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Psychometric Properties of FIST in Neurological Disorders: A Systematic Review

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Abstract

Aim: The study aims to systematically review the psychometric properties of the Function in Sitting Test (FIST), focusing on its use in patients with various neurological disorders such as stroke, spinal cord injury (SCI), and multiple sclerosis (MS). The review evaluates the reliability, validity, and minimal detectable change (MDC) of FIST across different populations to determine its clinical utility.

Methodology: A comprehensive literature search was performed in databases including CINAHL, PubMed, and the Cochrane Library from 2010 to 2024. The search was focused on identifying studies related to the psychometric properties of the FIST, using the keywords 'Function in Sitting Test' and 'psychometric properties.' No limitations were placed on participant demographics or study design, but the search was restricted to English-language articles. Studies that involved neurological dysfunctions and had sample sizes larger than 10 were included. The psychometric properties assessed in the selected studies were analyzed using intra-class correlation (ICC), Spearman's correlation, and minimal detectable change (MDC).

Results: The review included 6 studies conducted on various populations, including patients with stroke, SCI, MS, and sitting balance dysfunctions. FIST demonstrated strong psychometric properties:

-Reliability: The intra-rater ICC values were as high as 0.95, and inter-rater reliability values reached 0.99,

indicating consistent assessment across different raters and time points.

- Validity: Significant concurrent validity was found between FIST and established balance measures like the Berg Balance Scale (BBS) (r = 0.851) and the Functional Independence Measure (FIM) (r = 0.712). These findings support FIST's effectiveness in assessing balance in neurological patients.

- Minimal Detectable Change (MDC): The MDC values for stroke patients were reported to range between 2.3 and 5.5 points, indicating that changes above these values reflect meaningful clinical improvements.

Keywords: Function in sitting Test, Psychometric Properties, Systematic Review

Introduction

Maintaining or achieving sitting balance is thought to be essential for carrying out functional tasks including getting dressed, getting in and out of a chair, and eating[1]. Most Balance assessments tools such as the Berg Balance Scale, Performance-Oriented Mobility Assessment and Clinical Test of Sensory Interaction and Balance are designed to evaluate an individual's general balance ability rather than their specific seated balance.

The functional objectives of the sitting balance components must be assessed as part of the intricate sitting balance assessment. The preservation of a certain postural alignment (static), the promotion of voluntary movement or movement transitions between postures (proactive), and the responses that restore equilibrium in response to outside disruptions (reactive) are implied by the functional aims[2] .all these components can be measured by FIST.

According to the National Spinal Cord Injury Statistical Centre, there are around 291,000 persons with SCI worldwide. In comparison, 2.6 million people in the US are estimated to have SCI according to a systematic analysis that uses Global Burden of Disease (GBD) data. According to a different Centers for Disease Control and Prevention (CDC) research, there are 1.5 million people with SCI worldwide. Based on NIS data, Jain et al. estimate the incidence rate to have been 52–54 instances per 1,000,000 between 1993 and 2012[3].

Throughout the last ten years, there has been a variation in the crude prevalence of stroke in different sections of the nation from 44.29 to 559/100,000 individuals, and a cumulative incidence of stroke ranging from 105 to 152/100,000 persons each year[4].

Approximate prevalence of multiple sclerosis rates in various regions of India range from 0.17 to 1.33 per 100,000 people, according to estimations based on hospital data[5]. These studies demonstrate the prevalence of conditions including stroke, MS, and SCI.

Sitting Balance in the seated position can significantly impact an individual of neurological condition like Stroke, SCI, MS. So that there is need for reliable and valid assessment tools for sitting balance assessment.

The Function in sitting test was developed in 2010 via Gorman et.al is a 14 item test that scored 0 to 4 Maximum score 56. FIST was developed for measuring balance in sitting for adult patients with acute stroke. FIST assess balance by Reactive challenges that included nudges Anticipatory challenges like moving side to side ,lifting foot turning and picking objects and forward and lateral reaches .

Every clinical measuring instrument must be trustworthy. The Function in Sitting Test's dependability may best be described in terms of absolute reliability, which is clinically important.

The Function in Sitting Test absolute reliability offers a confidence interval that indicates the range in which a change in balance is likely to be a true change. To describe this, the least detectable change with 95% confidence (MDC95) is the most used method[6].

