of ability to identify the performance of the children. A prior written consent was obtained from parents whereas, teachers administered the questionnaire in the presence of an audiologist.

Test-retest reliability

After two weeks, we reevaluated the same 53 children by help of the same teacher in the presence of the same audiologist to confirm the scale's consistency by collecting the data and repeat the statistical analysis.

Statistical analysis

For the statistical analysis, the data were analyzed using the SPSS 26.0 version (IBM Corp. 2016). Kolmogorov-Smirnov test was used to check the normal distribution of data and the normality was ascertained with p value more than 0.05. The internal consistency was examined by calculating Cronbach's alpha. Also for test-retest reliability, Pearson's correlation coefficient value was calculated.

Results

At the first stage of this study, the items of the translated questionnaire were evaluated as easy. Bilingual translators have considered some items to be relatively favorable, which had led to conduct a meeting between the four translators and researchers that help to reach the favorable level of all items. After that, the five experts confirmed the face validity of the questionnaire (all experts assigned the score of 4 or higher of all items); which reflect their agreement that the Arabic version of CHAPS has a clear structure, syntax, and each question is achieving its purpose, in addition they confirmed that families and teachers can easily fill it. Consequently, the Arabic version of CHAPS was achieved.

The study sample consisted of 53 children (30 males and 23 females) aged from 7 to 9-year-old (mean age: 8.13±0.447 months). Hearing screening results were obtained, and the referral results were excluded from the study. The internal consistency value of the total score was found excellent (α=0.997) (the acceptable values are between (≥0.7 and ≥0.9). Internal reliability of the noise (=0.975), quiet (=0.984), ideal (=0.979), multiple input (=0.970), auditory memory/sequencing (=0.969) and auditory attention/span (=0.960) response subscales were excellent. For test-retest reliability, Pearson's (r) was equal to 0.994 (the acceptable values are between (+1, –1)) with a p value less than 0.01

The mean score of CHAPS item (=14.7) and the standard deviation (=19.436) when administering the questionnaire for the first time. In addition, the mean score (=15.08) and the standard deviation (=19.323) for the re-administration process (Table 1).

Discussion

Central auditory processing disorder is a common, silent disorder and difficult to diagnose due to the limited diagnostic and evaluation tools currently available. In the case of early detection, and intervention using the proper procedures, psychological and social effects can be minimized. But the diagnosis of CAPD stills complicated due to the absent of a diagnostic gold standard and the similarity with other disorders. So a test battery is recommended in the diagnostic process, which includes questionnaires and checklists. CHAPS's questionnaire is one of the most accurate scales used in CAPD screening. It has been translated into several languages and adopted as a primary screening tool for central auditory processing disorder [1].

Table 1. The mean scores of children's auditory performance scale items and the correlations of item-to-item, subscales, and internal consistency

Item		Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's α if item deleted	Cronbach's α (total values)
CHAPS (Total)						0.99
Noise	QUES1	11.88	19.47	0.89	0.97	0.97
	QUES2	11.90	19.98	0.91	0.97	
	QUES3	11.95	20.20	0.89	0.97	
	QUES4	11.80	19.28	0.92	0.97	
	QUES5	11.78	20.24	0.83	0.97	
	QUES6	11.84	20.38	0.86	0.97	
	QUES7	11.88	20.19	0.88	0.97	

