



# A Study on the Factor Structure, Construct Validity and Reliability of the Activities of Daily Living of Iranian Children (ADLIC) Scale

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Received 2020 November 15; Revised 2021 February 06; Accepted 2021 February 07.

## Abstract

**Background:** The first and most basic area of occupational performance is the activities of daily living. These activities of life highly depend on the contextual and ecological (environmental) factors. Cultural values, parental expectations, social routines, and physical environment influence acquisition time of a child's daily activities. At present, there is no comprehensive and adapted-culturally tool to evaluate the daily life activities of Iranian children aged 3 - 6 years.

**Objectives:** This study aimed to investigate the factor structure, construct validity, and reliability of the Activities of Daily Living in Iranian Children (ADLIC) scale.

**Methods:** The participants were 470 Iranian parents of children among the ages from 3 to 6. Exploratory factor analysis, internal consistency, and test-retest reliability were conducted for data analysis. Convergent validity was measured by correlation to the Pediatric Evaluation of Disability Inventory (PEDI).

**Results:** The results indicated that ADLIC has excellent reliability due to internal consistency (Cronbach's alpha 0.96). Furthermore, the temporal stability of ADLIC was supported using the Intra-class correlations coefficient, which ranged between 0.95 and 0.98. Convergent validity between the ADLIC and two subscales of PEDI, including self-care (0.88) and mobility (0.80), was good. The ADLIC scale showed a clear factor structure with five main components and ten factors based on the findings.

**Conclusions:** ADLIC has excellent psychometric properties, including internal consistency and temporal stability, and can be used as a reliable and valid measure to assess the daily living activities of children aged 3 - 6 years.

**Keywords:** Activities of Daily Living, Validity, Reliability, Assessment, Preschool Children

## 1. Background

Activities of daily living (ADL) are essential activities which support the involvement in different community environments (1). ADLs are mainly identified as life tasks required for self-maintenance, self-care, and chore completion. These tasks are fundamental for living in a social world which includes the skills used to take care of human body (1). The concept of ADL indicates a child's ability to perform daily tasks (2). Due to the International Classification of Functioning, Disability, and Health (ICF), performance is a general word for body function, body structure, activities, and participation (3), which indicates positive features of the relationship between a person (mentally and physically health status) and individual contextual factors (environmental and personal) (3). Contextual and en-

vironmental factors play a crucial role in the performance of daily activities. These factors include internal factors, such as the functions and structures of the body which are related to the person itself and also the cultural and individual contexts, as external factors are related to child's surroundings including physical and social environments, and chronological aspects (4).

The values and customs within a culture affect a child's development patterns of daily function and the parent's care styles. Besides, the way a child performs ADL is strongly influenced by his/ her culture and manner of upbringing. Then, the cultural and environmental factors affect the functional independence of children, especially at older ages (over four years) (5). There are some tests such as the Pediatric Evaluation of Disability inventory (PEDI) (6), Children Participation questionnaire (CPQ) (7),

Vineland Adaptive Behavior scale (VABS) (8), and Wee Functional Independence measure (WeeFIM) (9) are used worldwide to assess ADL, these assessments are not specific to ADL and are not, therefore, an accurate and reliable assessment for all aspects of ADL (10). Although some of these aforementioned assessments were translated to Farsi, the items were not modified or tailored to the Iranian culture. Furthermore, even though the most functional differences in children regarding independence in ADL are observed in preschool ages, the existing assessments have not been used to assess the ADL capabilities of younger child. The scale used to evaluate daily living activities in Iranian children (ADLIC) has 93 items. A five-point Likert scale (1 = totally dependent, 2 = moderately dependent, 3 = relatively independent, 4 = adaptively independent, and 5 = totally independent) was used to assess children's ADL dependency. ADLIC is a useful and culturally relevant tool to measure the occupational performance of Iranian children. It can be utilized in clinical and population-based researches. While, the scale has already been created, more studies are needed for better future use.

