

Functional Performance Assessment in Older Adults With Parkinson's Disease: Reliability and Validity of the One-Minute Sit-to-Stand Test

İsmail Ceylan

fztceylan@gmail.com

Ahi Evran University

Muhammed Samed Dalakçı

Ahi Evran University

Mehmet Canlı

Ahi Evran University

Büşra Kürtüncüoğlu

Ahi Evran University

Meltem Yücel Ilgar

Ahi Evran University

Büşra Aydın

Ahi Evran University

Halil Alkan

Muş Alparslan University

İrem Canlı

Ahi Evran University

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Abstract

Background

To investigate the validity and test–retest reliability of the One-Minute Sit-to-Stand Test (1STS) in older adults with Parkinson’s disease (PD).

Methods

Twenty-eight individuals with PD performed the 1STS twice with a 7-day interval. Concurrent validity was examined using correlations with the 2-Minute Walk Test (2MWT) and the Modified Hoehn and Yahr Test (MHYT). Test–retest reliability was assessed using the intraclass correlation coefficient (ICC).

Results

The 1STS showed a strong positive correlation with the 2MWT ($r = 0.69$, $p < 0.01$) and a moderate negative correlation with the MHYT ($r = -0.58$, $p < 0.01$). Test–retest reliability was excellent ($ICC = 0.94$, 95% CI: 0.86–0.97).

Conclusion

The 1STS is a reliable and potentially valid measure of functional performance in older adults with PD. It may be considered a practical option in clinical settings; however, further research is needed to confirm these findings.

Clinical trial number:not applicable.

Background

Aging is associated with a progressive decline in physiological reserves, leading to impairments in muscle strength, balance, and endurance (1). These changes contribute to reduced functional capacity and increased vulnerability to adverse health outcomes such as falls, disability, hospitalization, and loss of independence (2). In geriatric populations, the ability to perform basic functional tasks is therefore considered a key indicator of overall health status and quality of life (3).

Functional capacity in older adults is commonly assessed using field-based performance tests, which provide practical and ecologically valid insights into daily physical functioning (4). These tests are particularly valuable in clinical and community settings where time, space, and equipment may be limited. Among these, sit-to-stand tasks are of particular importance, as they reflect a fundamental movement required for independence in activities of daily living (5).

Parkinson’s disease (PD), a prevalent neurodegenerative disorder in older adults, further exacerbates age-related declines in functional capacity. Motor symptoms such as bradykinesia, rigidity, and postural instability contribute to impairments in mobility and transitional movements, including rising from a

seated position (6). These limitations are strongly associated with reduced independence and increased risk of falls in older individuals with PD (7).

The one-minute sit-to-stand test (1STS) has emerged as a simple and practical tool for assessing functional exercise capacity in various clinical populations. The test integrates multiple physiological components relevant to geriatric function, including lower extremity strength, endurance, balance, and coordination (8). Given its minimal space requirements and ease of administration, the 1STS may be particularly suitable for older adults and individuals with mobility limitations.

Although the psychometric properties of the 1STS have been established in several chronic disease populations (8), its validity and reliability in older adults with Parkinson's disease remain unclear. Establishing these properties is essential before the test can be confidently used in geriatric clinical practice.

Therefore, the aim of this study was to investigate the test–retest reliability and concurrent validity of the one-minute sit-to-stand test in older adults with Parkinson's disease.

Material and Methods

Study Design and Participants

This cross-sectional study was conducted with PD participants who were referred from the*****. The following inclusion criteria were implemented: diagnosed with PD, age between 50 and 85 years, possess sitting balance. Patients were excluded if they had Stage 5 Hoehn and Yahr Scale severe heart disease, severe pulmonary disease, neurological, or orthopaedic problems limiting their capacity to perform the tests.

Ethical approval

was ensured by the Muş Alparslan University Research Ethics Board (Approval No: 86743 – 2023/03–34). All participants provided written informed consent according to the Declaration of Helsinki.

