

# Validity and reliability of the Persian version of the Eating and Drinking Ability Classification System

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## Abstract

**Background/Aims** The ability to eat and drink is the most important factor in health, survival and longevity. Children with cerebral palsy can suffer from severe dysphagia, which can lead to a high risk of aspiration and choking. As classifying eating and drinking ability in children with cerebral palsy is important in research and treatment, the aim of this study was to determine the cross-cultural validation and reliability of the Persian version of the Eating and Drinking Ability Classification System.

**Methods** After translation procedures, the face validity, content validity, test-retest reliability and interrater reliability of the Eating and Drinking Ability Classification System were evaluated. In total, 130 parents of children with cerebral palsy and 34 therapists participated in the evaluation of the scale's reliability. The 73 boys and 57 girls with cerebral palsy were aged 3–20 years (mean age 4.4 years) and had various types of cerebral palsy. They were classified according to the Eating and Drinking Ability Classification System by both their parents and the therapists.

**Results** The overall results indicated that the words and sentences used were simple, clear, understandable, relevant and necessary. The intraclass correlation coefficients for test-retest reliability for parents, occupational therapists and speech therapists were 0.98, 0.98 and 0.995, respectively. The interrater reliability between parents and occupational therapists was 0.96, between parents and speech therapists was 0.95, and between occupational therapists and speech therapists was 0.985.

**Conclusions** The Persian version of the Eating and Drinking Ability Classification System seems to be valid and reliable. This system may be used to evaluate children with cerebral palsy.

**Key words:** ■ Cerebral palsy ■ Eating and Drinking Ability Classification System ■ Feeding ■ Reliability ■ Validity

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## INTRODUCTION

Cerebral palsy describes a group of permanent developmental and postural disorders that limits activity and is attributed to non-progressive disturbances that occur in the developing fetal or infant brain (Sankar and Mundkur, 2005; Odding et al, 2006; Rassafiani and Sahaf, 2011).

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Cerebral palsy occurs in about 2.0–2.5 per 1000 live births (Linden and Siebens, 1983; Rogers, 2004; Sankar and Mundkur, 2005). Other problems that may be associated with cerebral palsy include disturbances in sensation, perception, cognition, communication and behaviour, seizures, secondary musculoskeletal disorders and incontinence. Furthermore, these children may have problems with oral skills, eating, drinking and swallowing, which could lead to an increased risk of respiratory problems as a result of direct aspiration of food and liquids into the lungs (Joghataei et al, 2002; Odding et al, 2006; Soleimani et al, 2011). This makes enjoyable eating and drinking extremely difficult and can result in choking, which is distressing for the children (Thommessen et al, 1991).

### Eating and drinking issues

Problems with eating and drinking occur on a continuum from very mild to severe. For example, poor coordination of oral movements can cause low eating, and extreme impairments in oral motor function can result in severe dysphagia (Fung et al, 2002). The reported prevalence of eating and drinking problems in people with cerebral palsy ranges from 27% to 90% (Sullivan et al, 2000; Sellers, 2014). Bax et al (2005) found that 20% of children with cerebral palsy were severely underweight or ate inappropriately because of issues with eating and drinking. According to Reilly (2001), nutritional problems are seen in 90% of children with cerebral palsy. Multidisciplinary team members, including a gastroenterologist, occupational therapist, speech therapist, nutritionist, nurse and psychologist, should work together to help each family to overcome the nutritional problems that their child with cerebral palsy faces. Therapists may implement direct interventions to improve a child's eating and drinking performance. Tools, scales and evaluations are required to accurately determine the cause and severity in order to perform such interventions (Edvinsson and Lundqvist, 2015). Functional impairment in any part of the body disrupts activities of daily living and impedes individual independence and social function; therefore, there is a need for reliable tools and scales to evaluate and treat functional abnormalities (Bax et al, 2005). The primary purpose of classification systems is to differentiate between the diversity of expression and progressive stages of a health condition (Rosenbaum et al, 2014). These systems allow children to be classified into different groups for the purpose of describing, predicting and comparing goals (Dyszuk, 2014). Classification also provides information that can help health care professionals determine the present and future service needs of children with cerebral palsy (Bax et al, 2005).

