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The reliability and validity of the Turkish version of the lipedema screening questionnaire

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Abstract

Objectives: Lipedema is a progressive adipose disorder affecting women, with diagnosis often delayed due to symptom overlap and lack of validated tools. This study assesses the Turkish version of the Lipedema Screening Questionnaire (T-LSQ) through cultural adaptation and psychometric evaluation. The aim of this study was to investigate selected psychometric properties of the Turkish version of the Lipedema Screening Questionnaire (T-LSQ).

Methods: The study involved 59 female volunteers diagnosed with lipedema/lipolymphedema by a cardiovascular surgeon. Key demographics such as age, onset age, lipedema types and stages, clinical features, and Body Mass Index were recorded. The Turkish adaptation of the LSQ was performed in accordance with the protocol of Beaton et al. Confirmatory factor analysis was performed for structural validity. Convergent construct validity was assessed by examining the correlations between T-LSQ scores and the Lower Extremity Functional Scale (LEFS), Lymphedema Life Impact Scale (LLIS), and Lymphoedema Functioning, Disability and Health Questionnaire for Lower Extremity Lymphedema (Lymph-ICF-LL). Test–retest reliability and internal consistency were also evaluated.

Results: Significant correlations were found between the T-LSQ and the LEFS, LLIS, and Lymph-ICF-LL ($r = -0.407$, $r = 0.613$, and $r = 0.548$, respectively). Test–retest reliability was excellent (ICC = 0.996, 95% CI: 0.994–0.998), while Cronbach's alpha was 0.60. CFA findings provided mixed evidence regarding structural validity.

Conclusion: The Turkish version of the LSQ showed excellent test–retest reliability and evidence of convergent construct validity.

Keywords

Lipedema, lipedema screening questionnaire, Turkish adaptation, validity, reliability

Introduction

Lipedema is an adipose tissue disorder that usually occurs during periods of hormonal changes such as puberty, pregnancy or menopause and is characterized by pain, tenderness and abnormal increase in subcutaneous adipose tissue, especially in the lower extremities.[1] Disproportionately symmetrical accumulation of adipose tissue in the lower and/or upper extremities is resistant to reduction by exercise and diet.[2,3] Lipedema affects approximately 11% of the female population, and its aetiology has not yet been elucidated.[4] Lipedema is often associated with other diseases (e.g. obesity, chronic venous insufficiency and lymphoedema etc.). These are often confused in the diagnosis.[5] Allen and Hines reported that among women with increased lower-extremity adipose tissue, approximately 20% had lipedema, 20% had both lipedema and obesity, and 60% had obesity alone.[6]

Although distinctive conditions such as adipocyte hyperproliferation, fibrosis and inflammation have been described in the progression of lipedema, the underlying mechanisms have not been fully investigated.[7] Lipedema is clinically diagnosed, as no specific biomarker has been identified.[8]

A holistic approach to the assessment of a patient with lipoedema is important in defining the current severity of the disease, reviewing the appropriateness of treatment

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options and determining the need for referral.[9] Clinical tools that can be used today to assess the effectiveness of conservative treatment in women with lipoedema.[10] Since no specific biomarker has yet been found, the diagnosis is based solely on clinical grounds.[8] Wold and Herbst developed diagnostic criteria for lipedema.[11,12]

The Lipedema Screening Questionnaire (LSQ), developed by Amato et al., is a simple and practical tool for identifying patients with lipedema during history taking and physical examination. Early identification may facilitate timely treatment, improve prognosis, and enhance quality of life. This study aimed to perform the Turkish cross-cultural adaptation of the LSQ and to evaluate selected psychometric properties of the Turkish version of LSQ (T-LSQ).