Procedures

The study procedures consisted of two visits. Age, sex, and anthropometric data (weight, height, and body mass index) were recorded at the first visit. The 2MWT was performed twice due to the learning effect, 30 minutes apart, and the best 2MWT distance recorded. The second 1STS assessment was performed 7 days after the first measurement. At the second visit, within a week, participants were familiarised with the 1STS test procedure and then the 1STS test was performed twice, 30 minutes apart, to examine the test–retest reliability. All tests were conducted by the same physiotherapist(8).

Outcome Measurements

In this study, the following assessment tools were used: the 1STS, the 2MWT and the MHYT.

The 1STS test was conducted using a standardised 46 cm highchair without arm supports. Participants were seated in the chair and positioned with their knees and hips at 90° flexion, with their feet on the floor and arms across their chest. Participants were instructed to stand up and sit down as quickly as possible without using their arms for 1 minute and were allowed to stop whenever they wanted(8).

A repetition was identified as rising completely straight and returning to a sitting position. The number of completed repetitions was numbered and recorded by the physiotherapist.

2MWT is a functional capacity assessment used for individuals who are unable to complete the 6 or 12 minute walk tests due to limited endurance. During the test, the individual is instructed to walk at their own comfortable pace for two minutes without altering their walking speed (9).

The MHYT is an assessment tool used to determine the level of disability in individuals diagnosed with Parkinson's disease. An increase in the MHYT stage is interpreted as a progression of the disease (10).

Statistical Methods

Sample size was calculated a priori based on the method described by Walter et al. (11), assuming an expected ICC of 0.90, a minimum acceptable ICC of 0.75, 80% power, and $\alpha = 0.05$. The required sample size was 24 participants. To account for potential dropout, the target sample size was increased to 29 participants.

Data were analyzed using SPSS (Version 24, IBM Corp.) and R software (Version 4.3). Normality was assessed using the Shapiro–Wilk test. As the data were not normally distributed, Spearman's rank correlation coefficient was used to evaluate concurrent validity.

Test–retest reliability was assessed using the intraclass correlation coefficient (ICC) based on a two-way random-effects model with absolute agreement. Correlation strength was interpreted as follows: <0.30 (weak), 0.30–0.59 (moderate), 0.60–0.79 (strong), ≥ 0.80 (very strong). ICC values were interpreted as: <0.50 (poor), 0.50–0.74 (moderate), 0.75–0.89 (good), and ≥ 0.90 (excellent). A p-value < 0.05 was considered statistically significant.

Results

A total of 29 patients were enrolled in the study; however, one patient did not attend the second assessment and was excluded, resulting in 28 patients being included in the final analysis. Of the participants, 69.2% (n=17) were male and 30.8% (n=11) were female. The mean age was 64.31 ± 11.69 years for males and 70.00 ± 10.72 years for females. The mean disease duration was 6.30 ± 4.11

years (range: 2–15 years). Sociodemographic and clinical characteristics of the participants are summarized in Table 1.

Table 1. Sociodemographic and clinical characteristics of participants.

Variable	Male (n=17)	Female (n=11)	Total (n=28)
Age (years), mean $\pm$ SD	64.31 $\pm$ 11.69	70.00 $\pm$ 10.72	66.30 $\pm$ 11.45
Height (m), mean $\pm$ SD	1.72 $\pm$ 0.07	1.63 $\pm$ 0.05	1.69 $\pm$ 0.08
Weight (kg), mean $\pm$ SD	83.46 $\pm$ 14.90	83.57 $\pm$ 10.86	83.50 $\pm$ 13.48
BMI (kg/m ²), mean $\pm$ SD	28.07 $\pm$ 4.35	31.18 $\pm$ 2.62	29.16 $\pm$ 4.08
Disease duration (years), mean $\pm$ SD	5.92 $\pm$ 3.75	7.14 $\pm$ 4.81	6.30 $\pm$ 4.11
1STS (1st assessment), mean $\pm$ SD	17.08 $\pm$ 7.62	11.00 $\pm$ 3.74	14.95 $\pm$ 7.09
1STS (2nd assessment,), mean $\pm$ SD	17.62 $\pm$ 8.31	11.86 $\pm$ 2.61	15.60 $\pm$ 7.48
2MWT (meters), mean $\pm$ SD	132.38 $\pm$ 42.23	123.43 $\pm$ 27.25	129.25 $\pm$ 38.17
MHYT (stage 0-5), mean $\pm$ SD	1.35 $\pm$ 1.18	2.14 $\pm$ 1.11	1.63 $\pm$ 1.22

Abbreviations: SD, standard deviation; BMI, body mass index; 1STS, 1-Minute Sit-to-Stand Test; 2MWT, 2-Minute Walk Test; MHYT, Hoehn-Yahr Test.