The repeatability of a balancing score when assessed and retested by the same assessor is known as intra-rater reliability. Inter-rater reliability is the capacity of a balance score to be evaluated consistently by two or many assessors. Reliability measured typically with intra-class correlation (ICC), with a score of 0 denoting no association and a score of 1 denoting perfect agreement[7].

An assessor measures balance, and then after a certain amount of time, they evaluate the same individual again to determine intra-rater reliability. One assessor administering the test while other assessors evaluate it is one way to examine inter-rater reliability. Another method is having many assessors repeat the same measurements.

A ceiling effect occurs when too large a percentage of participants achieve the highest score on a test. Where the flooring effect occurs when too large a percentage of participants achieve the lowest score on a test. It will be calculated by percentage of score[8].

Methodology

Indentification and Selection of Studies

A literature search Was Undertaken to locate eligible published studies .Key word for literature search are Function in sitting Test, psychometric properties. Electronic searches of CINAHL, PubMED and Cochrane Library from 2010 to 2024 were conducted. With no limitations on the individuals conducting the outcome measures—a qualified clinician or not—we limited the search to English-language articles.

No search terms were used for intervention type or health condition and no methodological filter was used for study design.

Inclusion Criteria

Design

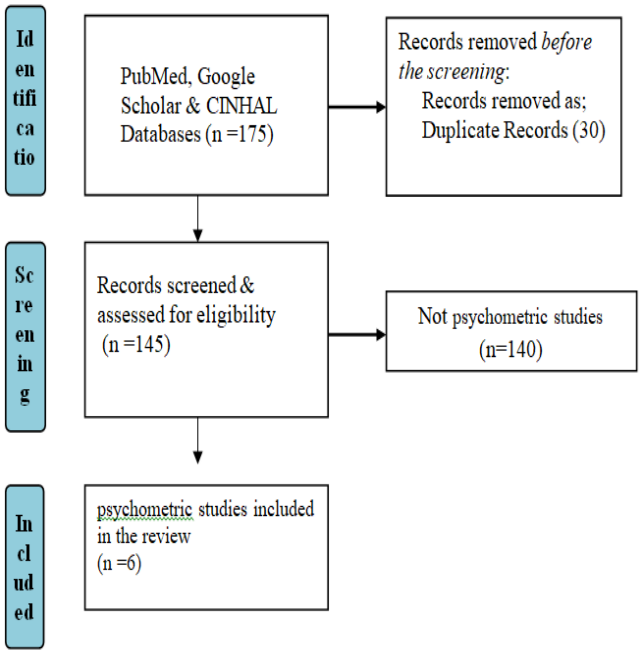
- psychometric properties of FIST Scale
- Published in English
- Sample Size More than 10

Participants

Patients with Neurological dysfunctions

Data Analysis

ICC, Spearman's correlation



Result

Table 1:

Sr.no	Year of publication. And Authors	No. of patients	Population	Statistical Test	Outcome Measures	Result
1	2010 Sharon L. Gorman[9]	31	Acute Stroke	Spearman Rank correlation coefficient,	FIST	The person separation index = 0.978 the coefficient alpha was= 0.98,
2	2014 Sharon L Gorman[10]	125	Sitting balance dysfunction	Spearman Rank correlation coefficient, MDC	FIST, FIM, and Berg Balance Scale (BBS)	Concurrent validity FIST & BBS = r- 0.851 FIST & FIM= r-0.712 MDC =5.50
3.	2016 JongHun Sung[11]	20	multiple sclerosis	ICC, Spearman's Correlation	FIST , posturography assessment	ICC Cronbach's-α= 0.91. Spearman correlations FIST &VTC = r =0.487 FIST & seated postural sway area r = − 0.267
4.	2020 Jehad Alzyoud[12]	40	Patients wit Stroke(first o recurrent)	MDC	FIST, SBS, and Barthel Index	.MDC90 SBS & FIST = 2.3 and 3.9
5.	2020 Libak Abou[13]	26	Spinal Cord Injury	ICC, MDC, correlation	FIST, The modified Functional Reach Test (lateral and forward mFRT) ,posturography assessment	Test-retest reliability= 0.95 MDC = 4. The internal consistency= 0.81. FIST correlates lateral mFRT r = 0.64 forward mFRT & VTC.r =0.23
6	2020 Anne E. Palermo[14]	38	Chronic Spinal Cord Injury	ICC, MDC, Spearman's correlation	FIST , MAS	Both ICC values of FIST 0.992& 0.96. Spearman's correlation r = 0.552