Item		Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's α if item deleted	Cronbach's α (total values)
Quiet	QUES8	10.36	13.06	0.95	0.98	0.98
	QUES9	10.34	12.76	0.90	0.98	
	QUES10	10.36	13.06	0.95	0.98	
	QUES11	10.22	12.80	0.90	0.98	
	QUES12	10.26	13.31	0.87	0.98	
	QUES13	10.34	13.35	0.94	0.98	
	QUES14	10.34	13.35	0.94	0.98	
Ideal	QUES15	4.23	2.46	0.96	0.96	0.97
	QUES16	4.25	2.50	0.94	0.97	
	QUES17	4.13	2.41	0.88	0.99	
Multiple Inputs	QUES18	4.44	2.79	0.89	0.96	0.97
	QUES19	4.30	2.55	0.89	0.96	
	QUES20	4.38	2.63	0.91	0.96	
Auditory memory/ sequencing	QUES21	13.28	39.98	0.74	0.97	0.96
	QUES22	13.19	38.17	0.87	0.96	
	QUES23	12.92	32.94	0.92	0.96	
	QUES24	12.92	36.94	0.82	0.96	
	QUES25	13.09	37.60	0.85	0.96	
	QUES26	12.94	32.82	0.93	0.96	
	QUES27	12.79	32.46	0.94	0.96	
	QUES28	12.83	32.75	0.92	0.96	
Auditory attention span	QUES29	13.70	24.01	0.78	0.95	0.96
	QUES30	13.59	21.41	0.90	0.95	
	QUES31	13.38	20.55	0.92	0.95	
	QUES32	13.72	23.34	0.86	0.95	
	QUES33	13.23	20.56	0.77	0.96	
	QUES34	13.67	23.18	0.84	0.95	
	QUES35	13.40	22.95	0.76	0.95	
	QUES36	13.48	23.00	0.84	0.95	

CHAPS; children's auditory performance scale, QUES; question

In this study, the CHAPS questionnaire was translated into Arabic for the first time with approving its reliability and validity. The statistical studies were conducted, and the scale was re-administrated to prove the validation. The results were good and reliable (α=0.997, Pearson's r=0.994). Therefore, we hope to adopt the Arabic version of CHAPS in the auditory screening of the central auditory processing disorder, as it is an easy-to-use tool, well formed, fast and inexpensive, and there is no difficulty in obtaining information and answers, most importantly, family members and teachers can use it. Also, we are working on national database children to increase the social awareness of the disorder, in addition to continuing to develop an Arabic diagnostic, rehabilitative protocol for central auditory processing disorder.

According to Bayden el al. in their research article, the Turkish version of CHAPS was reliable and valid instrument with an internal consistency (α=0.97) and a factor analysis to explain 77.75% of the variance in CHAPS scores. The translation-back-translation method was used in the translation process. 150 children were included in the study, aged from 7 to 15 years (mean age=102.85±34.47 months) and the data were collected from their parents [8]. Garbaruk et al. demonstrated that Fisher's questionnaire was more convenient for the parents to fill in, after approving CHAPS questionnaire and Fisher's auditory checklist in Russian. Their study included 52 children aged from 5-10 years by the participation of their parents in the filiation of the questionnaire and the checklist [9]. Carvalho et al. reviewed questionnaires and checklists used in Brazil for CAPD screening. Moreover, the Brazilian Portuguese version of CHAPS was adopted and they emphasized that CHAPS covers all central auditory processing abilities [11]. Bieńkowska et al. suggest that the Polish version of the children's auditory performance scale enables a reliable measurement of hearing and understanding difficulties in children [12]. Ahmadi et al. studied the performance of learning-difficulties children in Persian-CHAPS, and showed that 75% of learning-difficulties children failed in auditory processing, 86% in attention skills, and 82% in language skills; which could be indicative of a high likelihood of comorbidity of CAPD in those children [10]. These studies assure our results that the CHAPS is a good tool for screening CAPD which can be translated into different languages and used for various communities.

Conclusion

According to the results of the present study, the Arabic version of children's auditory performance scale had high-quality translation. Additionally, the reliability and face validity of the questionnaire were confirmed. Internal consistency and reliability of the Arabic version of the questionnaire were acceptable in all performed tests. Hence, we recommend using it clinically in the central auditory processing disorder screening programs, which may raise the awareness of central auditory processing disorder and its consequences.

Ethical Considerations

Compliance with ethical guidelines

The study protocol complies with the recommendation of the Declarations of Helsinki and Tokyo for humans and are approved by their Ethics Committee of Damascus University.

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Authors' contributions

GG: Study design, acquisition of data, statistical analysis, and drafting the manuscript; SMM: Study design and supervision, interpretation of the results, and critical revision of the manuscript.

Conflict of interest

The authors are responsible for all the statements in this work. Also, no conflicts of interest are to be declared.

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