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The glittre-ADL test can be used to assess the functional performance in patients with leprosy: A controlled transversal study

Anderson José, Carmen Lúcia Rondon Soares, Marian Marchiori, Fernanda de Cordoba Lanza, Simone Dal Corso, Carla Malaguti

ABSTRACT

Aims: The purpose of this study was to assess functional capacity in leprosy patients by using the Glittre-ADL test, comparing it with the performance of healthy subjects, and correlating with the Screening of Activity Limitation and Safety Awareness (SALSA) scale and quality of life (QoL). Methods: A controlled transversal study was conducted with 27 participants, 16 patients with leprosy (Leprosy Group, LG) and 11 healthy participants (Control Group, CG). Eligible participants performed the Glittre ADL-test and answered the QoL Questionnaire (WHOQOL-BREF). Additionally, the participants in the LG answered the SALSA and the WHO's Participation Scale. Results: Time to complete the Glittre-ADL test was higher in LG compared with CG (5.06 ± 0.96 min versus 3.76 ± 0.78 min, p < 0.05). The activity limitations according to the SALSA scale total scores revealed moderate limitations. A significant correlation was observed between the Glittre-ADL test and the SALSA score (r = 0.74) but no with QoL. Patients with leprosy showed a worse quality of life compared with their healthy pairs. Conclusion: The Glittre test is a valid test to assess functional performance in patients with leprosy, differentiating them from their healthy pairs. This is a suitable option to questionnaires and scales when an objective assessment of the functional performance is required in patients with leprosy.

Keywords: Activities of daily living, Leprosy, Physical therapy specialty, Quality of Life

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INTRODUCTION

Leprosy is an infectious disease that causes skin and peripheral nerve lesions, being able to cause important deficiencies and deformities [1–5]. Currently, this *Mycobacterium* infection affects about three million of people worldwide [6] and is endemic in more than 15 countries, although 83% of the cases are found in only three countries: India, Brazil and Birmania [7].

It is mandatory to prevent deficiencies and incapacities and to promote rehabilitation in this patients [8] because of the psychological, social and physical consequences [9] determined by leprosy, causing a decrease in functional capacity, physical activities of daily life, activities of daily life and quality of life [2, 3, 9–14]. Functional limitation in these patients has been credited to disease reactions, presence of peripheral nervous system involvement, multibacillary leprosy and the delay in diagnosis and treatment [12].

The Screening of Activity Limitation and Safety Awareness (SALSA) [15, 16] is a validated instrument to assess limitation in activities of daily life in leprosy and diabetes patients. Shortly, it is a quickly and easy questionnaire to use in clinical settings and has been translated into several languages worldwide. It provides a standardized measure of activity limitation in patients with peripheral neuropathy. However, it was shown that questionnaires do not necessarily reflect the actual physical activity and functional performance of those who complete them [17]. The same was also shown in leprosy patients because association between subjective perception of activities of daily life, assessed by questionnaires, and an objective measure made by accelerometers was not found [13].

The simulation of activities of daily life (ADLs) is a suitable alternative to questionnaires, as it provides an objective assessment of functional performance without the subjectivity of questionnaires and scales. The Glittre-ADL test has been established to measure functional status in patients with chronic obstructive pulmonary disease (COPD) [18], but it has also been used in hospitalized patients with pneumonia, exacerbated COPD, lung cancer, asthma, and tuberculosis [19]. However, a standardized set of ADL-like activities has never been applied in patients with leprosy, despite these patients present functional limitations and reduced performance to carry out ADLs [9].

In this context, the Glittre test is a promising test since it is representative of the ADLs. In brief words, it comprises a circuit of functional activities such as walking, using stairs, sitting on a chair and standing up, and handling 1-kg weights to simulate moving objects from one shelf to another and then to the floor [18]. Although it was initially developed for patients with chronic respiratory disease, the test consists of routine activities common to every person, either a healthy subject or a subject with any disease that limits her/his functionality. Based on the potential limitations of questionnaires, it is important to know if leprosy patients show alterations in a real simulation of ADLs. Additionally, it is still unknown if the Glittre test is capable of differentiating functional performance in leprosy patients and healthy people. Therefore, the objective of this study was to assess functional capacity in leprosy patients with the Glittre test, comparing them to healthy subjects and correlating the Glittre test with the SALSA scale and quality of life.

