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Original Article

Reliability and Validity of the Turkish Version of the ABILHAND-Kids Survey in Children with Cerebral Palsy

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ABSTRACT

Objectives: The aim of the present study is to develop a Turkish version of the ABILHAND-Kids Survey, which evaluates upper extremity function in children with cerebral palsy (CP), and to carry out a validity and reliability study of the survey for Turkish CP patients.

Materials and methods: Between November 2016 and March 2017, a total of 109 pediatric CP patients (62 males, 47 females; mean age 9.3±2.9 years; range, 6 to 15 years) followed in our outpatient clinic were included. The demographic characteristics and type of CP of the patients were recorded. A functional evaluation was made using the ABILHAND-Kids and Manual Ability Classification System (MACS) surveys. The reliability of the surveys was tested based on internal consistency (Cronbach's α) and test-retest (intraclass correlation coefficient [ICC]) methods. The validity of the approach was evaluated using converted scores from an ABILHAND-Kids Rasch analysis and a correlation of the MACS levels.

Results: The ICC value for the test/retest reliability was 0.98 and internal consistency was 0.94. A strong negative correlation was found between the Turkish version of the ABILHAND-Kids and MACS surveys (r=-0.849; p<0.001). A Rasch analysis indicated good item fit, unidimensionality, and model fit.

Conclusion: The Turkish version of the ABILHAND-Kids survey is a reliable and valid scale for the assessment of manual ability in Turkish children with CP.

Keywords: ABILHAND-kids, cerebral palsy, reliability, Turkish, validity.

Cerebral palsy (CP), as stated by the World Health Organization (WHO) International Classification of Functioning, Disability and Health (ICF), is a debilitating childhood disease that limits walking and engagement in daily activities, as well as the participation of the sufferer in social life.[1] The ICF categorizes the affected upper extremity functions into those affecting bodily functions, engagement in activities, and participation in social life. The range of motion of the joint, muscle tone, muscle power, and sensitivity are all included in evaluations of bodily functions, while activity levels are evaluated based on the capacity and performance concepts. Capacity refers to the ability of an individual to carry out daily tasks in a standard environment, while performance is related to the spontaneous use of the affected hand during play.[2]

Conventional or new all-surgical or non-surgical treatment methods are applied for the treatment and elimination of the disability and to increase walking capacity, to improve hand function, and to ease daily activities, although appropriate measures are required to evaluate the effectiveness of these treatment methods. The most common methods are

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the Manual Ability Classification System (MACS) and the Gross Motor Function Classification System (GMCSF), although other means of evaluation are currently being developed to effectively evaluate the functionality of the upper and lower extremities of patients. One such approach is the ABILHAND-Kids survey,[3] which evaluates the bilateral upper extremities of children, and which has proven validity and reliability, including 21 questions for families related to the common tasks undertaken by their children in their daily living activities.[4,5] The ABILHAND-Kids survey was originally developed in French as a standard means of assessment of manual ability in children with CP.[6] This survey evaluates the most typical indicators of manual activity, in which some of the items were developed based on the ABILHAND-Kids survey, which was developed to assess manual ability in adult patients, while other items were selected from existing scales or were adapted to broaden the variability of activities. Review of the literature shows that this scale, which has been commonly used recently in the assessment of functionality in CP patients, is available in English, French, Dutch, Swedish, and Polish,[6] while no Turkish version for CP patients is available.

In the present study, therefore, we aimed to develop the Turkish version of the ABILHAND-Kids survey and to carry out a validity and reliability study for Turkish CP patients.

MATERIALS AND METHODS

A total of 109 pediatric CP patients (62 males, 47 females; mean age 9.3±2.9 years; range, 6 to 15 years) admitted to the outpatient clinic of the Physical Medicine and Rehabilitation of the School of Medicine of Medicine Faculty of Dokuz Eylül University between November 2016 and March 2017 were included in the study. The inclusion criterion was having been diagnosed with CP at least six months prior to the study. Exclusion criteria were as follows: the presence of any additional acute orthopedic or neurological disorder within the last one month and having been treated with a botulinum toxin injection within the last three months. The study protocol was approved by the Medicine Faculty of Dokuz Eylül University Ethics Committee (2016/21-30). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data collection

The demographic characteristics of the patients and type of CP were recorded and the ABILHAND-Kids and MACS surveys were used for functional evaluation.

ABILHAND-Kids scale

A total of 21 items of the ABILHAND-Kids define a reliable and valid manual ability scale. It was first developed based on a Rasch model which allows for the conversion of scores into linear measures on a unidimensional scale.

