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Validation and Reliability Assessment of the Arabic Locomotor Capabilities Index for Adults with Lower Limb Amputation: A Cross-Cultural Study

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ABSTRACT

Background: Amputations can severely impact an individual's financial situation, emotional well-being, and social integration.

Background: Amputations can significantly negatively impact an individual's economic status, psychological health, and social life. The Locomotor Capabilities Index (LCI) measures how well people with lower-limb amputation can use prostheses to carry out activities. The validity and reliability of the Arabic version of the LCI were assessed in this study.

Methods: The English Locomotor Capabilities Index had been translated forward and backward for cross-cultural adaptation to Arabic (LCI). The Subsequent Arabic (SAUDI) LCI was then administered to fifty-seven patients with amputation; thirteen of them were women with a mean age of 53 years (ranging from 29 to 71), while forty-four were men with a mean age of 55 years (ranging between 20 and 85 years). All patients were trained in Al Nour Rehabilitation training centre – in Mecca -KSA. The validity and reliability of the Arabic LCI were evaluated through several measures. In two different subgroups of 20 and 30 amputation patients, the Arabic LCI was compared to the Time Up-and-Go test (TUG) and the Index of EQ-5D Health Utility to assess its structural validity. Scores from various age groups were compared to determine the discrimination value. Thirty individuals with amputations underwent test-retest reliability (7–14 day) evaluations.

Results: The Arabic LCI demonstrated good converging structure validity, exhibiting a strong correlation with TUG (r = 0.79 & 95%CI - 0.90- 0.60) and EQ-5D (r= 0.81,95%CI 0.61- 0.92), as well as discriminatory effect, with mean scores for older amputees significantly lower than for younger amputees ($p < 0.001$)) and high internal consistency (Cronbach alpha 0.93) (CI 95 % 0.91-0.94) . Test-retest reliability for unilateral amputees had an intraclass correlation coefficient of 0.93 (95 % CI 0.83-0.92). 17.5 % of the cases involved the ceiling effect. The ceiling effect occurred in 17.5% of the cases.

Conclusion: The Arabic version of the LCI has shown strong internal consistency and validity in adults with amputation.

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Introduction

Amputation is the surgical removal of a body part, such as an arm or leg. The prevalence of amputations globally has increased in recent years, subsequently impacting an individual's economic status, psychological health, and social life. Reintegration of patients with lower limb amputations into their communities and the presence of the required support system is imperative to ensuring healthy adjustment for these patients [1]. Around one-third of all hospital beds in 2008 and 2009 in Saudi Arabia were by Road Traffic Accidents (RTA) patients, with limb loss being the most common injury [2]. In 2021, there were 1008 amputations; 190 (19%) were caused by traffic accidents and 521 (52%) by diabetes mellitus [3].

Amputations due to traumatic causes affected 57.7 million people worldwide in 2017, most frequently caused by falls (36.2%), road injuries (15.7%), other transportation injuries (11.2%), and mechanical forces (10.4%) [4]. External circumstances in the Arab world, such as regional conflicts and crises, have directly escalated the frequency of amputations. A patient's use of the prosthesis depends on several factors, including the patient's mental and physical status, quality of the prosthesis, condition of

the amputation [5]. the diseases associated with the amputation and the type of activity the patient practices with the prosthesis [6]. Furthermore, patients with amputation who successfully wear prostheses may use the prosthesis differently and perform varying activities with it [7].

Numerous variables affect a patient's capacity to walk with a prosthesis; it is possible to predict how well these patients will do so through them. The patient's physical condition, along with the reason for and extent of the amputation, the patient's diet and weight, the use of analgesics and sedatives, the techniques used in providing rehabilitation services, the methods used to install the prosthesis, along with the psychological and mental condition [8-11]. In addition to the type and the surgery methodology used in amputation are some of these critical factors. Lower limb amputation, due to peripheral arterial diseases or diabetes, is often conducted on elderly patients suffering from other medical conditions which could hinder the progress of rehabilitation, the risk of strokes, heart failure and vascular problems in the contralateral side are notable impediments. As a result, an instrument that assesses walking capacity after amputation may be used to track changes in function in the context of comorbidity [12].