The concurrent validity of the 1STS was assessed by examining its correlations with the 2MWT and the MHYT (Figure 1A, 1B).

A strong positive correlation was found between the 1STS and 2MWT ($r = 0.69$). This indicates that patients who performed more repetitions on the 1STS also walked longer distances on the 2MWT. The scatter plot showing this relationship is presented in Figure 2.

A moderate negative correlation was observed between the 1STS and the MHYT (Spearman's $r = -0.58$, 95% CI: -0.81 to -0.20, $p < 0.01$). This suggests that patients with more advanced disease (higher MHYT stage) performed fewer repetitions on the 1STS (Figure 3).

The test-retest reliability of the 1STS was excellent (ICC = 0.94, 95% CI: 0.86–0.97), (Figure 4).

The summary of the validity and reliability findings is shown in below (Table 2).

Table 2. Summary of Validity and Reliability Findings

Psychometric Property	Comparison	Correlation Coefficient	95% CI	p-value	Interpretation
Concurrent Validity	1STS vs 2MWT	$r = 0.69$ (Spearman)	0.36–0.87	< 0.01	Strong positive
Concurrent Validity	1STS vs MHYT	$r = -0.58$ (Spearman)	-0.81 to -0.20	< 0.01	Moderate negative
Test-Retest Reliability	1STS	ICC = 0.94	0.86–0.97	< 0.01	Excellent

Abbreviations: CI, confidence interval; ICC, intraclass correlation coefficient; 1STS, 1-Minute Sit-to-Stand Test; 2MWT, 2-Minute Walk Test; MHYT, Hoehn-Yahr Test.

Discussion

This study evaluated the reliability and concurrent validity of the 1STS in older adults with Parkinson's disease from a geriatric functional perspective. The findings demonstrated that the 1STS is a highly reliable measure and shows meaningful associations with established indicators of functional capacity and disease severity.

There is no validity and reliability study of the 1STS specifically conducted in older adults with PD in the literature. Existing studies have primarily focused on cardiopulmonary diseases, as this test measures aerobic capacity, such as chronic obstructive pulmonary disease (12), pulmonary hypertension (13), cystic fibrosis (14), COVID-19 patients (15), Type 2 Diabetes (16) and it has been shown to be a valid and reliable method. In these studies, the ICC score for the 1STS has been reported to range between 0.90 and 0.98. The excellent test–retest reliability observed in this study indicates that the 1STS provides stable and reproducible results in older adults with PD. This is particularly important in geriatric assessment, where reliable tools are needed to monitor functional changes over time and evaluate the effectiveness of rehabilitation interventions.

In geriatric populations, the sit-to-stand movement is recognized as a fundamental component of functional independence. Difficulty in rising from a chair has been associated with increased risk of falls, disability, and mortality in older adults (17, 18). In individuals with Parkinson's disease, this task becomes even more challenging due to the combined effects of age-related sarcopenia and disease-specific motor impairments (19). Therefore, performance in the 1STS may provide clinically relevant information regarding an individual's functional reserve and independence level. When previous studies on the subject are examined, it is seen that the 1STS has been used to assess motor skills in diseases where physical performance may be affected (8, 13, 16). In individuals with PD, it has also been stated that it can be used as an alternative to the 6MWT (20). In our study, we investigated whether the 1STS is an appropriate alternative for individuals who are unable to complete the 6MWT. Based on the obtained data, a moderate significant correlation was found between the 1STS and the 2MWT ($r = 0.69$). Literature findings on the topic also appear to support our results. Furthermore, a loss of lower extremity muscle

strength and poor performance in functional tests may indicate more advanced stages of the disease. Clael and Paul, in their respective studies, concluded that the progression of the disease in individuals with PD creates difficulties in performing activities of daily living (20, 21). Neurological impairments in individuals with PD lead to reduced sit-to-stand performance (22). Furthermore, the progression of the disease contributes to this decline in functional ability (23). Sit-to-stand performance has been established as a reliable indicator of functional ability in PD populations (24). Our results corroborate these observations, showing a significant negative correlation between 1STS and MHYT scores ($r = -0.58$).