### Food therapists

Food therapists evaluate functional skills that may be involved in the eating process. These include motor skills, such as postural control of the trunk, head and limbs, and eating endurance. The examination and evaluation of a child's neuromuscular function, mouth structure, oral pattern, oral sensory motor skills, tongue and contributing factors – such as muscle strength and motor control, tone, reflexes, sensory, perceptual and cognitive abilities – and functional patterns, including habits and routines, is essential. Any context that may have an impact on successful eating should also be assessed. The final stage of clinical evaluation is the observation of feeding, eating and swallowing, which enables the impact of sensory, motor, cognitive and communication skills to be analysed (Pendleton and Schultz-Krohn, 2013).

Various tools are used to evaluate the oral skills of children with cerebral palsy, including the Oral Motor Assessment Scale, Schedule for Oral–Motor Assessment and Dysphagia Disorder Survey. However, these tools are rarely used as a measure of eating and drinking in the clinical field (Sellers et al, 2014a). Evidence shows that there is no agreement on the definition of mild, moderate and severe limitation

of the ability to eat and drink. Also, there is a lack of valid and reliable scales for classifying the eating and drinking ability of children with cerebral palsy in both clinical practice and research settings (Sellers, 2014a, 2014b).

### **Eating and Drinking Ability Classification System**

Until recently, four classification systems – the Manual Ability Classification System (MACS) and its abbreviated version (Mini-MACS), Gross Motor Function Classification System (GMFCS) and Communication Function Classification System (CFCS) – have been considered useful and practical scales for identifying, evaluating and determining functional limitation in children with cerebral palsy (Riyahi et al, 2012, 2013). However, there was no integrated and functional system for classifying the eating and drinking ability of children in this group of patients. To meet this need, Sellers et al (2014a) conducted a study to establish a system for classifying the ability of children with cerebral palsy to eat and drink and assess its reliability. The research was carried out in four stages: preparation of the classification system, nominal group processing, a Delphi survey and reliability testing (Sellers, 2014).

The Eating and Drinking Ability Classification System (EDACS) helps guide the selection of an effective therapeutic intervention and can improve caregivers' and therapists' communication, attitudes and level of knowledge (Sellers et al, 2014a). Its purpose is to stratify how people with cerebral palsy eat and drink in their everyday life, providing a broad description of the different levels of functional ability. It includes components that focus on safety (chances of suffocation or aspiration), efficacy (time spent compared to peers and loss of food and fluids from the mouth) and restrictions in the oral skills needed to bite, chew and swallow (Sellers et al, 2014b). The level of assistance needed at mealtimes is described in a separate measure. The focus is on the functional activities of eating and drinking, such as sucking, biting, chewing, swallowing and keeping food or liquids in the mouth.

The EDACS is an ordinal scale: distances between levels are not equal and people with cerebral palsy are not equally distributed between levels. To identify the level of eating and drinking ability, it is necessary to involve someone who knows the person with cerebral palsy, such as a parent or caregiver. Some aspects of eating and drinking are not visible, therefore determining the level with a professional who has knowledge about the necessary skills for safe and efficient eating and drinking can be helpful (Sellers, 2014a).

This system was developed in the English language and there is a need to validate it in Persian if it is to be used by other health care professions. The purpose of this study was to determine the validity and reliability of the EDACS in Persian.

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## **METHODS**

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A methodological and cross-sectional design was employed by this study (Szklo et al, 2001; Bhattacharjee, 2012; Szklo and Nieto, 2014).