The simple and appropriate outcome measure for prosthetic limb motion is critical for monitoring the outcomes of treatment intervention in patients with lower limb amputations. Outcome measures must be valid and reliable to obtain accurate results in clinical and academic studies [13]. LCI was initially developed in 1993 in Canada as part of the Prosthetic Profile of an Amputee questionnaire. It was designed to evaluate the ambulatory skills of lower-limb amputees using prosthetics. Further, it assessed their level of independence when performing the tasks in the questionnaire [14].

Based on fourteen tasks typically encountered in daily life, the LCI is a self-report measure of ambulatory skills [15]. In contrast to Russek's classification for people with lower limb amputation, Treweek and Condie recommended LCI as more suitable [13]. Compared to other measures, LCI was found to have a somewhat higher reliability and validity rating. Among three evaluations, the LCI (ICC = 0.88) had the highest test–retest reliability, followed by the Houghton Scale (ICC = 0.85) and the Prosthetic Evaluation Questionnaire (ICC = 0.77). The LCI has been subsequently translated from its original English source into numerous other languages [16].

This study aims to provide healthcare professionals in Saudi Arabia with a reliable assessment tool for Arabic-speaking individuals who have undergone lower limb amputation. By establishing the validity and reliability of the Arabic LCI, the study seeks to help professionals better understand the functional abilities of amputees in the Saudi Arabian context. This will improve the rehabilitation and overall quality of life for those affected.

Materials and Methods

Translation process

The cross-cultural adaption of the LCI from English to Arabic was completed in three steps. The English version was translated into Arabic (forward translation) by three translators, one of whom had no medical experience. The last version was produced in a consensus meeting. The second phase involved two bilinguals, who considered English as their first language, separately translating the Arabic version into English (reverse translation). Both translators were unaware of the topics under investigation, and one had no medical training. Finally, the translations were examined by a cohort of two translators, one backward translator, and one supervisor, where any differences were rectified such that the translations were conceptually equivalent to the original form. A penultimate draft was developed and tested on an initial set of two amputees trained at the Al Nour Rehabilitation training centre. The field testing of this version was successful. Ultimately, we created a definitive Arabic version of the LCI version.The Arabic version of LCI was a cross-cultural adaptation study conducted within a lower limb amputation population who had been discharged from the Al Nour Hospital Rehabilitation Unit. Reliability was assessed, and a small subsample of participants performed a subsequent retest.

Participants

Recent research indicates that there are currently no established guidelines for the necessary sample size in studies that evaluate measurement qualities. However, to determine the reliability of a parameter, a minimum ICC of 0.70 is recommended for a sample size of at least 50 patients [30].

The study involved sixty-one participants from the Rehabilitation Unit (at A1 Nour Hospital in Mecca), but only 57 patients with amputations completed the study; 13 of them were female patients (with a mean age of 53 and an age range of 29 to 71), and 44 male patients (with a mean age of 55 and age range of 20 to 85). The patient chart (Figure 1 and Table 1) shows patients distribution.

All had experienced Lower Limb Amputation (LLA) and had received services at this rehabilitation unit. The goal of the specialist training unit was to assist patients with their lower limb amputation who had subsequently undergone prosthetic rehabilitation to maintain their mobility. The training programme was offered to amputee patients after they completed regular prosthetic rehabilitation, and participation was voluntary.

The Inclusion Criteria

- Had a lower limb amputation up to the trans-femoral level.
- Had worn the prosthesis for at least six months with or without a walking aid.
- Understand, speak, and (it is better to be able to) read Arabic.
- Age 20 or older

Exclusion Criteria

- Psychological disorders.
- Upper limb amputations.
- History of systemic inflammatory rheumatic illnesses.
- Neurological or cardiac abnormalities.