Considering the limited resources to evaluate the ADL in preschool children, the Activities of Daily Living in Iranian Children (ADLIC) scale was developed and culturally adapted.

## 2. Objectives

The present study was conducted to evaluate the factor structure, construct validity, and ADLIC scale reliability to further investigation and enhance using this scale for clinical purposes.

## 3. Methods

### 3.1. Participants

The study population included parents from 3 to 6-year-old children selected from kindergartens in Tehran whose mothers responded to ADL test, specifically functional skills related to ADL. These communities were selected by cluster randomization of several kindergartens in Tehran.

The multi-stage type method of sampling was used in this study. Due to this sampling method, the cardinal areas of Tehran were divided into four regions: North, South, East, and West. After obtaining an introduction letter from the faculty, we were referred to the kindergartens for sampling. After reviewing and agreeing with the research team, a list of the kindergartens from different regions was prepared. In the next step, 2 to 3 kindergartens were randomly selected from each region. The consent forms were

sent to the selected kindergartens for the study process. At last, sampling began shortly after coordination with the managers of kindergartens.

The scale had 93 questions, and the study was conducted on 470 samples. 37 samples were used for the reliability of test-retest, and 124 samples were used for convergent validity. Moreover, 150 prototypes were used in the study to investigate the internal consistency of items.

### 3.2. Instruments

#### 3.2.1. The Activities of Daily Living in Iranian Children Scale

This assessment was developed for Iranian children aged from 3 to 6 years. The Activities of Daily Living in Iranian Children (ADLIC) scale can assess the different areas of daily activities of young children. ADLIC scale's design, construction, and framework are based on the Occupational Therapy Practice framework: Domain and process (3rd Edition) (OTPF-3) (11). This assessment is designed to be used as a descriptive assessment scale for both typically developing children and children with disabilities. Items on ADLIC scale were developed due to the OTPF, the opinion of the expert's panel, and the views of parents in the pilot study (12). This tool has a good face and content validity. The panel experts in the pilot study selected six ADL domains for the young children which included the following items: bathing, washing and personal hygiene, toileting, dressing, eating/feeding, functional mobility, others (personal device care, grooming, etc.). ADLIC scale consists of 93 items which assess all ADL skills in 6 domains. The score is graded based on (1) complete dependence; (2) medium dependence; (3) relative independence; (4) adaptive independence; and (5) complete independence.

#### 3.2.2. The Pediatric Evaluation of Disability Inventory Scale

This scale is designed to evaluate ADL in children aged 6-months to 7 years old. It is a soft, judgment-based measurement scale due to interviews, careful observation, and more. It also has three dimensions, including self-care, mobility, and social function. Some skills touched upon in the scale include the ability to take care of oneself, such as eating and drinking, using kitchen utensils, dressing, and combing. Pediatric Evaluation of Disability inventory (PEDI) includes 197 items which evaluate functional skills and twenty items that assess the caregiver assistance and modifications (13).

The validity and reliability of the original version of this scale were confirmed in 1996 in English. The results showed an internal consistency of 94%, and the reliability results using the test-retest method for all items were from 0.8 to 0.95 (13). Likewise, the content validity index (CVI) was desirable for all items of this test (above 0.8). The

Iranian version of this test was prepared and presented in 2014. The structure of this desirable scale was reported. Moreover, a 0.7 reliability score was reported using the internal consistency method for all above mentioned items (14).

### 3.3. Procedure

The Iran University of Medical Sciences ethics committee approved this study (ethic code: IR.IUMS.REC.1398.891).

The parents of 3-6-year-old children were then asked to complete a 93-item questionnaire. For this purpose, a package was prepared which included the consent form, ADLIC Scale, PEDI tool, and the demographic questionnaire. The parents who wished to participate in the study were required to read and sign the consent form and submit it to the kindergarten management within a week. Then, 650 packages containing questionnaires were distributed over a period of one month. By careful consideration, 166 cases were excluded from the study due to a lack of cooperation. 14 people who did not complete the questionnaire were removed, leaving 470 samples in the study.