MATERIALS AND METHODS

Study Design

This is a transversal and controlled study. All assessments (Glittre test, SALSA scale, participation scales, and QoL questionnaires) were made in one visit.

Participants

There were 27 participants in total, being 16 in the leprosy group (LG) and 11 in the control group (CG). Diagnosis and treatment of patients were realized according to the global guidelines on leprosy [1]. Eligible criteria for inclusion in this study were patients more than 18-year-old with diagnosis of leprosy and in treatment or in treatment post-discharge for leprosy reactions. Patients with diabetes, excess alcohol consumption, known to be infected with the human immunodeficiency virus, or with mental or physical conditions interfering with the assessment, history of corrective surgery due to leprosy or for other reasons and the presence of other chronic diseases were excluded. The CG was made of healthy subjects selected from the community, paired by age, sex and body mass index with the LG.

The procedures of the study were explained to all participants, and informed-consent forms were obtained after approval by the institutional Ethics Committee in Research (process number 281727/2009).

Assessments

Glittre test

The Glittre test is compound by a circuit of functional activities with 10 meters length in which the patient must cover five times in the shortest time possible. The patient performs activities such as walking, climbing up and down stairs, sitting on a chair and standing up, and handling 1-kg weights to simulate moving objects from one shelf to another and then to the floor. During the test, patients carried a backpack weighing 5 kg and 2.5 kg, being males and females, respectively [18].

Two tests were performed on the same day (an hour apart) to minimize the learning effect. Heart rate (HR), pulse oxygen saturation (SpO2), and time of completion were measured at rest and the end of each completed lap. At rest and the end of the tests blood pressure, and dyspnea and fatigue (modified Borg scale) [20] were assessed. The time to complete the five laps was the primary outcome.

SALSA scale

To determine activity limitations and safety awareness, we used the SALSA scale, which was developed for applications in diabetes mellitus, leprosy, and other peripheral neuropathies [15]. The main goal was to measure the extent of activity limitations and the risk of increased impairment, utilizing the version validated in Portuguese [16]. Scores range from 10 to 80. Low scores indicate few difficulties with activities of daily living while higher scores indicate increasing levels of limitation. Scores from 10 to 24 are considered as without significant limitations, from 25 to 39 as mild, from 40 to 49 as moderate, from 50 to 59 as severe, and from 60 to 80 as very severe limitations. The safety awareness score is calculated separately from the SALSA score and results in a value that ranges from 0 to 11. Higher values indicate increasing awareness of the risks involved with certain activities, but also suggest that there are limitations in those activities [15].

Participation scales

To determine social participation restrictions, the WHO's Participation Scale was used. This scale was designed for screening and measuring limits (conscious) in the participation of people with leprosy, disabilities, or other stigmatizing conditions. It covers eight out of the nine main life areas defined by the International Classification of Functioning, Disability and Health (ICF) created by the World Health Organization (WHO). It is composed of 18 items, with final scores ranging from zero to 90. The score is classified as follows: no significant restriction (12 points or less), mild restriction (13–22), moderate restriction (23–32), severe restriction (33–52), and extreme restriction (53–90) [9].

Quality of Life Questionnaire (WHOQOL-BREF)

This is an international cross-culturally comparable quality of life (QoL) assessment instrument. This instrument is subdivided into physical, psychological, social relationships and environmental domains. The score for all domains ranges from 0 to 20, zero being the worst QoL and 20 being the best. [21, 22]

Data analysis

The collected data were analyzed with the Statistical Package for the Social Sciences™ (SPSS, version 13.0). The Shapiro-Wilk test tested the normality of the data. Parametric variables were expressed in mean and standard deviations, and non-parametric variables were expressed in median (interquartile range). Comparisons between the LG and the CG were performed using the unpaired Student's *t* test for parametric variables and Mann-Whitney test for nonparametric variables. Intragroup comparisons were made with the paired Student's *t* test for parametric variables and Wilcoxon test for non-parametric variables. The correlation between the Glittre test and SALSA scale was assessed with Spearman's rank correlation. The probability of type I error was established at 5% for all tests ($p < 0.05$).