Methods

Ethical approval was obtained from the Gazi University Clinical Research Ethics Commission (No. 77082166-302.08.01-474156; July 18, 2022), and the study was registered as a clinical trial (NCT: 07061808). Written informed consent was obtained from all participants. Adults (≥18 years) with a clinical diagnosis of lipedema or lipolymphedema who were referred to the university hospital physiotherapy department by a cardiovascular surgeon were included in the study. The diagnosis was established by the cardiovascular surgeon according to the Wold diagnostic criteria[11,12] before administration of the T-LSQ. The Body Mass Index (BMI) was calculated.[13] Type I is characterized by affected fat deposits on the pelvis, buttocks, and hips, often referred to as the saddlebags. Type II involves fat accumulation from the buttocks to the knees, mostly sparing the lower legs. Type III affects the entire legs with disproportionate fat distribution from the buttocks to the ankles, often marked by the development of a prominent "cuff" of fat tissue at the ankle. Type IV primarily affects the arms, while Type V exclusively affects the lower legs. Lipedema most often starts in the legs, but the arms frequently become involved as the disease progresses. Thus, the most common phenotypes observed at diagnosis are combinations of types II and IV or III and IV.[14,15] The severity of lipedema is classified according to superficial and structural changes in adipose tissue.

According to Meier-Vollrath and Schmeller, the stages of lipedema are as follows: Stage I is a condition in which palpation feels like "Styrofoam balls in a plastic bag", there is enlarged subcutaneous tissue, and the skin is normally smooth and soft. Stage II is characterized by the formation of hard fatty nodules resembling walnuts to apples, and the skin has an irregular "mattress" like appearance (Cushion Phenomenon). Stage III is characterized by larger hardening and deforming fatty deposits. Participants with concomitant lymphedema (lipolymphedema), previously categorized as Stage IV according to the classification used in this study, were recorded separately.[14,15]

The prepared evaluation form and questionnaires were administered to the individuals included in the study once, and the LSQ was administered twice at 10-day intervals. The Standard Mini Mental Test (SMMT),[16] Lower Extremity Functional Scale (LEFS),[17] Lymphoedema Functionality, Disability and Health Questionnaire (Lymph-ICF-LL),[18] Lymphedema Life Impact Scale[19] (LLIS and Lipedema Screening Questionnaire were used for evaluation.

The Standard Mini Mental Test (SMMT), developed by Folstein et al., is widely used for the evaluation of cognitive status.[16] Its Turkish validity and reliability for the Turkish population was performed by Güngen et al.[20] The SMMT is divided into five main sections: orientation (10 points), memory (3 points), attention and calculation (5 points), memory (3 points) and language (9 points). The 30-point scale is available in two versions. Scores between 24 and 30 are considered normal values.[16]

Lymphoedema Functioning, Disability and Quality of Life Questionnaire- Lower Limb ICF is a questionnaire that evaluates dysfunction, activity limitation and participation restrictions. It consists of 5 sub-dimensions: physical function, mental function, home activities, mobility, daily living and social activities. It was developed to evaluate individuals with lower extremity lymphoedema and consists of 28 items.[18] Turkish validity and reliability were performed by Kostanoglu et al. using Short Form-36 (SF-36)[21] with 30 individuals with lymphoedema. Each question was answered using a Visual Analogue Scale (VAS) ranging from 0 to 10 cm.[22] The total score of the Lymph-ICF-LL questionnaire is equal to the sum of the scores obtained by dividing the questions by the total number of answers and takes an average of 5 minutes to complete. The higher the total score, the lower the QoL.[23]

Lymphoedema Life Impact Scale is an 18-item scale developed to investigate the physical, functional and psychosocial effects of lymphoedema in patients with lymphoedema[19] Eight items assess physical problems, 4 items assess psychosocial problems, 6 items assess functional problems, and the score range for each item is between 1 and 5. High scores indicate that the limitation in the evaluated area is high. Turkish validity and reliability of the scale were performed by Degirmenci et al.[24]