By the consent of the parents who wanted to continue participating in this study, the questionnaire was re-established after 2 weeks.

To test the reliability with the test-retest, a questionnaire was sent to 45 households, of which only 37 completed the questionnaire, and the rest were removed.

The convergent validity was completed by sending PEDI tool to 200 parents, of whom only 124 completed the study, and the rest were excluded from the study.

### 3.4. Statistical Analysis

Statistical Package for the Social Sciences (SPSS-version26) software was used for data analysis. The construct validity for this study was evaluated using maximum likelihood exploratory Factor analysis (MLEFA) with Promax rotation. The Kaiser-Meyer-Olkin test (KMO) and Bartlett's test of sphericity were used to check the study sample's appropriateness and the model.

The presence of an item in a latent factor was determined due to a factor loading of almost 0.3 which was estimated using the following formula:  $CV = 5.152 \div \sqrt{(n - 2)}$ ; where CV was the number of extractable factors and 'n' was the sample size. The number of latent factors was estimated using Horn's parallel analysis. Next, items with communalities of less than 0.2 were excluded from the EFA (15).

Cronbach's alpha was used to estimate the internal consistency, and intra-class correlation coefficient (ICC) was used to test the test-retest stability. The Spearman correlation coefficient test was used to test the convergent validity.

## 4. Results

### 4.1. Participants' Characteristics

The results gathered from the demographic forms show a mean age of 32.74 years for the mothers, 36.55 years for the fathers, and 4.46 years for the children (SD = 1.06 years).

### 4.2. Exploratory Factor Analysis

KMO index and Bartlett test were used in this study to analyze the exploratory factor. The response obtained from the samples in all dimensions of ADLIC scale and according to the number obtained for KMO was adequate. Because the P-value score for Bartlett test was less than 0.001, it can be concluded that all components of this questionnaire, including bathing, washing and personal hygiene, toileting, dressing, eating/feeding, and functional mobility, have the desired construct validity (see Table 1). Moreover, the Communality and factor loading parameters in the present study were calculated for all domains, and the results are reported in Table 2. The results show desirable validity for the items in each domain in all cases. Considering the statistical calculations, 20 items were removed from the questionnaire, including 7 items from bathing, washing and personal hygiene, 4 items from toileting, 3 items from dressing, 2 items from eating/feeding, 1 item from functional mobility, and 3 items from others. The present questionnaire was prepared with 73 items that have good structural validity and reliability.

### 4.3. Internal Consistency

Cronbach's alpha was used to calculate the internal consistency of data. Alpha values above 0.9 are considered excellent, between 0.7 - 0.9 indicate good, between 0.6 - 0.7 are acceptable, between 0.5 - 0.6 are weak, and less than 0.5 indicate unacceptable internal consistency (16, 17). The Cronbach's alpha coefficient of all the items was estimated, and the results of the analyses are presented in Table 3.

ICC investigated the test-retest reliability of questionnaire. An ICC value above 0.75 provides excellent reliability, and above 0.7 is acceptable. While an ICC value from 0.6 to 0.75 is a good indicator of reliability, a value from 0.4 to 0.59 indicates poor stability (18).

### 4.4. Convergent Validity

The convergent validity was calculated using Spearman correlation coefficient between the ADLIC scale measures and the PEDI subscales (self-care, mobility). The ADL questionnaire's overall relationship was good with self-care (0.88) and mobility (0.80). The results showed a significant correlation between these two assessments. The results obtained in this section can be seen in Table 4.