### **Translation**

The EDACS was translated into Persian in three steps, according to the international quality of life assessment protocol (Bullinger et al, 1998). First, two independent translators who were fluent in Persian and English translated the original version of the EDACS from English into Persian. They also determined the difficulty of finding appropriate words and words in common. The researchers used the best translation as the first Persian version. In the next step, two English language experts who were fluent in Persian examined quality of forward translation from the perspectives of clarity, common language, cultural match and conceptual equivalence. The second

Persian edition was prepared according to the research team's suggestions. This version was back-translated into English by two English language translators who were fluent in Persian and English. The translated version was compared to the original English version in a meeting of researchers and translators. Finally, an English version that was back-translated from the Persian version was sent to the developer (Sellers), resulting in some valuable suggestions. All of these suggestions were applied, with the permission and approval of the developer, resulting in the final Persian version of the scale.

### Validity

Validity refers to how well a test measures what it is purported to measure. There are various types of validity, including face, content, construct, criterion-related, formative and sampling validity (Bhattacharjee, 2012; Fletcher et al, 2012). In this study, face validity and content validity were evaluated by a team of experts including therapists and parents of children with cerebral palsy. These participants were requested to rate the 'clarity', 'understandability', 'relevance' and 'necessity' of each of the scale items using a Likert scale from 1(not at all) to 4 (perfectly). To determine the validity of the content, a content validity index was computed for all items and scale levels.

### Reliability

Reliability is the degree to which an assessment tool produces stable and consistent results. There are a number of types of reliability, including test-retest, parallel forms, interrater and internal consistency reliability (Bhattacharjee, 2012; Fletcher et al, 2012). In order to evaluate the reliability of the EDACS, parents of children with cerebral palsy and therapists were invited to participate in reliability testing. Parents were included if they had a child with cerebral palsy aged 3 years or older and were literate. Occupational therapists and speech therapists with bachelor's degree or higher who consented to participate were included. Parents and therapists were excluded if they were unwilling to cooperate at each stage of the study.

Sample size was calculated based on the results of the study by Sellers et al (2014b) and took into account a non-response rate of 15%, type 1 errors of 5% and type 2 errors of 0.2%. The intraclass correlation coefficient (ICC) was considered to be 93 (90–95).

### Procedure

Children with a diagnosis of cerebral palsy made by a neurologist were identified from their medical records. A convenient sampling was used for recruiting parents and therapists in all 5 private and 4 government clinics and hospitals in Arak, Iran. In total 130 parents and 34 therapists participated in this study.

A demographic questionnaire and reliability check sheet were used for this study. The demographic questionnaire was used to collect information about the child's diagnosis, age, gender, etc. Four trained therapists provided participants with descriptions of the purpose of the study and how to complete the forms. The GMFCS, CFCS, MACS and mini-MACS were also provided to parents and therapists of children with cerebral palsy to be completed. Parents completed these scales for their children and therapists completed these scales for their patients.

The time required to complete the forms was 15 minutes. First, participants were asked to study the help sheet, which included information about EDACS. Then they were asked to determine the level of a child's disability using the EDACS chart. Therapists who had not previously seen a child's eating and drinking ability were allowed to ask the child's primary caregiver questions or observe the child performing these tasks. All of these forms and questionnaire were completed in one session.

Overall, four different assessors, including the researcher, the child's parent, an occupational therapist and a speech therapist, evaluated the child with cerebral palsy in order to determine between-assessor reliability. All participating children were assessed again to evaluate test-retest reliability 4 weeks after the initial assessment. All data were collected and analysed using IBM SPSS 22 software.

### **Ethical approval**

Informed consent was obtained from all participants. Ethical approval to perform the study was obtained from the Arak University of Medical Sciences Ethics Committee (ID: IR.ARAKMU.REC.1395.415).

### **Scales**

#### **Eating and Drinking Ability Classification System**

The EDACS includes aspects of eating and drinking (risk of choking or aspiration) and efficiency (time spent compared to peers and spilling food and liquids out of the mouth) that are associated with the oral skills required for biting, chewing and swallowing. The level of assistance required at meal times is described separately. There are five distinct levels of ability, ranging from no difficulties eating or drinking (level I), to severely impaired or absent swallow reflex, so oral nutrition poses a high risk to respiratory health (level V) (Sellers, 2014).