RESULTS

As expected, no difference was found between groups in baseline characteristics (Table 1).

Patients of the LG presented higher time to complete the Glittre test. Healthy subjects (CG) presented higher heart rate at the end of the test. Dyspnea and arterial blood pressure were similar in both groups. There was a significant increase in heart rate and dyspnea from rest to the end of the test in both groups (Table 2).

The scores in SALSA scale were: total score 30.9 ± 8.4, self-care 4.9±2.0, mobility 7.1±3.1, work 10.3±3.4 and dexterity 8.6±2.8. The activity limitations according

Table 1: Sample Characteristics

Variables	LG (n = 16)	CG (n = 11)	p-values
Gender (M/F)	10/6	6/5	
Age (years)	44±13	44±12	0.90
Weight (Kg)	68.1±18.9	70.3±13.7	0.76
Height (m)	1.62±0.1	1.62±0.1	0.99
BMI (kg/m²)	25.7±5.7	26.9±5.2	0.59

Abbreviations: LG leprosy group, CG control group, BMI body mass index.
Data expressed in mean ±standard deviation.

Table 2: Results of Glittre ADL-test

Variables	LG (n = 16)	CG (n = 11)
Total time (min)	5.06±0.96	3.76±0.78*
Initial HR (bpm)	86.0±14.3	97.5±14.8
Final HR (bpm)	108.7±13.5•	132±20•*
Initial Perception of Fatigue	0.5±0.9	0.7±1.0
Final Perception of Fatigue	2.4±1.5•	1.6±2.0•

Abbreviations: LG leprosy group, CG control group, GT Glittre test, HR heart rate
* $p \leq 0.05$ LG versus CG.
• $p < 0.05$ initial versus final intragroup.

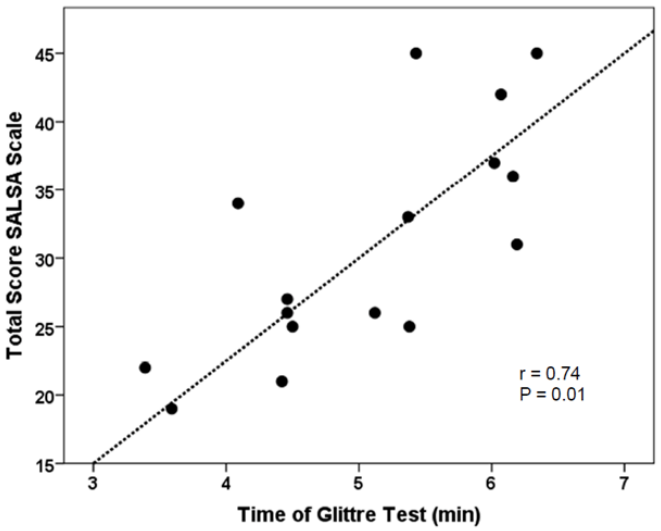

Figure 1: Relationship between performance in the Glittre test and total score of the SALSA scale.

Table 3: Quality of Life

Variables	Leprosy Group (n = 16)	Control Group (n = 11)	p-value
Physical	12.6±3.1	14.9±2.9	0.07
% Physical	53.8±19.8	67.9±17.9	0.07
Psychic	13.0±2.8	15.5±1.5	0.007
% Physic	56.0±17.8	71.6±9.3	0.007
Social	14.2±3.3	15.9±1.6	0.14
% Social	64.1±20.6	74.2±10.2	0.14
Environment	12.3±2.9	13.6±1.3	0.25
% Environment	53.3±18.2	60.2±8.2	0.20
Total	13.1±2.3	15.0±1.4	0.02

to the SALSA scale total scores suggest moderate limitations. Three patients (18.8%) were classified with no significant limitations, 10 (62.5%) with mild and three (18.8%) with moderate. The risk awareness was 0 (0–8) and no limitation at the risk-awareness score was found.