The data was collected from December 2022 through March 2023. All participants from the rehabilitation unit (Al Nour Hospital) were informed of the aim of the study and gave their written consent. Data from other rehabilitation units do not contain any personally identifiable information. The study was approved by the Local Ethics Committee of the Ministry of Health KSA (H-02-K-076-1122-841).

Research Design

The cross-cultural adaptation study assessed patients using the LCI, the Timed Up and Go (TUG), and the EuroQol instrument (EQ-5D). The latter is a standardized health status scale developed by the EuroQol group to provide a simple, general health status scale for clinical and economic assessment. The first and second sessions were conducted to assess test-retest reproducibility. The time interval between the two sessions was 7–14 days. Those who had stable health and prosthesis participated in the retest session.

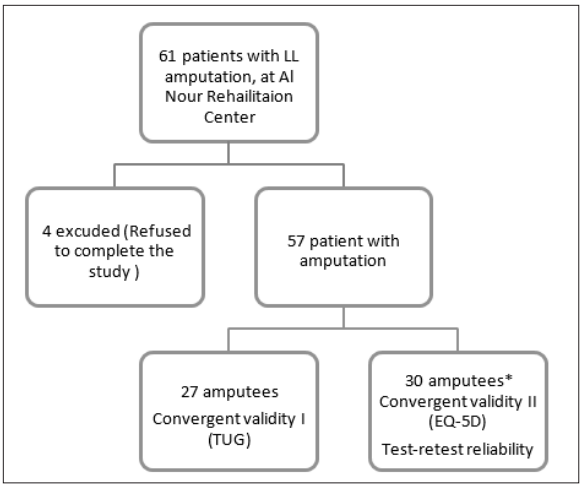

Figure 1: Flowchart of the Participants in the Validity and Reliability Analysis

* If an amputee completed the LCI on more than one session, data from the first session was utilized.
All patients were explicitly asked, ''Has your health or prosthetic status changed over the last few days since you filled out this questionnaire?'' The three possible responses were:
− No.
− Yes, it changed for the better and − Yes, it changed for the worse.

Table 1: Demographic and Amputation-Related Characteristics of Patients with Lower Limb Amputation at the First Point of Admission for the Study

Demographic Data			
			Mean (SD) unless stated.
Age (year), mean (SD; range)			52.21 (15.14, 20-85)
Height (cm), mean (SD; range)			165.60 (8.59, 146-185)
Weight (kg), mean (SD; range)			71.70 (16.97, 45-120)
Gender	Male (%)		44 (77%)
	Female (%)		13 (23%)
Amputation Related Data			
	Illiterate (%)		4 (7.02%)
Level of education	Primary (%)		9 (19.3%)
	Preparatory school (%)		8 (14.03%)
	Secondary school (%)		18 (31.58%)
	University (%)		16 (28.07%)
Amputation-related data	Level of amputation (%)	Unilateral, below knee (%)	36 (63.16%)
		Unilateral, above knee (%)	21 (36.84%)
	Cause of amputation (%)	Trauma	9(15.79%)
		Vascular	46 (80.7%)
		Cancer	2 (3.51%)
The duration since the amputation (year), mean (SD; IQR)			8.95 (9.88, 9)
The duration of prosthetic wear (year), mean (SD; IQR)			7.40 (8.49, 7)
IQR: interquartile range; SD: standard deviation			

Questionnaires and Mobility Tests

The Locomotor Capabilities Index (LCI):

The LCI consists of a set of subscales (14-items) that measure the difficulty of performing different locomotor activities with their prosthesis on. It contains fourteen questions, of which the majority are phrased as, "Would you say that you can do the following activities with your prosthesis on?" The scale is intended for assessing locomotor skills and level of independence in using a lower-limb prosthesis. People with lower-limb amputations can rate their perceived independence when performing fourteen activities while wearing their prosthesis on a 5-point ordinal scale, with 0 being "cannot" and four being "can perform the activity alone, without a mobility aid."