Procedures

The parents of the children with CP were asked to complete the survey and to evaluate the convenience and difficulty experienced by their child when carrying out each activity. Each activity was to be performed in the following ways: *(i)* without technical or human support (even if the child is assisted in daily life); *(ii)* independent of the actually used extremity (extremities) during the completion of the activity; and *(iii)* Using any strategy (compensation allowed). While answering the questions, the parents were asked to provide their perception of the difficulty experienced by their child during each task using a three-level answer scale as "Impossible", "Difficult" and "Easy". When no attempt was made to carry out a particular activity, the activity was not graded, and a blank answer was given (marked "?" on the grading paper). There were four possible answers for each activity: *(i)* Impossible: The child cannot perform the activity without help; *(ii)* Difficult: The child can perform the activity without help, but has some difficulties in doing so; *(iii)* Easy: The child can perform the activity without help and has no difficulty; and *(iv)* Question mark: The parents are unable to assess the difficulty of the activity, as the child has never performed such an activity before. The answer "Impossible" should be given in place of the question mark, if the child made no attempt to perform the activity and if they perceived it as impossible.

Relevant explanations were made to the parents only at the beginning of the test, and five items were used for practice to help the parents understand the levels of the evaluation scale and the use of its entire scope.

The ABILHAND-Kids activities were presented in a random order to prevent any systematic effect, for which there were 10 variable random orders. The evaluator chose the next item from among the 10 random orders during the evaluation for whichever child was being evaluated.

MACS

The MACS is a recently developed classification system which has been designed to classify the ways in which children with CP aged 4 to 18 years use their hands while manipulating objects in daily life. It has attracted international attention and has been translated into 17 languages (www.macs.nu) to date, having first been established during the 2001 WHO ICF meeting.[7] Later, a MACS which was capable of evaluating handling skills was developed, initially to measure hand function in children aged 8 to 12 years. The reliability and validity of the scale have been proven for ages ≥4 years (between health professionals intraclass correlation coefficient [ICC]=97%) and between the families and professionals ICC=0.96 (95% of confidence interval [CI]). The system evaluates[8] the ability of a child with CP to use a hand while holding an object in daily activities, with the aim of being able to determine hand performance rather than maximum capacity. Both hand functions are evaluated together and examined at five levels:[7] *(i)* Level I: Handles objects easily and successfully; *(ii)* Level II: Handles most objects, but with somewhat reduced quality and/or speed of achievement; *(iii)* Level III: Handles objects with difficulty, needs help to prepare and/or modify activities; *(iv)* Level IV: Handles a limited selection of easily managed objects in adapted situations; and *(v)* Level V: Does not handle objects and has very limited function.

The validity of the Turkish version of the system was carried out by Akpinar et al.[9]

Translation procedures

All translation procedures were conducted in accordance with translation and cultural adaptation guidelines and standards.[10,11] Carlyne Arnould, as the

TABLE 1
ABILHAND-Kids

Patient:

Date:

How **DIFFICULT** are the activities below?

		Impossible	Difficult	Easy	?
1	Opening a jar of jam				
2	Putting on a backpack				
3	Opening the cap of the toothpaste				
4	Unwrapping a bar of chocolate				
5	Washing his upper body				
6	Rolling up sweater sleeves				
7	Sharpening a pencil				
8	Taking off a t-shirt				
9	Putting toothpaste unto a toothbrush				
10	Opening a breadbox				
11	Unscrewing a bottle cap				
12	Zipping up pants				
13	Buttoning his shirt or sweater				
14	Filling a glass of water				
15	Switching the bedside lamp				
16	Putting on a hat				
17	Fastening the snaps on his jacket				
18	Buttoning up his pants				
19	Opening up a pack of chips				
20	Zipping up a jacket				
21	Taking coins out of a pocket				

Question mark: The parents are unable to assess the difficulty of the activity, as the child has never performed such an activity before.

developer of the scale, was contacted via e-mail on the date of 04.07.2016, and necessary permission was obtained to adapt the ABILHAND-Kids scale into the Turkish language (Table 1). The translation was made by two Turkish members of the academic staff in the Department of Physical Therapy and Rehabilitation. The Turkish form was, then, translated into English by an English language specialist with no knowledge of the original form of the scale. The consistency of the two forms was evaluated, the obtained form was discussed, and relevant corrections were made for the meaning and grammar. As a result, a tentative Turkish version of the form was created which was applied to 20 healthy individuals chosen via an improbable sampling testing method. A pre-test was made to evaluate the comprehensibility of the questions, after which, the final version of the form was created (Appendix).