The social-participation restrictions according to the WHO's Participation Scale showed a mean (IQR) value of 27 (18–72) in the LG patients, which is considered moderate restriction.

There were found moderate correlations between time of the Glittre test and all domains of the SALSA scale: self-care (r = 0.62 P = 0.01), mobility (r = 0.63, P = 0.009), work (r = 0.50, P = 0.046) and dexterity (r = 0.52, P = 0.039). Figure 1 shows the association between total score on the SALSA scale and time of the Glittre test.

Patients with leprosy showed a worse quality of life total score compared with their healthy pairs. The same occurred in the psychic domain. It was not found any difference between groups in the other domains (Table 3). In the intragroup analysis, leprosy patients did not show any difference between domains. It was not found significant correlation between the Glittre test and quality of life.

DISCUSSION

Our results showed that an objective assessment of functional capacity using the Glittre test was able to detect a reduction in functional performance in leprosy patients. This study also revealed that the Glittre test was associated with the total score and all domains of the SALSA scale, being a valid option when an objective assessment of functional performance in these patients is required. Also, leprosy patients present an impaired health-related quality of life.

To the best of our knowledge, this is the first study that investigates an objective assessment of functional performance in patients with leprosy. The ability to perform daily activities with a satisfactory degree of independence and comfort has great relevance for patients with chronic diseases and with peripheral dermato-neuropathy such as leprosy. Usually, this ability is assessed by scales [3, 10, 15]. Moreover, questionnaires do not reflect the actual physical activity and functional performance [17]. Questionnaires also demonstrated not being accurate to the assessment of ADLs in leprosy patients, since they did not show correlation between subjective perception of ADLs limitations and an objective measure assessed by accelerometers [13]. Only a study evaluated functional capacity objectively by using the six-minute walk test [13], and patients walked a lower distance, which was associated with the perception of activities limitations measured by a questionnaire. However, there was no control group, and the six-minute walk test assesses only the performance to walk, which does not necessarily reflect the capacity of doing more complex ADLs, such as climbing up and down stairs and handling objects, like the tasks in the Glittre test. Additionally, hands are a body part hugely affected by leprosy [2] and play an important role to perform ADLs, which makes the Glittre test a suitable option for assessment in this group of patients.

It is interesting to note that patients with leprosy present great difficulty in doing ADL, represented by the time of completion of the Glittre test (5.06 min). On average, this time was superior compared with patients with severe and limiting respiratory diseases like COPD (4.67 min [17], 4.77 min [23] and 5.3 min [24]) and with patients hospitalized because of acute respiratory diseases (4.07 min) [19]. Besides this, the Glittre test was

capable of differentiating performance between patients and their healthy pairs. This was also shown in another study that compared performance in the Glittre test between healthy subjects and COPD patients (5.3±2.9 versus 3.3±0.3 min, P = 0.02), respectively [24].

As the test is composed of several complex tasks, a learning effect is expected [18, 19]. Patients were able to complete the second test faster than the first, but with no statistical difference (5.31s ± 0.64 versus 5.06s ± 0.95). Also, the variability found in our study is in accordance with the previously observed (less than 7%) [18].

The moderate to high magnitude of the association between the SALSA scale and the Glittre test showed that the latter is valid in determining that the indicators of limitations in the reported activities reflected the functional limitations. From this perspective, we believe that the use of the Glittre test can offer a valuable and objective information about limitations and peripheral factors involved in activities, helping to guide the rehabilitation process for this population.

Similar to the correlations between the Glittre test and the SALSA scale in our study, other studies validated this test showing its correlation with other questionnaires, such as the dyspnea domain in the PFSQD quality of life questionnaire (r = 0.3) [18], the dyspnea during most daily activities in the PFSQD (r = 0.36) [18], the activity subscore in the George's Respiratory Questionnaire (r = 0.43) [18], the total score in the London Chest Activity of Daily Living (LCADL) (r = 0.88) [25], the physical activity domain in the LCADL (r = 0.67) [24] and functional capacity domain in the SF-36 (r = -0.69) [24].