The questionnaires have two subscales that evaluate the difficulty of behaviours between basic (7 items) and advanced (7 items). The total score of the items determines the total LCI score, which can range from 0 (poor) to 56 (excellent) [17]. Sub-scores for basic and advanced prosthetics can also vary from 0 to 28 and tended to be completed within five minutes, the LCI was initially devised to be self-administered but can now be conducted during a telephone or in-person interview [18, 15].

Timed Up and Go

The Timed Up and Go test is a quick and easy way to assess a person's risk of falling. It is both sensitive and specific, meaning it is good at identifying people who are likely to fall and those who are not [19]. This test was initially designed for elderly persons but is now utilized for additional purposes, such as for those with Parkinson's, as well as receiving validation to be used for those with multiple sclerosis, hip fractures, Alzheimer's, Cerebral Vascular Accidents (CVA), Total Knee Replacements (TKR), Total Hip Replacements (THR), or Huntingdon's. The materials required for the test include a chair with an armrest, a stopwatch, and tape (to mark three meters). If needed, patients are instructed to wear regular footwear and use a walking aid. Then, they start in a seated position, ordered to stand upon the therapist's command, walk three meters, turn around, walk back to the chair, and sit down. The time stops when the patient is seated. The time (in seconds) to complete this sequential task is recorded using a stopwatch [20].

EQ-5D-5L

EQ-5D-5L EuroQol Corporation created the EQ-5D, a standardized health measure, to provide a simple and general health measure for clinical and economic evaluation purposes [21]. The EQ-5D-5L is a questionnaire that asks people to rate their quality of life in five areas: how easily they can move around (mobility), take care of themselves (self-care), do their (normal activities), deal with (pain or discomfort), and feel (anxious or depressed) [22]. Each dimension is scored on a 5-level severity scale ranging from "no problems" to "extreme problems."

The respondent uses a Visual Analog Scale (VAS) to rate their health in reply to the question, "We would like to know how good or bad your health is TODAY." The test includes a calibrated line ranging from 0 ("worst conceivable health status") to one hundred ("best imaginable health state"). Respondents indicate where they think their current health status falls concerning these anchors [20].

Table 2: The Locomotor Capabilities Index (LCI) Item Scores (N=57)

Items*	Median (Std.)	Upper	Lower	Minimum	Maximum
1. "Get up from a chair."	4,(0.7)	0.598	0.249	2	4
2. "Pick up an object from the floor when standing up with your prosthesis."	4,(1.1)	1.995	0.643	0	4
3. "Get up from the floor (e.g., if you fell)."	4,(1)	1.253	0.608	1	4
4. "Walk in the house."	4,(0.5)	0.348	0.147	2	4
5. "Walk outside on even ground. "	4,(0.7)	1.035	0.224	0	4
6. "Walk outside on uneven ground (e.g., grass, gravel, and slope)."	3,(1)	1.427	0.427	0	4
7. "Walk outside in inclement weather (e.g., snow, rain, ice)."	3,(1.7)	3.385	2.586	0	4
LCI Basic	24,(5.1)	35.995	16.598	9	28
8. "Go up the stairs with a handrail."	3,(1.3)	2.215	1.074	0	4
9. "Go down the stairs with a handrail."	3,(1.3)	2.269	1.054	0	4
10. "Step up a sidewalk curb."	3,(1.1)	1.895	0.772	0	4
11. "Step down a sidewalk curb."	3,(1.2)	1.908	0.786	0	4
12. "Go up a few steps (stairs) without a handrail."	2,(1.5)	2.587	1.569	0	4
13. "Go down a few steps (stairs) without a handrail."	2,(1.5)	2.564	1.574	0	4
14. "Walk while carrying an object."	4,(1.8)	3.626	2.5	0	4
LCI Advanced	21,(8)	82.716	45.494	1	28
LCI total	46,(12.3)	194.73	102.139	11	56

"Each item has four score levels ranging from 0 (poor) to 4 (excellent); each LCI score (basic, advanced, and total) is the total score of the items."