The Lower Extremity Functional Scale is a questionnaire consisting of 20 items[17] to assess the functional status of patients with musculoskeletal dysfunction affecting the lower extremities. Each question has 5 options ranging from 0 to 4 (0: Extreme difficulty or inability to perform the activity, 1: Considerable difficulty, 2: Moderate difficulty, 3: Some difficulty, 4: No difficulty). The total score ranges from 0 to 80, with higher scores indicating better functional status.[17] The Turkish validity and reliability study of the scale was conducted by Cıtaker et al.[25]

The Lipedema Screening Questionnaire (LSQ), developed by Amato et al., is a practical tool that can be applied quickly and easily during history taking and physical examination. The questionnaire consists of 9 questions. According to the answer to each question, scores of 0, 1, 2, or 3 are obtained The total score ranges from 0 to 20. In the original questionnaire, the probability of lipedema is calculated using a total score coefficient of 0.361 and a constant of −3.075.[3]

Translation

In the process of adapting the questionnaire to Turkish, the protocol of Beaton et al. was applied.[26] In 2020, permission was obtained from Amato et al. to make a Turkish version of the LSQ developed in Brazil, and the process of adapting the questionnaire to Turkish was initiated.

The 1st stage of translation was to translate the original language into the target language. Three independent translators (T1, T2, T3), who were fluent in 2 languages and had not seen the questionnaire before, translated the index from English into Turkish. One of the translators (T1) was familiar with the medical terms in the questionnaire. The other 2 translators (T2, T3) did not have any medical or professional background related to the questionnaire.

In the 2nd stage, inadequate terms and expressions in the questionnaire created separately by 3 translators were identified. By selecting the most appropriate words for the questionnaire, the questionnaires were synthesised, and finally, a single common questionnaire was created.

In the 3rd stage, the questionnaire was again translated from the target language into the original language by 2 translators (T4, T5) who had no knowledge of the subject. This process was done to check whether the same content was reflected in the original version. Incompatibilities and differences between the questionnaires were identified.

Necessary adjustments were made in stage 4th, all translators evaluated the questionnaire to ensure cultural equivalence and to minimize the differences between the target language and the source language. Words with the same meaning, problems with grammar, colloquial language, difficulties with idioms and the use of words appropriate to the lifestyle of the target culture were discussed, and support was received from Gazi University Academic Writing Unit to check the final version of the questionnaire.

In the 5th Stage, in order to test the translated questionnaire, the questionnaire was applied as a pilot study to 10 individuals who met the inclusion criteria. An understandability form was created for the pilot study. During the application, if there were words that the individuals had difficulty in understanding, these words were explained to the individual. After all cultural adaptation procedures were completed and corrections were made, the questionnaire was finalized. All translations and the final version of the questionnaire were sent to the people who developed the questionnaire.

Data analysis

The SPSS program (version 22) was used for statistical analyses. Descriptive statistics were calculated for demographic information and lipedema-related characteristics. The normality of the total scale scores was assessed using the Shapiro-Wilk test.

The reliability of the LSQ was evaluated through test–retest reliability and internal consistency. Test–retest reliability was assessed using the intraclass correlation coefficient (ICC) with a 95% confidence interval, based on a two-way mixed-effects, single-measure, absolute-agreement model. Measurement error was estimated using the standard error of measurement (SEM), calculated as $SDpooled \times \sqrt{(1-ICC)}$, and the smallest detectable change at the individual level (SDC_{95}) was calculated as $1.96 \times \sqrt{2} \times SEM$. Cronbach's alpha was calculated as a measure of internal consistency, and a Cronbach's alpha value of 0.80 and above was considered acceptable.[27,28]

For validity, structural validity and convergent construct validity analyses were performed. Structural validity was assessed using confirmatory factor analysis, while convergent construct validity was evaluated by examining

Table 1. Sociodemographic features of participants.