The SALSA scale score in our study revealed moderate activity limitations and social-participation restrictions but low risk-awareness among leprosy patients. The findings resembled those of other studies in Brazil involving patients with leprosy [11, 12, 26] This lower risk-awareness can be explained by the behavioral adaptation of this patients to the gradual loss of physical performance [27].

In comparison with the control group, leprosy patients showed a decrease in quality of life, assessed by the WHOQOL-BREF. The total score obtained in our study is similar to other study made with Brazilians (11.2±3.63) [28]. It is well established that leprosy causes direct impacts in quality of life of patients [10, 14, 29–38]. However, our study did not show any association between quality of life and the Glittre test, possibly by a type II error.

Studies that assess quality of life with the WHOQOL-BREF showed different results in relation with the most compromised domains, but domains that assess physical and environmental aspects are more common: physical aspects (15.0±25.1) and social (56.9±20.1) [35], physical (11.0±3.56) and environmental (11.47±2.11) [28], physical (9.9±3.3) and environmental (11.9±3.0) [38], physical 53.6 (32.1–67.9) and environmental 53.1 (46.9–64.8), psychological 12.95 (55.94%) and physical 12.35 (52.18%) [36].

The physical domain in the WHOQOL-BREF represents activities of daily living, dependence on drugs, energy and fatigue, mobility, pain and discomfort, sleep and rest, and work capacity; in other words, the whole functional state. This result shows that functional impairment constitutes the most compromised aspect of life due to this disease and is responsible for the main complaints of these patients. Besides the fact that our results show a decrease in quality of life of our patients, we could not show a significant difference in this domain, probably by the small size of our sample (P = 0.07).

It was attested that the Glittre test is a valid and objective tool to assess functional performance in patients with leprosy patients. This test can be considered when a more precise assessment is desired and also for patients that present some limitation to answer the SALSA scale. This measurement can give objective information about the patient's deficiencies and can also give data to a physical rehabilitation program for these patients.

Longitudinal studies using the Glittre test to investigate intervention effects to reduce physical limitations in patients with leprosy are desirable and timely. Follow-up assessment using Glitter test would be helpful to detect deterioration of the functional capacity due the evolution of the deformity in patients who did not reach control of the disease.

Limitations of the study

This study presents some limitations. First, the sample size is small and was not previously calculated. However, we tried to establish a control group with similar demographic and anthropometric characteristics that the patients included in the study. This reinforces that the difference in the main outcome of our study, time to complete the Glittre test, was due to the functional limitation in leprosy patients.

CONCLUSION

The Glittre test is a valid test to assess functional performance in patients with leprosy, differentiating them from healthy pairs. This test presented good correlation with the SALSA scale, demonstrating being viable alternative to questionnaires and scales when an objective and detailed assessment of patients with leprosy is required. The Glittre test can provide additional information about the actual limitations in the performance of ADLs by leprosy patients. Therefore, the Glittre test may be useful in rehabilitations programs as a tool to promote functional improvement.

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Author Contributions

Anderson José – Analysis and interpretation of data, Drafting the article, Critical revision of the article, Final approval of the version to be published
Carmen Lúcia Rondon – Conception and design, Acquisition of data, Analysis and interpretation of data, Critical revision of the article, Final approval of the version to be published
Marian Marchiori – Analysis and interpretation of data, Critical revision of the article, Final approval of the version to be published
Fernanda de Cordoba Lanza – Conception and design, Analysis and interpretation of data, Critical revision of the article, Final approval of the version to be published
Simone Dal Corso – Conception and design, Analysis and interpretation of data, Drafting the article, Critical revision of the article, Final approval of the version to be published
Carla Malaguti – Conception and design, Analysis and interpretation of data, Drafting the article, Critical revision of the article, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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