Evaluation of Validity

To determine convergent validity, LCI results were compared to the TUG test and EQ-5D results in two subgroups of lower limb amputation patients. Coefficients with an absolute value of <0.40 were interpreted as indicating weak correlations. In contrast, those with a value of 0.40–0.69 were determined as moderate correlations, and those with a value of ≥0.70 were strong correlations. The hypothesis suggested that the patients with higher LCI scores, encompassing the coefficients between 0.40–0.69 and their moderate correlations and coefficients of 0.70 with their strong correlations (23), enjoyed higher TUG values.

The correlation between the LCI score, TUG test results, and EQ-5D scores was assessed using Spearman's correlation coefficient (r). A correlation coefficient of at least 0.7 is recommended in value studies as a good correlation criterion [23].

Discrimination value was assessed by comparing LCI scores in amputation patients between different age groups and degrees of amputation. One might assume that younger amputees possess higher LCI scores when compared to their older counterparts, and those with severer levels of amputation will hold lower LCI scores in contrast to patients with lower levels of amputation. The factor of gender might also impact the LCI scores, as reported in a prior study where male participants enjoyed higher LCI scores than female participants [24]. The Kruskal-Wallis test assessed the overall differences in LCI scores among amputees of various ages and genders. In contrast, the Mann-Whitney test was used for specific pairwise comparisons between different age groups or genders. These tests provided valuable insights into the relationships between LCI scores and demographic factors in the amputee population.

Evaluation of Reliability

Internal Consistency Measures: The homogeneity of a scale and the items should be modestly associated with one another. The Cronbach alpha coefficient and the 95% Confidence Intervals (CI) were calculated using the bootstrap technique to determine the internal consistency. Internal consistency was considered to be good if the value reported was between 0.70 and 0.95 [26]. The internal consistency reliability of the LCI was assessed using the responses from all 57 participants.

Test-Retest Reliability: Test-retest reliability was assessed in the same subgroup of 30 amputees who submitted data for the EQ-5D validity analysis. The LCI was performed twice by the individuals, with a mean interval of 11 days (where the range was 7-14). The Intra-Class Correlation Coefficient (ICC) was used to analyse the test-retest LCI scores using the two-way random and absolute agreement criterion. The ICC (1. 1) and 95 % confidence CI for the entire LCI, as well as the basic and advanced subscales for above knee and below knee amputees, were calculated. A value of 0.70 for the ICC (range 0 to 1) is considered adequate reliability.

Ceiling and Floor Effects: The existence of high ceiling and/or floor effects can affect an instrument's reliability and validity. If such effects are present, the likelihood of extreme items, features on the lower or upper end of the scale, being absent from data recordings increases thus limiting content validity. As a result, patients with the lowest or highest possible score cannot be distinguished from one another, and subsequently reduce reliability. Ceiling or floor effects are exhibited when more than 15% of respondents receive the greatest or lowest possible scores [26].

Furthermore, the responsiveness becomes restricted when patient changes are difficult to assess. The absence of floor or ceiling effects in a sample size of at least 50 patients, ensures a positive conclusion for their non-presence.

Statistical Analysis

The scores of the Arabic version of LCI were calculated for each participant. The total, basic, and advanced scores were then summarized using descriptive statistics, including the mean, median, and standard deviation. All statistical exams had been two-sided, with a p-value of 0.05 considered statistically significant. Data were analysed with JASP (version 0.17) 2023.

Results

Score Distribution

All fifty-seven participants provided answers for all items. Basic items 1, "Get up from a chair," and four, "Walk in the house," witnessed the highest mean scores (3.6 and 3.7, respectively). In contrast, the lowest mean scores were registered for advanced item 6 and basic item 7, "Go down a few steps (stairs) without a handrail" and "Walk outside in inclement weather (e.g., snow, rain, ice).", which had mean scores of 2.3 and 1.9, respectively (Table 2). The mean total score was 41.6 (standard deviation 12.3, median 46), the mean basic score was 22.5 (standard deviation 5.1, median 24), and the mean advanced score was 19.1 (standard deviation eight, median 21).

