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

Ebru Şahin1, Banu Dilek1, Ali Karakaş1, Onur Engin1, Selmin Gülbahar1, Ömer Faruk Dadaş1, Minuse Özlen Peker1, Özlem El1

1Department of Physical Medicine and Rehabilitation, Medicine Faculty of Dokuz Eylül University, Izmir, Turkey
2Department of Physical Medicine and Rehabilitation, Karadeniz Ereğli State Hospital, Zonguldak, Turkey
3Department of Biostatistics, Medicine Faculty of Ege University, Izmir, Turkey

Received: December 18, 2018 Accepted: August 19, 2019 Published online: June 24, 2020

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.
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 Eylul 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 Eylul 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. 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 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: 

(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. All translation procedures were conducted in accordance with translation and cultural adaptation guidelines and standards. 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.
Reliability and Validity of the Turkish Version of the ABILHAND-Kids Survey in Children with CP
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: Standard 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. 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.

Acknowledgement

We thank Carlyne Arnould for permission the scale to use. We also thank all participants for their interest and participation.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

REFERENCES

1. Caty GD, Arnould C, Thonnard JL, Lejeune TM. ABILOCO-Kids: a Rasch-built 10-item questionnaire for assessing locomotion ability in children with cerebral palsy. J Rehabil Med 2008;40:823-30.
2. Klingels K, Feys H, De Wit L, Jaspers E, Van de Winckel A, Verbeke G, et al. Arm and hand function in children with unilateral cerebral palsy: a one-year follow-up study. Eur J Paediatr Neurol 2012;16:257-65.
3. İrdesel J. Serebral palsi rehabilitasyonu. In: Ozcan O, Arpacıoğlu O, Turan B, editor. Nörorehabilitasyon. Bursa: Güneş & Nobiel Tip Kitabevleri; 2000. s. 137-48.
4. Arnould C, Penta M, Thonnard JL. Hand impairments and their relationship with manual ability in children with cerebral palsy. J Rehabil Med 2007;39:708-14.
5. Wallen M, Stewart K. Upper limb function in everyday life of children with cerebral palsy: description and review of parent report measures. Disabil Rehabil 2015;37:1353-61.
6. Öksüz Ç, Alemdaroglu I, Kilinç M, Aboğlu H, Demirci C, Karahan S, et al. Reliability and validity of the Turkish version of ABILHAND-Kids’ questionnaire in a group of patients with neuromuscular disorders. Physiother Theory Pract 2017;33:780-7.
7. Penta M, Tesio L, Arnould C, Zancan A, Thonnard JL. The ABILHAND questionnaire as a measure of manual ability in chronic stroke patients: Rasch-based validation and relationship to upper limb impairment. Stroke 2001;32:1627-34.
8. Eliasson AC, Krumlind-Sundholm L, Röslad B, Beckung E, Arner M, Ohvall AM, et al. The Manual Ability Classification System (MACS) for children with cerebral palsy: scale development and evidence of validity and reliability. Dev Med Child Neurol 2006;48:549-54.
9. Akpinar P, Tezel CG, Eliasson AC, Icaçsioglu A. Reliability and cross-cultural validation of the Turkish version of Manual Ability Classification System (MACS) for children with cerebral palsy. Disabil Rehabil 2010;32:1910-6.
10. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine 2000;25:3186-91.
11. Wild D, Grove A, Martin M, Eremenco S, McElroy S, Verjee-Lorenz A, et al. Principles of Good Practice for the Translation and Cultural Adaptation Process for Patient-Reported Outcomes (PRO) Measures: report of the ISPOR Task Force for Translation and Cultural Adaptation. Value Health 2005;8:94-104.
12. Andrich D, Sheridan B, Luo G. Rumm 2010. Perth: Rumm Laboratories; 2012.
13. Türkbey TA, Kutlay S. Upper Extremity Problems in Cerebral Palsy. Turkiye Klinikleri J PM&R-Special Topics 2017;10:39-48.
14. Kamonseki DH, Cedin L, Clemente AF, Peixoto BO, Zamuner AR. Translation, cross-cultural adaptation and validation of the ABILHAND-Kids for the Brazilian Portuguese. Fisioter Pesqui 2017;24:176-83.
15. Yıldız R, Erol E, Şimşek A, Apaydın U, Gökmen D, Elbasan B. Reliability and Validity of the Turkish Version of the Abiloco-Kids. J Dev Phys Disabil 2018;30:269-8.
## 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        | Vücudu üst kısımlarını yıkamak |       |   |
| 6        | Kazağın kollarını yukarı sıvamak |       |   |
| 7        | Kurşun kalemlerini açmak |       |   |
| 8        | T-shirt’u 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       | Çeketin çıtçıtlarını kapatmak |       |   |
| 18       | Pantolonun düğmelerini iliklemek |       |   |
| 19       | Bir cips poşetini açmak |       |   |
| 20       | Çeket fermuarını çekmek |       |   |
| 21       | Cepten bozuk para çıkarmak |       |   |