In terms of clinical relevance, the 1STS test evaluates a fundamental motor task integral to numerous activities of daily living, and performance efficiency reflects an individual's level of functional independence. Notably, approximately 80% of older adults with Parkinson's disease experience difficulty rising from a chair (25). Among older adults without Parkinson's disease, impaired ability to stand from a seated position has been directly associated with an increased risk of all-cause mortality compared with those who rise easily (26). In the present study, all participants successfully completed at least three repetitions during the 1STS assessment.

The impact of relative 1STS power in PD remains unclear and warrants further investigation, including responsiveness and minimal clinically important difference. Limitations include the small sample size, assessment of only concurrent validity, and the lack of consideration of factors such as cognitive status, fatigue, and medication timing. Future studies should explore the responsiveness of the 1STS, its predictive value for adverse outcomes such as falls and hospitalization, and its relationship with geriatric syndromes such as frailty and sarcopenia.

Conclusions

In conclusion, the 1STS test in patients with PD is a valid, reliable, understandable, and easy method that can be used by clinicians and researchers. From a clinical perspective, the 1STS is a simple, time-efficient, and space-saving assessment that may be particularly useful in geriatric rehabilitation settings where longer walking tests are not feasible.

Abbreviations

1STS

One-Minute Sit-to-Stand Test

2MWT

Two-Minute Walk Test

MHYT

Modified Hoehn and Yahr Test

PD

Parkinson's Disease

ICC
Intraclass Correlation Coefficient
CI
Confidence Interval
SD
Standard Deviation
BMI
Body Mass Index

Declarations

Ethical statement: Ethical approval was ensured by the Muş Alparslan University Research Ethics Board (Approval No: 86743-2023/03-34). The study was conducted in accordance with the Declaration of Helsinki.

Consent for publication: Not applicable.

Data availability statement: The datasets of the current study are available from the corresponding author upon reasonable request.

Conflict of interest: The authors have no conflicts of interest with respect to the data collected and procedures used within this study.

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Authors' contributions:

1. **Research project:** A. Conception, B. Organization, C. Execution;
2. **Statistical Analysis:** A. Design, B. Execution, C. Review and Critique;
3. **Manuscript Preparation:** A. Writing of the first draft, B. Review and Critique;
1. **İsmail Ceylan:** 1A, 1B, 1C, 2A, 2B, 2C, 3A, 3B; 2. **Muhammed Samed Dalakçı:** 1A, 1B, 1C, 2A, 2B, 3A, 3B; 3. **Mehmet Canlı:** 1C, 3B; 4. **Büşra Kürtüncüoğlu:** 1C; 5. **Meltem Yücel Ilgaz:** 1C; 6. **Büşra Aydın:** 1C, 2B; 7. **Halil Alkan:** 2A, 2B; 8. **İrem Canlı:** 1C, 2B.

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References

1. Zhu, L., Shen, X., Shi, X. & Ouyang, X. Factors associated with intrinsic capacity impairment in hospitalized older adults: a latent class analysis. *BMC Geriatr.* **24** (1), 494 (2024).