**Table 1.** Kaiser-Meyer-Olkin Measure and Bartlett's Test of the ADLIC (N = 470)<sup>a</sup>

KMO and Bartlett's Test	Areas of ADLIC				
	Bathing, Washing and Personal Hygiene	Toileting	Dressing	Eating/Feeding	Functional Mobility
Kaiser-Meyer-Olkin measure of sampling adequacy	0.856	0.746	0.782	0.701	0.665
<b>Bartlett's Test of Sphericity</b>					
Approx. chi-square	2685.911	2895.751	531.322	338.356	152.451
Df	136	136	36	26	45

<sup>a</sup>P < 0.001.**Table 3.** The Internal Consistency and Test-retest Reliability of ADL Total Measure for Each Area

Items	Numbers	Number of Items	Cronbach's Alpha and ICC
<b>Total measure</b>			
Cronbach's alpha	150	93	0.96
ICC	37	93	0.98
<b>Bathing, washing, and personal hygiene</b>			
Cronbach's alpha	150	26	0.93
ICC	37	26	0.98
<b>Toileting</b>			
Cronbach's alpha	150	17	0.87
ICC	37	17	0.95
<b>Dressing</b>			
Cronbach's alpha	150	21	0.89
ICC	37	21	0.97
<b>Eating/feeding</b>			
Cronbach's alpha	150	10	0.63
ICC	37	10	0.95
<b>Functional mobility</b>			
Cronbach's alpha	150	16	0.89
ICC	37	16	0.95

**Table 4.** Spearman Correlations Between the Children's ADL Scale Measures and PEDI Subscales (Self-care, Mobility) of Children Without Developmental Disabilities (N = 124)<sup>a</sup>

	Total Measure	Bathing, Washing and Personal Hygiene	Toileting	Dressing	Eating/Feeding	Functional Mobility
<b>PEDI (self-care)</b>	0.88	0.81	0.76	0.84	0.77	0.73
<b>PEDI (mobility)</b>	0.80	0.74	0.71	0.76	0.68	0.70

<sup>a</sup>P < 0.01.

## 5. Discussion

To evaluate the factor structure and certain psychometric properties of the ADLIC scale, the exploratory factor analysis, internal consistency, test-retest reliability, and convergent validity were calculated in this study. OTPF-3 was used to classify items as a reference framework for ADL.

The psychometric properties of the ADLIC scale were

assessed among Iranian children aged from 3 to 6 years.

Cronbach's alpha coefficient obtained was 0.96, which is excellent for an assessment which evaluates children's daily activities. The samples in this study were selected from different areas of Tehran and with different cultures and lifestyles, which indicates a high internal consistency of the items on the ADLIC scale. Rosenberg et al. (7) con-

ducted a study in 2010 to build CPQ on 480 children aged from 4 to 6 years and obtained a Cronbach's alpha coefficient from 0.79 to 0.90, which indicates good internal stability. CPQ test is similar in that both use the same age ranges and assessment, and both are due to OTPF. Another advantage of the CPQ test is that it's specifically designed to assess the exact details of all ADL related tasks in children. While, ADL tasks are assessed in other tools such as the CPQ, WeeFIM, PEDI, and VABS, they are unable to accurately evaluate all areas of ADL used by occupational therapists following OTPF-3 (3, 5, 7, 8).

Reliability is considered one of the most important capabilities of a scale, making it powerful and reliable for clinical applications. Therefore, to evaluate the reliability of the tools to evaluate daily living activities in children, 37 samples were evaluated in two stages with an interval of 2 weeks. ICC was used to estimate the reliability of the test-retest, and excellent results were obtained in terms of temporal stability (ICC = 0.98). Virginia et al. conducted a study in 2002 on 445 healthy Chinese children using WeeFIM tool, which resulted in ICC = 0.99. Our test and WeeFIM yielded similar results due to reliability, specifically good reliability over time. However, the main difference is that our test is specific to ADL and addresses the ADL skills in detail. It can be a useful and effective tool for assessing ADL, specifically designing ADL-based interventions (4, 12).