Convergent Validity

The mean LCI in the TUG test subgroup was 40.27 (range 11-56), and the mean TUG result was 62.3 (range 13.28-230) seconds. The LCI and TUG strongly correlated (Pearson's r = 0.79, 95%CI -0.90- 0.60, $p < 0.001$). The mean EQ-5D index was 0.94 (standard deviation: 0.04; range: 0.95-0.81). The LCI and EQ-5D index strongly correlated (Pearson's r = 0.81, 95% CI 0.61-0.92, $p < 0.001$).

Discriminative Validity

Data collected from younger amputees showed that the mean LCI score was significantly higher than that of the older age group (Figure 3). The former group (20-29) constructed a mean of 48.8 (SD 7.70), whereas the oldest group (80+) saw a mean of 24.5 (SD 10.61). The mean total score for women was 41.39 (SD 11.96, median 46) and for men 41.73 (SD 12.51, median 44.5), where the difference was insignificant (p = 0.9) (Figure 2).

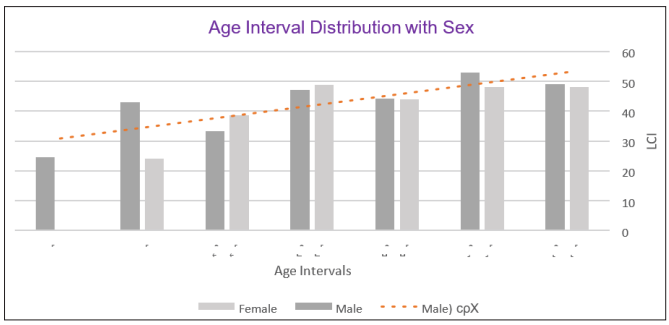

Figure 2: Age Interval Distribution with Sex

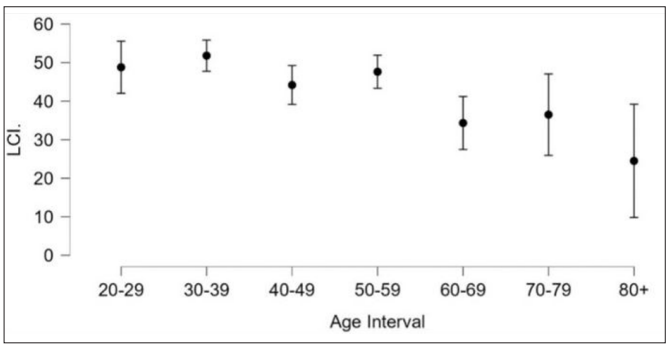

Figure 3: LCI Distribution with Age Intervals

Internal Consistency

Cronbach's alpha was calculated for three categories: the total LCI, basic, and advanced activities. The values obtained were 0.93 (95% CI 0.91-0.94) for the total LCI, 0.83 (95% CI 0.79-0.87) for basic activities, and 0.92 (95% CI 0.90-0.94) for advanced activities. These values indicate strong internal consistency within each category, as Cronbach's alpha coefficients are relatively high.

Test-Retest Reliability

The ICC values for the total LCI were 0.93, 0.96 for the basic LCI, and 0.89 for the advanced LCI, following the completion

of the test-retest. Additionally, all 95% confidence intervals were more significant than 0.70 (Table 3). The mean difference in the LCI scores between the two testing times was four for the total LCI, 0.9 for the basic LCI, and 3 for the advanced LCI. However, it is essential to note that all these differences were statistically insignificant. These findings indicate that the LCI has good reliability, as evidenced by high ICC values, and the testretest results suggest that the LCI scores are consistent over time. The 95% confidence interval being more significant than 0.70 further support the reliability of the LCI measurements.

Table 3: Test-Retest Reliability

	LCI Pre Total	LCI Post Total	LCI Pre Basic	LCI Post Basic	LCI Pre Advanced	LCI Pre Advanced
Valid	30	30	30	30	30	30
Median	44.5	46	22.5	23.5	20	22.5
Mean	40.3	44.3	22	22.9	18.3	21.3
SD	13.3	10.6	5.5	4.6	8.5	6.6
Minimum	11	19	9	13	1	5
Maximum	56	56	28	28	28	28
SD: Standard Deviation						

Ceiling and Floor Effects

Twelve patients out of the fifty-seven participants with amputation scored fifty-three or above, and 10 (17.5%) obtained the highest possible score (ceiling effect). Men scored higher more frequently than women did. Only one patient with amputation (1.75%) achieved the lowest viable count, scoring below 14 (Table 4).