#### **Gross Motor Function Classification System**

This is a standard observational classification system that divides children with cerebral palsy into five levels on the basis of current gross motor abilities, limitation in gross motor function and the need for assistive technology and devices. Level I denotes maximum independence (eg children can climb stairs without using a railing) and level V represents the least independence (eg children are transported in a manual wheelchair in all settings). This scale is widely used globally and has been translated into Farsi (Dehghan et al, 2011).

#### **Manual Ability Classification System**

The MACS is one of the most valuable scales for classifying the ability of a child with cerebral palsy to manipulate objects during everyday activities using their hands. It highlights the impact upper limb functional impairment has on the manual abilities of children and adults with cerebral palsy in daily activities.

The child is allocated a MACS level based on their ability to manipulate objects and the amount of help or adjustments needed for them to perform manual activities in everyday life. Level I reflects the best manual ability and level V reflects a lack of active manual function. This scale is widely used and has been translated to Farsi and updated (Riyahi et al, 2013).

#### **Communication Functional Classification System**

This system categorises the everyday abilities of children with cerebral palsy to communicate based on a description of the activity and level of participation. In this scale, the importance of being able to receive and understand what is said and the ability to send the message and express a response is emphasised. It categorises communication function based on a person's dependence on alternative communication systems, such as signs, symbols or audio communication aids. This scale is widely used, has been translated to Farsi and updated (Soleymani et al, 2015).

### Statistical analysis

Descriptive statistics (frequencies and descriptive) were used to determine the demographic characteristics of participants. A two-way random effects model of ICC with a 95% confidence interval was used to evaluate test–retest reliability. ICC values of <0.2, 0.2–0.4, 0.4–0.6, 0.6–0.8 and 0.8–1.0 were considered poor, fair, moderate, good and very good, respectively (Szklo et al, 2001; Szklo and Nieto, 2014).

## RESULTS

### Translation and validity

After completing the forward and backward translation, the face and content validities were evaluated. Ten experienced therapists (five occupational therapists and five speech therapists) and 10 parents took part in this phase of the study. The therapists had an average work experience of 7.78 years (standard deviation [SD]=5.91) and had spent an average of 7.28 years (SD=5.91) working with children with cerebral palsy. They had an average age of 31.60 years (SD=5.98) and 8 were women. One therapist had a doctorate, four had a master's degree and five had a bachelor's degree. The parents had a mean age of 36.60 years (SD=9.46) and two were male. Of the parents, one had a master's degree, four had bachelor's degrees and five had graduated from high school.

The parents and therapists examined the simplicity, clarity, relevance and necessity of all the words and sentences used in the scale guidance sheet. With the exception of a few words and sentences, the overall results indicated that the content was simple, clear, understandable, relevant and necessary. The wording in the user information, levels and distinctions between the levels were altered to make the EDACS easier to understand and improve the fluency of the translated version without changing the original content. The developer of the EDACS (Sellers) approved the final version of the EDACS and corrected terms in the guidance sheet.

The content validity index ranged from 0.6 to 1. Items with values <0.78 (firm bite and effortful chew textures, mixed textures, slippery textures, tastes or flavours) were returned to the team of experts to address. Corrective comments were incorporated and the revised items assessed until the desired values were obtained.