Reliability and validity

The Cronbach's alpha (α) and corrected item-total correlations were used to assess internal consistency, and intra-rater reliability studies were also carried out. The agreement between the two independent ratings was analyzed using an ICC for 30 patients with CP. A maximum of two weeks between the tests was deemed sufficient to prevent bias, and the validity was assessed using the MACS.

Statistical analysis

Statistical analysis was performed using the IBM SPSS version 22.0 software (IBM Corp., Armonk, NY, USA). Descriptive data were expressed in mean ± standard deviation (SD) or median [interquartile range; IQR], while numerical variables were expressed in number and percentage. The ICC test/retest reliability value was measured and calculated with a two-way random model. The internal consistency of the scale was evaluated by Cronbach's α; floor and ceiling effects were calculated for content validity; and Spearman's correlation coefficient was calculated between the scale and the scales considered to offer the optimum construct validity. The expected response of a subject to an item was computed based on the Rasch Analysis Rating Scale model. Data were analyzed using the Rasch Model package program RUMM2030 student version (browse around and discover about RUMM for Windows, Australia).[12] Also in this model, item-trait interactions were calculated with chi-square. A *p* value of <0.05 was considered statistically significant.

RESULTS

Baseline demographic and clinical characteristics of the patients are presented in Table 2.

The ICC absolute agreement value for test-retest reliability, which was made for 30 patients, was calculated as 0.98 with 95% CI (0.98-1.00), indicating a good correlation between the answers ($p<0.01$). The internal consistency of the ABILHAND-Kids estimated through the internal consistency coefficient (Cronbach's α) was 0.94.

A rating scale model was used, since the p value of the likelihood ratio test was found to be non-significant in the Rasch analysis (p=0.66). None of the 21 items had a disordered threshold, and all items were found to fit the Rasch model (Table 3). The overall mean item fit residual was -0.111±1.002 and the mean person fit residual was -0.214±0.838. The item-trait interaction was non-significant (chi-square 44.72 [df=42], p=0.358), and the invariance property of all items was provided. The easiest task was item 16 (put on a hat), while the most difficult task was item 18 (button up trousers), the logit scores of which were -3.584 and 2.358, respectively.

The reliability of the scale was found to be good, based on a Pearson Separation Index (PSI) value of 0.94. No differential item functioning (DIF) was found in any of the items in the scale, when the DIF was evaluated in terms of sex and CP type. The scale including 21 items is unidimensional, since there is no significant difference between the expected and observed *p* values.

TABLE 2
Demographic and clinical characteristics of patients (n=109)

	n	Mean±SD
Age (year)		9.3±2.9
Sex		
Female	47	
Male	62	
Type of cerebral palsy		
Spastic	103	
Ataxic	4	
Dyskinetic	2	
MACS level		
Level 1	14	
Level 2	34	
Level 3	30	
Level 4	11	
Level 5	20	
ABILHAND score (of all patients)		20.8±13.7

SD: Standard deviation; MACS: Manual Ability Classification System.

TABLE 3
Individual item fit analysis of 21 items

Items	Difficulty (logits)	SE (logits)	Residual (z)	Chi-square	df	*p*
1	1.400	0.199	0.254	4.539	2	0.103
2	0.621	0.187	1.373	0.935	2	0.626
3	-0.368	0.202	-0.262	1.568	2	0.457
4	0.020	0.190	0.567	0.590	2	0.745
5	0.152	0.191	1.934	2.588	2	0.274
6	-0.419	0.205	0.973	1.580	2	0.454
7	1.023	0.196	-0.387	0.704	2	0.703
8	0.877	0.188	1.601	1.408	2	0.495
9	-0.302	0.201	-1.018	3.409	2	0.182
10	-2.012	0.262	0.150	4.543	2	0.103
11	0.056	0.191	-0.715	0.551	2	0.759
12	0.750	0.189	-0.084	2.301	2	0.317
13	2.339	0.225	-1.484	7.311	2	0.026
14	-0.583	0.202	-0.471	0.839	2	0.657
15	-3.129	0.349	-0.152	0.536	2	0.765
16	-3.584	0.397	-0.513	0.553	2	0.759
17	0.805	0.196	-0.710	0.433	2	0.805
18	2.358	0.224	-1.527	4.793	2	0.091
19	-0.208	0.194	-0.730	1.096	2	0.578
20	0.774	0.191	-1.636	2.823	2	0.244
21	-0.569	0.204	0.509	1.621	2	0.445

SE: Standad error; df: Degree of freedom.