2. Jang, A. R., Sagong, H. & Yoon, J. Y. Frailty trajectory among community-dwelling middle-aged and older adults in Korea: evidence from the Korean Longitudinal Study of Aging. *BMC Geriatr.* **22** (1), 524 (2022).
3. Brañas, F. et al. Effects of frailty, geriatric syndromes, and comorbidity on mortality and quality of life in older adults with HIV. *BMC Geriatr.* **23** (1), 4 (2023).
4. Godhe, M. et al. Reliability in Novel field-based fitness measurements and postexercise scores from a physical fitness test battery in older adults. *Gerontology* **70** (6), 639–660 (2024).
5. Meulemans, L., Deboutte, J., Seghers, J., Delecluse, C. & Van Roie, E. Age-related differences across the adult lifespan: a comparison of six field assessments of physical function. *Aging Clin. Exp. Res.* **37** (1), 72 (2025).
6. Pigott, J. S., Kane, E. J., Ambler, G., Walters, K. & Schrag, A. Systematic review and meta-analysis of clinical effectiveness of self-management interventions in Parkinson's disease. *BMC Geriatr.* **22** (1), 45 (2022).
7. Fernandes, J. B. et al. Barriers and strategies affecting the use of assistive devices for falls prevention among people with Parkinson's disease: a qualitative pilot study. *BMC Geriatr.* **25** (1), 352 (2025).
8. Tanriverdi, A., Kahraman, B. O., Ozpelit, E. & Savci, S. Test–retest reliability and validity of 1-minute sit-to-stand test in patients with chronic heart failure. *Heart Lung Circulation.* **32** (4), 518–524 (2023).
9. Ceylan, İ., Mhmood, A. H. & Al-Janabi, R. Q. K. Effects of early mobilization in elderly patients undergoing cardiac surgery. *Ir. J. Med. Sci. (1971-).* **193** (6), 2733–2744 (2024).
10. Ma, H. et al. Utility of gait biomarkers in screening for obstructive sleep apnea among patients with Parkinson's disease: a cross-sectional study. *BMC Neurol.* (2026).
11. Walter, S., Eliasziw, M. & Donner, A. Sample size and optimal designs for reliability studies. *Stat. Med.* **17** (1), 101–110 (1998).
12. Reychler, G. et al. One minute sit-to-stand test is an alternative to 6MWT to measure functional exercise performance in COPD patients. *Clin. Respir. J.* **12** (3), 1247–1256 (2018).
13. Kronberger, C. et al. Functional capacity testing in patients with pulmonary hypertension (PH) using the one-minute sit-to-stand test (1-min STST). *Plos one.* **18** (3), e0282697 (2023).
14. Combret, Y., Prieur, G. & Medrinal, C. Validity and reliability of the one-minute sit-to-stand test for the measurement of cardio-respiratory responses in children with cystic fibrosis. *Authors' reply Pulmonol.* **29** (2), 174–175 (2023).
15. Niyogi, S. G. et al. One minute sit-to-stand test as a potential triage marker in COVID-19 patients: A pilot observational study. *Trends Anaesth. Crit. Care.* **39**, 5–9 (2021).
16. Alanazi, A. Assessing the Feasibility of the One-Minute Sit-to-Stand Test as a Substitute for the Six-Minute Walk Test in Type 2 Diabetes: A Cross-Sectional Study. *J. Clin. Med.* **14** (12), 4088 (2025).
17. Piano, L., Geri, T. & Testa, M. Raising and stabilization phase of the sit-to-stand movement better discriminate healthy elderly adults from young subjects: a pilot cross-sectional study. *Archives*

Physiotherapy. **10** (1), 7 (2020).

18. Tateoka, K., Tsuji, T., Shoji, T., Tokunaga, S. & Okura, T. Relationship between acceleration in a sit-to-stand movement and physical function in older adults. *Geriatrics* **8** (6), 123 (2023).
19. Yilmaz, M. et al. Evaluation of sarcopenia and phase angle in elderly patients with Parkinson's Disease. *Int. J. Neurosci.* **135** (4), 488–495 (2025).
20. Clael, S. et al. Association of strength and physical functions in people with Parkinson's disease. *Neurosci. J.* **2018** (1), 8507018 (2018).
21. Paul, S., Canning, C., Sherrington, C. & Fung, V. Reduced muscle strength is the major determinant of reduced leg muscle power in Parkinson's disease. *Parkinsonism Relat. Disord.* **18** (8), 974–977 (2012).
22. Ramsey, V. K., Miszko, T. A. & Horvat, M. Muscle activation and force production in Parkinson's patients during sit to stand transfers. *Clin. Biomech. Elsevier Ltd.* **19** (4), 377–384 (2004).
23. Baizabal-Carvallo, J. F., Alonso-Juarez, M. & Fekete, R. The Role of Muscle Strength in the Sit-to-Stand Task in Parkinson's Disease. *Parkinson's Disease*. **2023** (1), 5016802 (2023).
24. Bryant, M. S., Kang, G. E. & Protas, E. J. Relation of chair rising ability to activities of daily living and physical activity in Parkinson's disease. *Archives Physiotherapy*. **10** (1), 22 (2020).
25. Brod, M., Mendelsohn, G. A. & Roberts, B. Patients' experiences of Parkinson's disease. *Journals Gerontol. Ser. B: Psychol. Sci. Social Sci.* **53** (4), P213–P22 (1998).
26. Losa-Reyna, J. et al. Impact of relative muscle power on hospitalization and all-cause mortality in older adults. *Journals Gerontology: Ser. A.* **77** (4), 781–789 (2022).