### Reliability

The demographic characteristics of participants are presented in *Table 1*. A total of 130 children with cerebral palsy participated, including 73 boys (56.2%) and 57 girls (43.8%), with an average age of 4.36 years (standard deviation[SD]=2.83). Their parents (mothers) had an average age of 31.47 years (SD=5.97). A total of 17 occupational therapists, including 12 women (70.6%) and 5 men (29.4%) with an average age of 33.88 years (SD=8.66), took part in the reliability testing. They had an average work experience of 7.04 (SD=6.47) years and had worked with children with cerebral palsy for an average of 6.64 (SD=6.57) years. A total of 17 speech therapists, including 12 women (70.6%) and 5 men (29.4%) with an average age of 32.59 (SD=6.09) years, participated in this part of the study. They had been working as speech therapists for an average of 5.72 (SD=4.87) years and had worked with children with cerebral palsy for 5.21 (SD=4.89) years on average.

Attrition was tracked during data collection. The first assessment was not completed for 20 children because they did not attend rehabilitation centres. Three occupational therapists and three speech therapists did not complete the retest, as they moved to other cities and no longer had access to the forms.

**Table 1. The demographics of participating children with cerebral palsy, parents and therapists**

Child (n=130)		Frequency	Percentage
Sex	Male	73	56.2
	Female	57	43.8
Diagnosis	Monoplegia	9	6.9
	Hemiplegia	32	24.6
	Diplegia	29	22.3
	Quadriplegia	57	43.8
	Tetraplegia	2	1.5
	Double hemiplegia	1	0.8
Seizure	Yes	72	55.4
	No	58	44.6
Trauma	Yes	23	17.7
	No	107	82.3
Visual deficit	None	101	77.7
	Deficit	21	16.2
	Blind	8	6.2
Auditory deficit	None	110	84.6
	Deficit	9	6.9
	Deaf	11	8.5
Mental disability	Yes	82	63.1
	No	48	36.9
Gross Motor Function Classification System level	1	9	6.9
	2	42	32.3
	3	27	20.8
	4	34	26.2
	5	18	13.8
Communication Function Classification System level	1	23	17.7
	2	24	18.5
	3	26	20.0
	4	30	23.1
	5	27	20.8
Manual Ability Classification System level	1	7	5.4
	2	14	10.8
	3	13	10.0
	4	12	9.2
	5	8	6.2

	Mini-Manual Ability Classification System level	1	10	7.7
		2	27	20.8
		3	18	13.8
		4	15	11.5
		5	6	4.6
Parents (n=130)	Level of education	Under diploma	37	28.5
		Diploma	53	40.8
		BCh	33	25.4
		MSc	7	5.4
Main caregiver		Father	3	2.3
		Mother	114	87.7
		Nurse	9	6.9
		Other	4	3.1
Occupational therapist (n=17)	Sex	Male	5	29.4
		Female	12	70.6
Education level		Newly graduated	3	17.6
		BCh	8	47.1
		MSc	5	29.4
		PhD	1	5.9
Speech therapist (n=17)	Sex	Male	5	29.4
		Female	12	70.6
Education level		Newly graduated	3	17.6
		BCh	9	52.9
		MSc	5	29.4
		PhD	0	0

**Table 2. Result of test-retest and interrater reliability**

Group	ICC (95% CI)	P-value
<b>Test-retest reliability</b>		
Parent time 1/parent time 2	0.98 (0.970–0.980)	0.001
Occupational therapist time 1/occupational therapist time 2	0.98 (0.970–0.990)	0.001
Speech therapist time 1/speech therapist time 2	0.995 (0.993–0.997)	0.001
<b>Interrater reliability</b>		
Parent time 1/occupational therapist time 1	0.96 (0.960–0.970)	0.001
Parent time 1/speech therapist time 1	0.95 (0.920–0.960)	0.001
Occupational therapist time 1/speech therapist time 1	0.985 (0.979–0.989)	0.001
ICC: Intraclass correlation coefficient; CI: confidence interval		



The ICC results for test–retest reliability were 0.98, 0.98 and 0.995 for parents, occupational therapists and speech therapists, respectively. Interrater reliability between parents and occupational therapists was 0.96, between parents and speech therapists it was 0.95, and between occupational therapists and speech therapists it was 0.985 (*Table 2*).