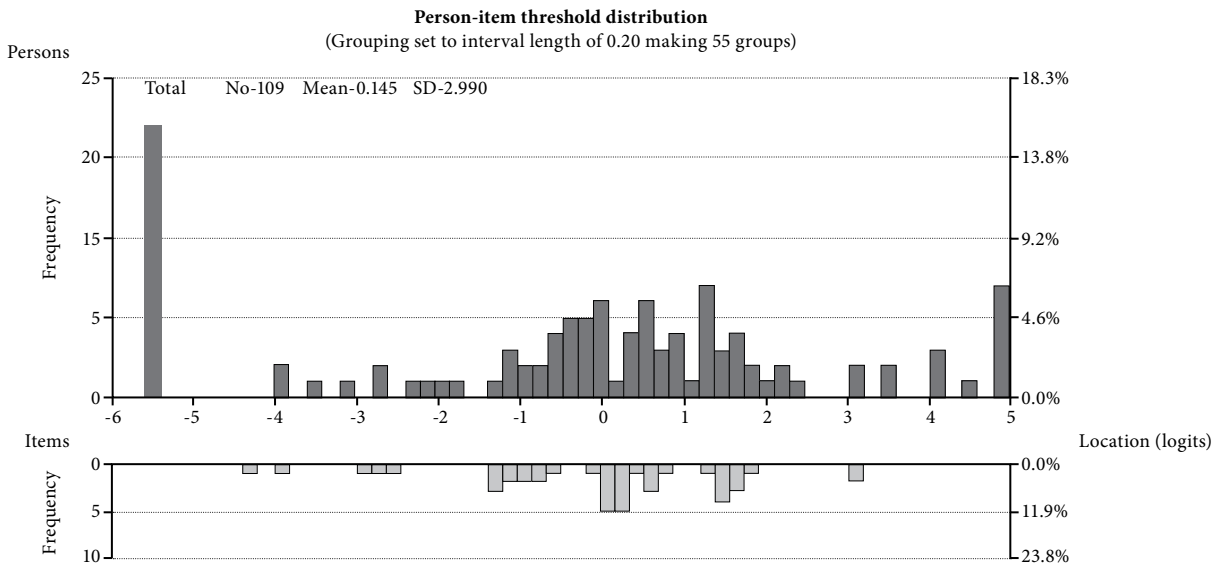

Figure 1. Targeting issues veya targeting range of ABILHAND-KIDS for manual ability of children.

The residual correlations of three-item couples (item 3 [taking the cap off a toothpaste tube] and item 11 [unscrewing a bottle cap]; item 12 [zipping up trousers] and item 20 [zipping-up a jacket]; and item 13 [buttoning up a shirt/sweater] and item 8 [buttoning up trousers] were found to be higher than 0.30, when the local independence assumption was evaluated. These item couples were retained in the scale, since they presented no problems affecting the unidimensionality of the scale.

When the overall individual and item distributions were analyzed for the 21-item scale, the mean manual ability score (mean person score: -0.145) of the children was found to be lower than the mean difficulty of the items (mean item score: 0) (Figure 1).

Furthermore, a negative and strong correlation was found between the ABILHAND-Kids Rasch converted score and the MACS ($r=-0.849$; $p<0.001$). The floor and ceiling effects of the logit scores of the ABILHAND-Kids scale were 16% and 7%, respectively. The 16% floor effect was obtained in children with a -5.48 minimum logit score, while the 7% ceiling effect was obtained in children with a 4.89 maximum logit score.

DISCUSSION

The upper extremities are affected by CP to varying degrees, from mild difficulty in fine motor skills to severe upper extremity deformities. The gripping, reaching, and releasing functions of the upper extremities and daily life activities such as nutrition, dressing, self-care, hygiene, and playing games are limited in the presence of muscle weakness, spasticity, sensorial disorders, motor control problems, and such movement disorders as dystonia/athetosis. In addition, there may be aesthetic concerns about the appearance of an upper extremity. Definitions and detailed evaluations of upper extremity problems are important while tailoring an appropriate treatment plan, and there is a number of scales which can be used for the evaluation of upper extremity functions.[13] Understanding upper limb performance in everyday life, as perceived by children with CP and their families, demands a comprehensive assessment and acknowledgement of the importance of the perspectives of the child and family. Parents have a better perception of the manual skills of their children for the completion of the ABILHAND-Kids scale, and this results in a wider evaluation variation, higher reliability (R=0.94), and reproducibility (R=0.91), and it is for this reason that the ABILHAND-Kids survey is based only on the opinions of parents. Good reliability and validity were also found for the Turkish version of the scale.