Figures

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Figure 1

Legend not included with this version

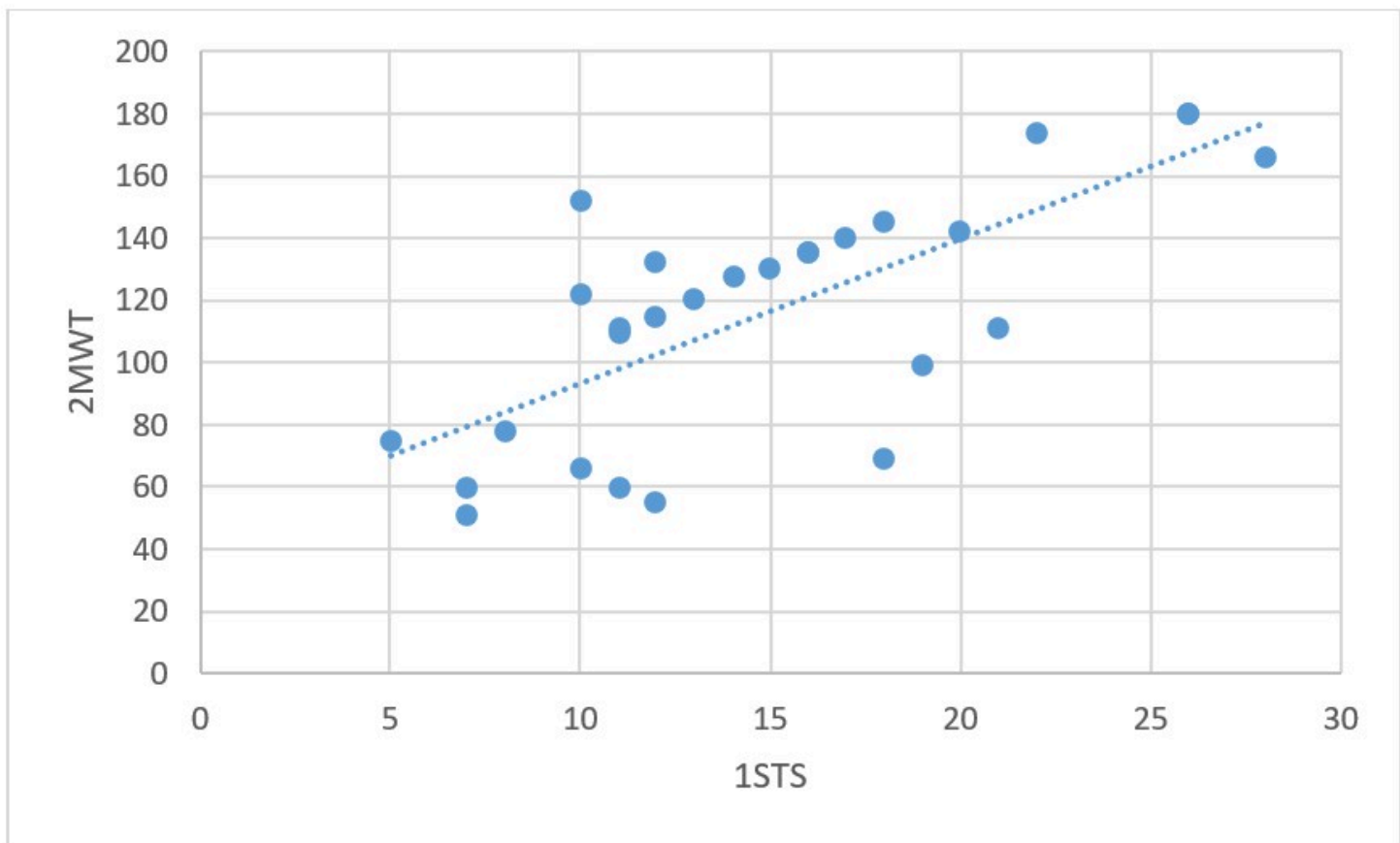