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## DISCUSSION

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One of the most important features considered in the selection of a measurement tool is whether it can easily be translated into another language. The developer who created the original version of the EDACS primarily addressed this issue. Developers try to avoid using words, phrases and sentences that are ambiguous, lack clarity and have multiple meanings, thereby facilitating the process of translation into other languages (Keller and Kielhofner, 2005). When a scale is translated, its reliability in the translated language should be determined (Siebes et al, 2006), therefore, this study investigated the validity and reliability of the Persian version of the EDACS.

### Content

The content of the scale was easy for parents and therapists to understand as the majority of the participants in both groups had the same understanding of the overall content and levels of the EDACS; therefore, high reliability coefficients were obtained. This means that the EDACS scores were similar in both groups. Structuring the scale based on the users' national language, accurate translation, and performing several steps to simplify the words and sentences used in the guide sheet were effective in obtaining high reliability coefficients between parents and therapists as well as between therapists.

### Reliability

There are a number of aspects relating to reliability that need to be considered here. Reducing the possibility of error during measurement is the main one (Akpınar et al, 2010). The interrater correlation coefficients obtained indicate that the scale is suitable for use in clinical practice. Another aspect of reliability is the consistency of the measurement after a time interval: the results of the retest must be similar to the results of the test (Akpınar et al, 2010). In this study the interval was 4 weeks, which is short enough to produce similar results and long enough to prevent the effects of the initial test impacting on the results of the retest. The test–retest results showed good agreement, in line with numerous studies. Sellers et al (2014a) assessed the reliability of the EDACS by using it to assess 129 participants with cerebral palsy aged 4–22 years (mean age 14 years). Levels of reliability between the two groups of therapists and between the parents and therapists were 'excellent' and 'good', respectively. Parents agreed with or chose a level above that of the therapist, indicating that some parents believed their children to be more able than the therapists did. Sellers et al (2014a) concluded that the EDACS was a valid and sustainable system for classifying eating and drinking ability in children with cerebral palsy.

The EDACS was developed through consultation with people with cerebral palsy, parents and health professionals. It is designed for use by parents and therapists and can facilitate clinical or community-based research (Sellers et al, 2014b). Scott (2014) states that this scale, rather than specialty-based assessment of swallowing or oral movement or a measure of a specific swallowing disorder, deals with broader aspects of eating and drinking ability. It takes into account the standard components of nutrition assessment, such as safety, efficacy and limitations in the oral skills needed for biting, chewing and swallowing, as well as the level of assistance needed

during meal times. The need for other comprehensive specialised assessments in the field of eating and drinking does not negate the benefits of the EDACS. As a case in point, other scales do not include the functional aspects of eating and drinking and the amount of assistance needed. Scott (2014) states that, despite some weaknesses in reliability, this qualitative scale provides information about performance and safety along with an indication of the severity and, more importantly, provides a common language between professionals and parents.

This functional scale can be applied to aid decision-making and determine health care priorities in practice. It can also be used in research studies in line with clinical goals. It more realistically classifies a child's functional ability as it creates a single language shared between professionals and parents. It also provides the possibility of grouping children with cerebral palsy based on their abilities and comparing them. We suggest evaluating the Persian version of the EDACS in children with cerebral palsy in different health care centres and clinics in Iran and comparing the scoring of this scale by different therapists in other cities.

### Limitations

The major limitation of this study is that there is at present no alternative system for the classification of eating and drinking functions in Iran. Therefore, it was not possible to compare the results of the Persian version of the EDACS with other tools to determine concurrent criterion validity. Another limitation was the self-reporting of data, which could be susceptible to misclassification bias.

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## CONCLUSIONS

The Persian version of the EDACS is valid and reliable and can be used as a practical scale to classify the ability of children with cerebral palsy to eat and drink. It can also be used to improve families and therapists' knowledge and insight into children's abilities and needs, and enable healthcare professionals to predict future performance.

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### Conflict of interests

The authors declare that there are no conflict of interests.

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