The relationship between ADL questionnaire and self-care and mobility of the PEDI tool was assessed to examine the presence of the correlation. PEDI tool was selected because it was the most appropriate tool two evaluates the same construct studied in the present questionnaire. The results showed that the ADL questionnaire's overall relationship was good with self-care (0.88) and mobility (0.80). It means that our instrument is convergent with PEDI, and our test has the desired value to evaluate daily life activities as a tool. However, the advantage of this test is in its being specific to ADL and ability to examine the exact details of all ADL occupations. In 2001, Ziviani et al. (19) reported a good relationship between WeeFIM and PEDI assessments. Due to recently obtained results and other studies, PEDI is a good tool for evaluating relations with other ADL tools.

The exploratory factor analysis was utilized to identify the close relationship among items or a group of items. This type of factor analysis is conducted when the researcher does not have any hypotheses regarding the relationships among factors (20). Due to the findings, ADLIC scale showed a clear factor structure with ten factors, namely (1) bathing (10 items); (2) washing (5 items); (3) personal hygiene (4 items); (4) preparation for toileting (9 items); (5) elimination (4 items); (6) clothes fastening (5 items); (7) wearing and putting out (13 items); (8) eating/feeding (8 items); (9) functional mobility indoor (6

items); and (10) functional mobility outdoor (9 items).

This study's findings indicate that the ADLIC scale is efficient and useful to assess the ADL's occupation among Iranian children aged 3 to 6 years. This scale helps care professionals spatially occupational therapies to evaluate the functional independency in early childhood years and identify the functional limitation in the child's ADL and perform consulting and preventive interventions to improve the occupational performance in children.

### 5.1. Limitations

Due to the large number of items on the questionnaire, some parents did not complete the questionnaire completely, so we had to remove them from the study.

A few parents had insufficient participation due to a low understanding of the importance of ADL independence in children.

There was a prolongation of the sampling process due to a lack of cooperation among kindergarten management as well as complex processes such as obtaining a permit for sampling inside a certain kindergarten.

### 5.2. Conclusions

ADLIC scale is a comprehensive test with desirable psychometric properties that examines all ADL domains following the Iranian culture. ADLIC scale can be used to evaluate the daily activities of 3 to 6-year-old children.

### Footnotes

**Authors' Contribution:** Study concept and design: HS, MAZ, MA, and AA. Acquisition of data: HS. Analysis and interpretation of data: MAZ. Drafting of the manuscript: HS. Critical revision of the manuscript for important intellectual content: NML, MAZ, MA, and AA. Statistical analysis: MA. Administrative, technical, and material support: HS. Study supervision: MAZ, MA, and AA.

**Conflict of Interests:** Authors have no conflict of interest to declare.

**Ethical Approval:** The Iran University of Medical Sciences ethics committee approved this study (ethic code: IR.IUMS.REC.1398.891).

**Funding/Support:** There were no external funding source for this study.

**Informed Consent:** The consent forms were sent to the selected kindergartens for the study process. The parents who wished to participate in the study were required to read and sign the consent form and submit it to the kindergarten management within a week.

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**Table 2.** Exploratory Factors Extracted From the ADLIC (N = 470)