Figure 2

Correlation between 1STS and 2MWT

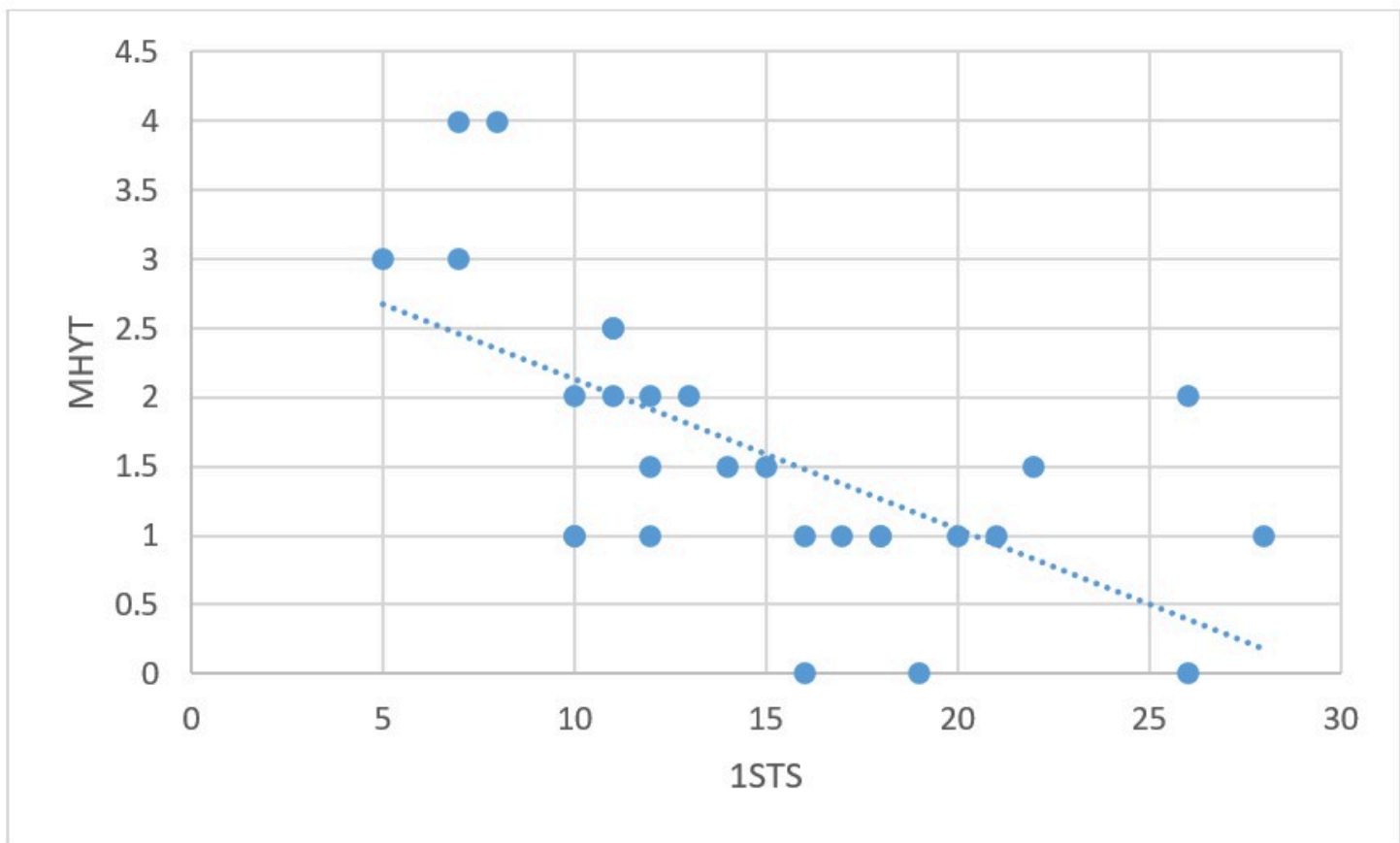


Figure 3

Correlation between 1STS and MHYT.