Table 4: Characteristics of the Study of Population Validity & Internal Consistency

	Discriminative validity I & Internal consistency	Convergent validity I	Discriminative validity II Convergent validity II & Testretest reliability
Number of amputees	57	20	30
Age, mean (SD, range) yrs.	52.21 (15.14, 20-85)	51.9 (17.23, 20-85)	52.1 (14.33, 20-80)
Women, n (%)	13(23%)	7 (35%)	5 (17%)
Above Knee (%)	21 (36.84%)	7 (35%)	12 (40%)
Below Knee (%)	36 (63.16%)	13 (65%)	18 (60%)
Time from prosthetic fitting to LCI testing, mean (range) years.	7.40 (0.7, 17)	4.2 (1, 36)	9.1 (1, 36)

Discussion

The results of this study show that the Arabic LCI is a valid measure. The LCI showed strong correlations with the EQ-5D and the TUG test, indicating that it can effectively differentiate between groups with different physical abilities. The study showed that the test-retest reliability was satisfactory in a small group of participants. Furthermore, the reliability tests demonstrated good internal consistency. The Arabic LCI's characteristics measurements are similar to those in the original English version [14].

Studies assessing the original LCI's validity in English have indicated a strong correlation with the River Mead Mobility Index (Spearman coefficient of 0.75) and The Functional Independence Measure (FIM) (Spearman correlation coefficient of 0.62). These findings are consistent with related studies that have used the TUG test. In addition, the LCI reliability assessment showed high internal consistency (Cronbach's Alpha 0.95 for total LCI and more significant than 0.90 for both subscales) and test-test consensus. It was high (ICC = 0.80), consistent with the reliability results of the related studies [14]. On the other hand, if Cronbach's alpha is very high, it could suggest that some of the elements may be redundant [17]. Our study's findings are consistent with the reliability results of other LCI studies. Studies indicate that the LCI for younger amputees with trans-tibial amputations is 31.6 and for trans-femoral amputations is 29.2. A study of 50 unilateral amputees found a mean LCI of 41 after recovery. Population characteristics should be considered when comparing LCI results to past research [25].

According to our study, "getting up from a chair" and "walking indoors" are the most successful LCI items, while "climbing and descending a stair without a railing" are the least successful. This aligns with earlier research. The Arabic LCI clearly indicates that younger and older amputees demonstrate varying degrees of independence in locomotor activities. These findings provide conclusive evidence that LCI effectively identifies disparities in mobility.

Men had higher ceiling LCI values than women, but mean scores were not significantly different. Hermodsson et al. found men three times more likely to achieve good function after major lower limb amputation [24].

The research on the Arabic version of LCI showed a strong correlation with TUG. Pearson's r was measured at -0.79, 95% CI -0.90- 0.60, and $p < 0.001$. In comparison to Miller et al.'s study on 55 amputees, our research had a higher correlation of -0.64. The TUG test is an objective measure while the LCI is subjective. The TUG test evaluates the patient's safety reasoning functions under pressure, including the time taken to lock the wheels of a walking frame. Patients with amputations are prone to falls, which can lead to decreased function [26]. Our study revealed a significant relationship between LCI and EQ-5D-5L in measuring perceived

health. Walking is a basic human ability and hence features in the assessment of health [27].

People with amputations or vascular disease may face various difficulties, such as limited movement, feeling alone, lack of energy, pain, insomnia, and emotional problems. One way to help with these challenges is by incorporating wheelchair mobility into rehabilitation programs, which can be particularly beneficial for amputee patients who mainly use a wheelchair but can transfer and walk a little with a prosthesis. However, it is essential to note that the EQ-5D assessment tool is not specifically designed to measure the functional ability of amputees with a prosthesis and has not been evaluated for its effectiveness in monitoring changes in function over time for this group of patients [28].