The ABILHAND-Kids scale is a useful for the definition of factors which may affect the long-term manual functioning of children, for the determination of upper extremity disorders in children, and for the evaluation of the association between manual skills, dystonia, and choreoathetosis. The ABILHAND-Kids survey has been used as an outcome measure in several interventional studies, and for other clinical conditions, including radial deficiency, obstetric brachial plexus injury and pediatric ischemic stroke.[14] Furthermore, the ABILHAND-Kids survey (0.91) has been found to demonstrate a higher test-retest reliability than other scales in a review analyzing the functional evaluation of upper extremities in CP (Klingels, 2010). The internal consistency coefficient of the ABILHAND-Kids scale was found to be high (0.94) in the present study, and the results are consistent with those of previous studies[4,5,6,14,15] in which the ABILHAND-Kids measures were significantly related to school education, type of CP, and gross motor function.

In a recent Brazilian ABILHAND-Kids test-retest study, reliability in the first and second assessment was found to be 0.91 for intra-rater ICC and 0.97 for inter-raters, while the ICC in the present study was found to be 0.98. In another study in Turkey, children with neuromuscular disease (NMD) were evaluated using the ABILHAND-Kids scale, although as was noted as a limitation of the study by the authors, primary involvement occurs in the major muscle groups of the lower extremities in these patients and disabled patients with mild NMD may have better upper extremity function up until the latter phases of the disease. In the light of these findings, clinicians and researchers should consider the possible influence of the floor effect of the scale, particularly for the diagnostic groups with mild disability.[6]

In our study, the Rasch analysis was used to evaluate the validity and reliability of the ABILHAND-Kids scale. It permits the conversion of a total score into a linear score, allowing an arithmetical computation and parametric statistical analysis to be carried out for the present study. All items fitted the model, and none showed evidence of misfit, indicating that there was no need to remove any items. The ABILHAND-Kids scale was found to be unidimensional in nature, indicating the use only for the measurement of manual ability. In addition, the findings confirmed the unidimensional nature of the Turkish version of the ABILHAND-Kids scale in children with CP,

supporting the validity of the questionnaire for use in this patient group.[15] The respondents' scores may be entered into the http://www.rehab-scales.org website to calculate a Rasch-generated total score in logits. This test is cost-effective, rapid, and easy to complete.

In our study, a strong negative correlation was found between the ABILHAND-Kids rasch converted scores and MACS (r=-0.849; p<0.001). The easiest item in the scale was item 16 (put on a hat), while the most difficult item was item 18 (button up trousers). No item on the scale emerged as a problem affecting the unidimensional nature of the scale. However, in the present study, the CP types were not homogeneously distributed, and most of the study population were of the spastic type, which can be considered a limitation of the study. As a further limitation, the evaluations were all made by a single researcher, which may have reduced the generalizability of the finding to the larger populations.

In conclusion, based on the results of the present study, the Turkish version of the ABILHAND-Kids scale is reliable and valid for the evaluation of manual skills among Turkish CP children between the ages of 6 and 15 years.

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Appendix

ABILHAND-Kids Manuel Yetenek Ölçütü-Türkçe sürümü

Hasta:

Tarih:

Aşağıdaki aktiviteler ne kadar **ZOR**?

		İmkansız	Zor	Kolay	?
1	Reçel kavanozunu açmak				
2	Sırt çantasını/okul çantasını takmak				
3	Diş macununun kapağını açmak				
4	Çikolata paketini açmak				
5	Vücudun üst kısımlarını yıkamak				
6	Kazağın kollarını yukarı sıvamak				
7	Kurşun kalem açmak				
8	T-shirt'ü çıkarmak				
9	Diş fırçasına diş macunu sıkmak				
10	Ekmek kutusunu açmak				
11	Şişe kapağını açmak				
12	Pantolonun fermuarını çekmek				
13	Gömlek/kazağın düğmelerini iliklemek				
14	Bardağa su doldurmak				
15	Masa üstündeki gece lambasını açmak				
16	Şapka takmak				
17	Ceketin çıtçıtlarını kapatmak				
18	Pantolonun düğmelerini iliklemek				
19	Bir cips poşetini açmak				
20	Ceket fermuarını çekmek				
21	Cepten bozuk para çıkarmak				