Descriptive statistics				
	Minimum	Maximum	Mean	Standart deviation
Age (year)	22	79	45.97	10.90
Boy (cm)	151.00	174.00	162.90	5.56
Body weight (kg)	59.00	130.00	82.51	16.73
BMI kg/cm^2	23.00	48.00	31.18	6.32
Waist height ratio	0.43	0.78	0.56	0.08
Waist hip ratio	0.58	0.97	0.79	0.07
Starting age (years)	11.00	64.00	26.02	14.28

BMI: Body Mass Index.

correlations between T-LSQ scores and theoretically related measures. The T-LSQ total score was correlated with the total scores of the LEFS, LLIS, and Lymph-ICF-LL using Pearson's correlation coefficient. Pearson correlations were interpreted as follows: 0.81–1.00 (excellent), 0.61–0.80 (very good), 0.41–0.60 (good), 0.21–0.40 (weak), and 0–0.20 (poor).[29]

Results

A total of 59 patients with lipedema/lipolymphedema participated in the study. The mean age, height, body weight and BMI scores of the patients were presented in Table 1. Other comorbid diseases were hypertension (20.3%), cardiac problems (11.9%), thyroid dysfunction (25.4%), chronic venous insufficiency (69.5%), and gonarthrosis (28.8%). Regarding lipedema-related characteristics, 91.5% of the patients experienced easy bruising, 89.8% had fat pads and skin thickening, 81.4% had varicose veins. Additionally, 94.9% of the patients reported pain, and 91.5% described a feeling of tightness. Although 78% of the patients had never received treatment for lipoedema, 72.9% had a history of unsuccessful dieting. Among the participants, 69.5% were married, 61% were university graduates, and 54.2% were working women. The distribution of lipedema types among participants was as follows: 1.7% had Type1, 22% had Type2, 40.7% had Type3 and 35.6% had Type4 lipedema. Regarding disease stage, 16.9% were classified as Stage 1, 55.9% as Stage 2, and 18.6% as Stage 3. Five participants (8.5%) had lipolymphedema and were reported separately from Stages 1–3. Descriptive statistics for the T-LSQ and comparator measures are presented in Table 2.

The sociodemographic characteristics of the participants are presented here Table 1.

Descriptive statistics for the T-LSQ and the comparator measures are presented in Table 2.

Validity

Construct validity. Confirmatory Factor Analysis (CFA) was conducted to asses the theoretical structure of the scale and its suitability for the sample (construct validity). A Normality test was performed to determine whether the scale was normally distributed. The related scale items were not distributed as multivariate normal. Since the dataset did not meet the assumption of normality, the maximum likelihood estimation with robust standard errors and a Satorra-Bentler scaled test statistic method (MLM) was used to estimate the CFA model, as it provides robust estimators in cases of non-normal distributions. The Satorra–Bentler scaled chi-square test was nonsignificant [χ^2 (27) = 33.773, p = .173], with χ^2/df = 1.251, Comparative Fit Index (CFI) = 0.838, Standardized Root Mean Square (SRMR) = 0.092, and Root Mean Square Error of Approximation (RMSEA) = 0.065. While some fit indices suggested acceptable fit, the CFI and SRMR indicated suboptimal fit. Therefore, the CFA findings provided mixed and preliminary evidence regarding the structural validity of the T-LSQ.

Standardized factor loadings ranged from 0.038 to 0.822. Item 4 showed a very low and nonsignificant factor loading (λ = 0.038, p = .818), while Item 5 also showed a nonsignificant loading (λ = 0.243, p = .087).

For convergent construct validity, correlations were examined between the T-LSQ and the LEFS, LLIS, and Lymph-ICF-LL scores. Significant correlations were found between the T-LSQ and the LEFS (r = −0.407), LLIS (r = 0.613), and Lymph-ICF-LL (r = 0.548) (p < .05).

Confirmatory factor analysis results are presented in Table 3.

Reliability

The internal consistency reliability was assessed by calculating Cronbach's alpha coefficient, known as the Internal Consistency Coefficient (ICC). Regarding the internal consistency of the LSQ, Cronbach's alpha coefficient for 9 items was calculated as 0.60, which was below the predefined threshold of 0.80 for acceptable internal consistency. Table 3 presents the internal consistency values of the scale when each item was removed from the LSQ.