Factors	Qn. Item	Factor Loading	h <sup>2</sup>	Eigenvalue	Variance, %
1	8) Wash body by washers	0.875	0.661	3.685	21.69
	13) Dry the body	0.780	0.576		
	9) Organize washing tools after showering	0.720	0.547		
	10) Rinse the hair	0.702	0.517		
	11) Rinse the body	0.702	0.517		
	7) Wash hair by shampoo	0.673	0.477		
	1) Maintain appropriate body position while showering	0.643	0.421		
	4) Select and use the bathing tools (soap, shampoos, washcloth)	0.643	0.421		
	12) Dry the hair	0.530	0.430		
	3) Adjust the water temperature	0.324	0.285		
2	21) Use the towel/cloth to clean or wipe out	0.841	0.604	2.540	14.95
	20) Rinse the face and hands	0.803	0.589		
	18) Wash the brush and put it in the correct location	0.670	0.490		
	19) Use the washers to rinse face and hands	0.640	0.535		
	16) Brush the teeth	0.573	0.488		
3	24) Clean the nose and mouth by the tissue	0.950	0.819	2.180	12.82
	25) Blow the nose	0.790	0.642		
	23) Hold a tissue in front of the nose while coughing and sneezing	0.739	0.590		
	22) Comb and tidy the hair	0.389	0.356		
4	42) Dry clothes or diapers continuously during the day	0.991	0.984	4.578	50.86
	43) Dry clothes or diapers continuously during at night	0.991	0.984		
	32) Take off the pants/underwear before toileting	0.991	0.984		
	30) Go and come back from the toilet	0.991	0.984		
	31) Pull down the pants before toileting	0.781	0.624		
	41) Pull up your pants after toileting	0.681	0.435		
	40) Wear your pants after toileting	0.638	0.420		
	27) Demonstrate the need to change wet or dirty diapers when urinating and defecating	0.520	0.381		
5	28) Demonstrate the need to go to the toilet for defecating	0.491	0.355	2.339	25.98
	38) Wash the toilet after defecation	0.875	0.776		
	37) Wash and clean yourself after urinating and defecating	0.827	0.688		
	34) Get the right position for toileting	0.676	0.471		
6	39) Wash hands with water and detergents after defecation	0.643	0.421	2.107	23.41
	47) Close the buttons	0.853	0.622		
	46) Open the buttons	0.825	0.692		
	48) Open the zipper, buckle, Velcro	0.768	0.612		
	49) Close the zipper, buckle, Velcro	0.586	0.444		
7	50) Tide the shoelaces	0.424	0.236	1.878	20.86
	54) Take off the button-through clothes	0.808	0.618		
	56) Take off the /trousers/shorts/ underpants	0.808	0.618		
	63) Take off the hat	0.799	0.605		
	61) Take off the socks	0.778	0.594		
	59) Put on the shorts /underpants	0.768	0.552		
	60) Put on the trousers	0.737	0.540		
	52) Put off your shoes	0.720	0.521		
	53) Wear your shoes	0.629	0.405		
58) Put on the blouse	0.622	0.401			
62) Wear the socks	0.590	0.394			

	55) Take off the blouse	0.526	0.321		
	64) Wear the hat	0.498	0.315		
	57) Put on the button-through clothes	0.352	0.252		
<b>8</b>	74) Drink from the cup or glass	0.982	0.964	3.860	77.20
	66) Swallow the food without getting stuck in the throat	0.982	0.964		
	67) Chew the food	0.982	0.964		
	65) Swallow the liquids	0.866	0.751		
	73) Eat the solid and mixed (soup, rice, and chicken) food	0.765	0.586		
	72) Eat the pureed/crushed food	0.618	0.382		
	69) Use a spoon	0.580	0.386		
	70) Use a fork	0.580	0.386		
<b>9</b>	80) Stand with maintaining the balance	0.837	0.679	2.625	26.25
	87) Move through the spaces inside the house (rooms, kitchen, living room)	0.779	0.638		
	75) Roll/ move with buttock on the floor/creep/crawl to browse in the house	0.688	0.455		
	76) Go to the bed	0.633	0.418		
	77) Get out of the bed	0.633	0.418		
	79) Sand up and sit on the bench	0.599	0.398		
<b>10</b>	83) Walk on the uneven surface	0.897	0.787	2.277	22.77
	82) Walk on the ramp	0.846	0.713		
	84) Go up and down the stairs	0.794	0.647		
	81) Walk outside the house	0.685	0.564		
	85) Change the way while walking and maintain the balance	0.685	0.564		
	86) Carry the objects while walking	0.593	0.395		
	90) Replace on the car seat	0.567	0.357		
	88) Get in the car	0.487	0.331		
	89) Get out of the car	0.441	0.314		

<sup>a</sup>h<sup>2</sup>, Communalities.