A study conducted in the Saudi region, which included patients like those in our study, used the EQ-5D to investigate patients with amputation who also suffered from diabetes and foot ulcers. The study found that patients who underwent significant amputations had a lower EQ-5D index than those who achieved primary healing or underwent minor amputations. According to the study, the average EQ-5D index for 26 amputated patients was 0.31, while the patients in our study had a higher index of 0.94 [29].

Recent research indicates that there are currently no established guidelines for the necessary sample size in studies that evaluate measurement qualities. However, to determine the reliability of a parameter, a minimum ICC of 0.70 is recommended for a sample size of at least 50 patients [30].

There are varying opinions on what ICC values are considered acceptable, with clinical measures typically requiring ICCs over 0.90 and research purposes accepting ICCs of 0.70 or higher. In this study, all three LCI components (overall, basic, and advanced) had ICCs greater than 0.70, with the overall and basic LCI having an ICC of 0.96 and the advanced LCI having an ICC of 0.89 in the comprehensive test-retest [31].

Using a higher ICC in data sets for bilateral patients with amputation can inflate reliability and create variability. This can cause issues with test-retest samples, especially for basic LCI. Lower ICC values were found in the subsample of unilaterally amputee patients. To ensure adequate clinical usage, a larger sample of unilateral trans-tibial patients with amputation should be studied. LCI may result in a ceiling effect where a high proportion of patients receive the best score. For example, 46% of 50 patients with amputations received the best score in one study, while 40% of 329 patients received the best score in another study [13]. In a study it was found that participants with peripheral arterial disease-related amputations had a normal age distribution, and a similar trend was observed. To address the issue of the ceiling effect, the LCI-5 was modified by changing item responses 3 and 4 from "yes, alone" to "yes, alone with ambulation aids" and "yes, alone without ambulation aids," respectively [17].

The high internal consistency score might be due to the ceiling effect. Given the increasing focus on health economics and patient safety, there is a growing need to assess rehabilitation procedures in clinical practices carefully. Regardless of their intended purpose, tests used in clinical settings should demonstrate high reliability and validity and be simple enough to perform. The LCI meets these standards because of its ease of use in everyday practice. It is imperative to ensure the safety of elderly amputees who may not be aware of their physical limitations.

It is possible that patients who have undergone amputations and have low levels of function may not be aware of their ability to complete tasks on a questionnaire. For the safety of elderly amputees, they may need to avoid certain activities when alone and rely on a wheelchair when outside. The study showed that it was beneficial for patients to test their ability to complete tasks with the help of a test administrator. For example, they could try standing up with the support of a chair or walking while carrying an object [9]. Through the administration of these tests, it is possible to establish rehabilitation objectives for individuals who have undergone amputations, considering their alignment with the LCI's highly functional elements [24].

It is important, however, to ensure the test's emphasis does not shift from being a selfadministered test to an observed one. As a potential enhancement to the LCI, Franchignoni et al. proposed recommendations for item scoring (example: carrying an object) [17]. Even when treating comparable patients, different units may utilize different techniques for lower limb amputation and rehabilitation post-amputation. These variations can arise when varying levels of amputation present [31], or when the timing of prosthetic fitting is different [24]. A systematic protocol for gauging the effectiveness of rehabilitation following lower limb amputations is necessary to identify the best practices. In these circumstances, the LCI would be helpful.

Conclusion

The Arabic version of the LCI has proven to be a trustworthy and advantageous method for assessing adult amputee patients. The results obtained indicates a high degree of consistency between multiple tests.

Recommendation

To accurately measure differences in mobility over time, it would be helpful to create a comprehensive scale with a broad range of measurements. Additionally, it would be beneficial to conduct further research on amputations not included in the current study and to increase the sample size for future data collection. To gain a comprehensive understanding of the ceiling effect's impact, it is crucial to include patients with varying functional abilities in our studies as we continue to employ this tool.

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