Table 2. Descriptive statistics for the T-LSQ and comparator measures.

Measure	N	Mean ± SD	Min–Max
T-LSQ	59	12.49 ± 3.08	7–18
T-LSQ retest	59	12.46 ± 3.09	7–18
LEFS	59	52.12 ± 15.70	16–80
LLIS	59	51.24 ± 13.84	23–85
Lymph-ICF-LL	59	132.54 ± 59.66	8–256

Table 3. Confirmatory factor analysis results.

Satorra -Bentler				
Standardized	Coefficient	Standard error	Z	*p*
LSQ 1	0.298	0.132	2.24	**0.025***
LSQ 2	0.378	0.138	2.72	**0.006***
LSQ 3	0.430	0.139	3.08	**0.002***
LSQ 4	0.038	0.165	0.23	0.818
LSQ 5	0.243	0.142	1.71	0.087
LSQ 6	0.444	0.125	3.54	**< 0.001***
LSQ 7	0.822	0.099	8.26	**< 0.001***
LSQ 8	0.425	0.130	3.25	**0.001***
LSQ 9	0.293	0.137	2.14	**0.033***

LSQ: The Lipedema Screening Questionnaire, ***p* < .05**.

Test-retest reliability. The Pearson correlation coefficient between the LSQ total score and LSQ repeated total scores, obtained by administering the scale at two different time points, was calculated as 0.996. This indicates a very strong, significant, and positive relationship ($p < .001$).

The Internal consistency analysis was also performed, with the reliability statistic showing a Cronbach's Alpha of 0.60 for 9-item scale. The correlation between the LSQ total scores from the two administrations was highly significant (Pearson correlation r = 0.99**, $p < .001$)."*

The mean T-LSQ total scores were 12.49 ± 3.08 at the first assessment and 12.46 ± 3.09 at the retest. The T-LSQ demonstrated excellent test–retest reliability, with an ICC of 0.996 (95% CI: 0.994–0.998). The Standart Error of Measurement (SEM) was 0.20 points and the Smallest Detectible Change $(SDC)_{95}$ was 0.54 points.

Discussion

In this study, the LSQ was successfully adapted to the Turkish language, and selected psychometric properties of the T-LSQ were evaluated in patients with clinically diagnosed lipedema/lipolymphedema. The T-LSQ demonstrated excellent test–retest reliability and evidence of convergent construct validity; however, internal consistency was below the predefined acceptable threshold, and the findings regarding structural validity were mixed.

Although there is no single definitive diagnostic test for lipedema, various methods such as ultrasound, magnetic resonance, and tissue dielectric constant are used to assist in the diagnosis, but the lack of assessment tools that can be easily applied in clinical practice draws attention.[30] The absence of a Turkish-language questionnaire for lipedema supported the need for the Turkish adaptation of the Lipedema Screening Questionnaire (LSQ). Its simple and clear questions target common symptoms of lipedema and may facilitate clinical assessment.

The waist-to-hip ratio of the participants was 0.79 in the current study. Waist-to-hip ratio is the ratio of waist circumference to hip circumference. In a study by Herbst, it was emphasised that the waist and hip circumference ratio is a method that can be used to show the incompatibility of the upper body and lower body in lipedema.[31] This ratio found in our study is an indication of the expected typical appearance in lipedema, that is, the lower body size is larger than the upper body size.

Test-retest analyses of the LSQ

In their study, Marx et al. stated that there was no statistically significant difference between the results obtained from the test-retest between 2 days and 2 weeks and that the test-retest applications performed within this time period may be sufficient. Taking this into consideration, we determined the test-retest period as 10 days.[32] According to the statistical analyses, the T-LSQ demonstrated excellent test–retest reliability, with an ICC of 0.996 (95% CI: 0.994–0.998). The SEM was 0.20 points and the SDC_{95} was 0.54 points, indicating low measurement error.