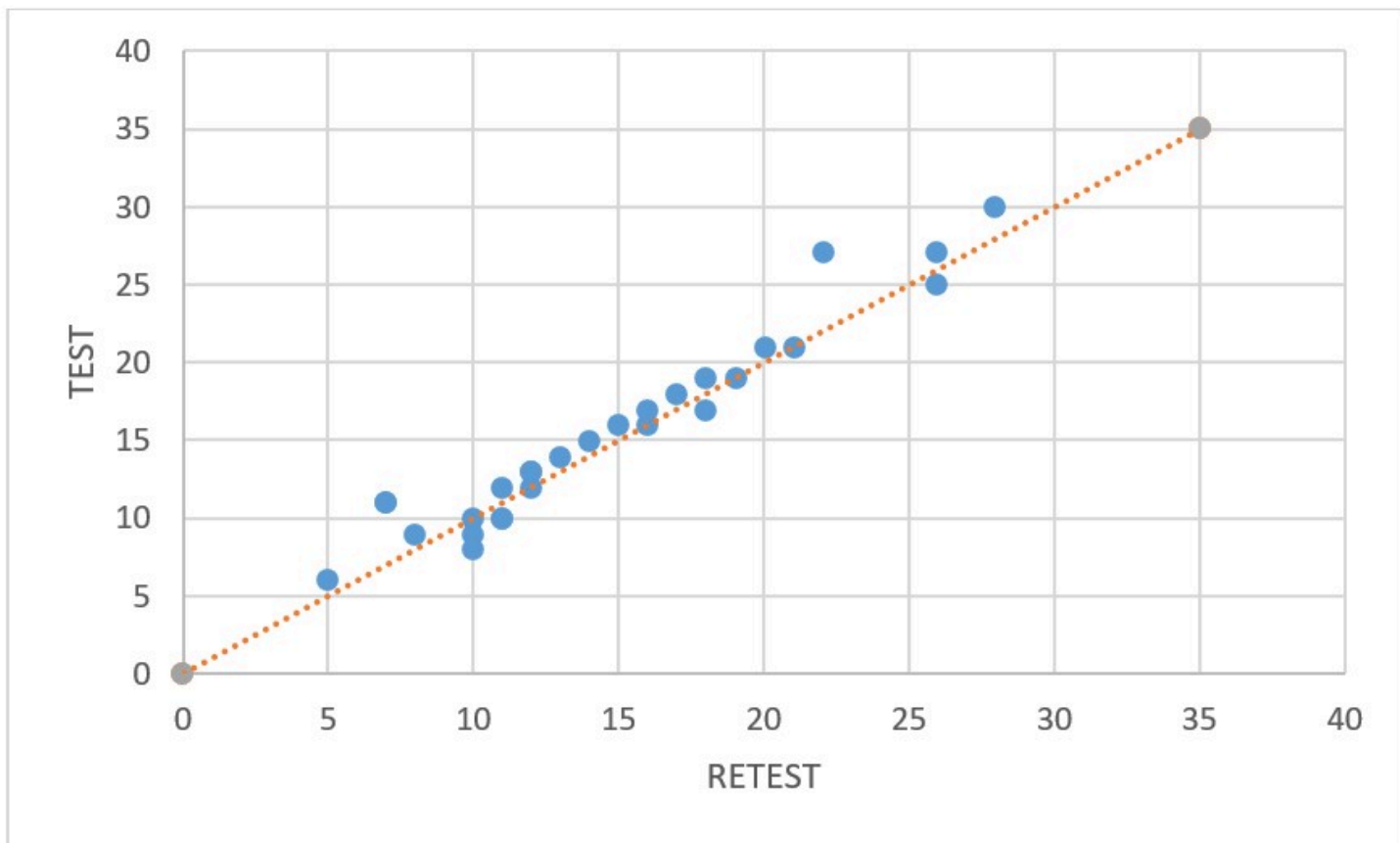


Figure 4

Test-Retest Reliability of the 1STS.