Validity of the LSQ

No prior validity study of the scale has been conducted. The psychometric evaluation of the Turkish version of the LSQ was performed with 59 participants diagnosed with lipedema/lipolymphedema. To assess convergent construct validity, the correlations between the total scores obtained from the T-LSQ and those from the LEFS, LLIS, and Lymph-ICF-LL were analyzed. Statistically significant correlations were found between the T-LSQ and the LEFS, LLIS, and Lymph-ICF-LL scores in the theoretically expected directions, supporting convergent construct validity.

LEFS and LSQ correlation. A significant negative correlation was observed between the LEFS, a questionnaire assessing lower limb functionality, and T-LSQ scores ($r = -0.407$, $p = .001$). This finding indicates that higher T-LSQ scores were associated with lower levels of lower limb functionality. The direction of this correlation was theoretically expected and supports the convergent construct validity of the T-LSQ.

LLIS and LSQ correlation. Correlation analysis between the LLIS, a questionnaire evaluating the physical, functional and psychosocial effects of lymphoedema[19] and the T-LSQ showed a significant positive correlation ($r = 0.613$, $p < .001$). As T-LSQ scores increased, LLIS scores also increased, indicating greater impairment in quality of life. The direction of this correlation was theoretically expected and supports the convergent construct validity of the T-LSQ.

Lymph-ICF-LL and LSQ correlation. Similarly, correlation analysis between the Lymph-ICF-LL, a questionnaire assessing lower limb dysfunction, activity limitations and participation restrictions, and the T-LSQ revealed a significant positive correlation ($r = 0.548$, $p < .001$). As T-LSQ scores increased, greater limitations in lower limb function and participation were observed. The direction of this correlation was theoretically expected and supports the convergent construct validity of the T-LSQ.

It was concluded that in participants with lipedema-induced lower extremity lymphedema, a decline in lower extremity function negatively impacted the quality of life, both in general and specifically for patients with lower extremity lymphedema.

Patients with lipedema experience challenges that affect both their quality of life and lower limb function.[2] The observed relationships between the T-LSQ and measures of lower extremity function, quality of life, and symptom

burden support its convergent construct validity. However, these findings should not be interpreted as evidence of diagnostic accuracy.

The present study has several limitations. The study included only participants with clinically diagnosed lipedema/lipolymphedema and did not include non-lipedema or relevant differential-diagnosis groups. Therefore, the diagnostic accuracy and screening performance of the T-LSQ could not be evaluated. In addition, the relatively small sample size limits the interpretation of the CFA findings, and the internal consistency was below the predefined acceptable threshold. Further studies with larger samples and appropriate comparison groups are needed to evaluate the factor structure and diagnostic performance of the T-LSQ.

Conclusion

The Turkish version of the Lipedema Screening Questionnaire demonstrated excellent test–retest reliability and evidence of convergent construct validity. However, internal consistency was below the predefined acceptable threshold, and the findings regarding structural validity were mixed. Further studies with larger samples and appropriate comparison groups are needed to evaluate the structural validity and diagnostic performance of the T-LSQ.

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Ethical considerations

This study was approved by the Gazi University Clinical Research Ethics Commission (Approval No: 77082166-302.08.01-474156), in accordance with the principles of the Declaration of Helsinki.

Consent to participate

Written informed consent was obtained from all participants prior to data collection.

Author contributions

CE: Conceptualization, Data curation, Methodology, Writing – original draft, Writing – review & editing.
İK: Conceptualization, Data curation, Methodology, Writing – original draft, Supervision.
DE: Data curation, Writing – review & editing.
FK: Statistic analysis, Writing – review & editing.

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Declaration of conflicting interests

The authors have no relevant financial or non-financial interests to disclose.

Data Availability Statement

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.

Guarantor

Canan Ergin is the guarantor on behalf of the study.

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