Table 2: Newcastle-Ottawa Quality Assessment Scale for Cohort Studies – For assessing the quality of study (Score < 7 Indicates good quality of study)[15]

Study	Representativ-eness of the exposed cohort (1 star)	Selection of the non exposed cohort (1 star)	Ascertainment of exposure (1 star)	Demonstration that outcome of interest was not present at start of study (1 star)	Comparability o cohorts on the basis of the design or analys (0-2 stars)	Assessment of outcome (1 star)	Was follow-up long enough for outcomes to occur (1 star)	Adequacy of follow up of cohorts (1 star)	Total NOS Score (9 stars)
Sharon L.Gorman (2010)	Yes (1)	No (0)	No (0)	Yes (1)	2/2	Yes (1)	Yes (1)	Yes (1)	7/9
2014 Sharon L Gorman	Yes (1)	No (0)	Yes (1)	No (0)	2/2	Yes (1)	Yes (1)	Yes (1)	7/9

2016 JongHun Sung	Yes (1)	No (0)	Yes (1)	Yes (1)	2/2	Yes (1)	Yes(1)	Yes (1)	8/9
2020 Jehad Alzyoud	Yes (1)	No(0)	Yes (1)	Yes (1)	2/2	Yes (1)	Yes (1)	Yes (1)	8/9
2020 Libak Abou	Yes (1)	No (0)	Yes (1)	Yes (1)	2/2	Yes (1)	Yes (1)	Yes (1)	8/9
2020 Anne E. Palermo	Yes (1)	No(0)	Yes (1)	Yes (1)	2/2	Yes (1)	Yes(1)	Yes (1)	8/9

Discussion

In these study discusses various psychometric properties of FIST scale in different population. This study included 6 trials with 2 trails on Spinal cord Injury, 1 trials on Multiple sclerosis, 1 trails on subjects with Sitting balance dysfunction and 2 trails on Stroke.

Reliability

Reliability refers to the consistency of a measurement tool, in this case, the Function in Sitting Test (FIST). It is evaluated by assessing intra-rater and inter-rater reliability:

- Intra-rater reliability measures how consistently the same rater can score the FIST when assessing the same patient multiple times. Inter-rater reliability measures the consistency of scores when different raters assess the same patient.
- A high Intra-Class Correlation Coefficient (ICC) indicates strong reliability. For example, the study by Libak Abou et al. (2020) demonstrated a high intra-rater reliability of the FIST, with an ICC of 0.95, showing that the tool is highly consistent when used by the same rater across different times. Additionally, Sharon L. Gorman et al. (2014) reported an inter-rater ICC of 0.99, further supporting the reliability of the FIST across different raters.

Validity

Validity assesses the degree to which the FIST measures what it is intended to measure—sitting balance in neurological patients:

- Concurrent validity of the FIST has been established by comparing it to other established measures of balance and functional mobility. For instance, Sharon L. Gorman et al. (2014) found a significant correlation between FIST scores and the Berg Balance Scale (BBS), with a correlation coefficient of 0.851 ($p < 0.001$). Additionally, a significant correlation ($r = 0.712$, $p < 0.001$) was found between the FIST and the Functional Independence Measure (FIM), indicating that FIST is a valid measure of sitting balance and overall function.
- Construct validity is also supported by the ability of the FIST to distinguish between different neurological conditions. The study by Jehad Alzyoud et al. (2022) showed that FIST could effectively differentiate balance impairments in patients with stroke compared to healthy controls.

Minimal Detectable Change (MDC)

The Minimal Detectable Change (MDC) represents the smallest difference in FIST scores that reflects a real change in the patient's balance, rather than just measurement variability:

- The MDC provides clinicians with a threshold to determine whether observed changes in FIST scores are clinically meaningful. In a study by Jehad Alzyoud et al. (2022), an MDC of 3.9 points was reported for stroke patients, meaning any change below this value might not indicate a significant improvement in balance. Another study by Sharon L. Gorman et al. (2014) suggested an MDC of 2.18 points in patients with balance disorders, reinforcing the practical utility of FIST in tracking real changes in patient conditions.

In these study outcome measure used are as follows FIST, Sitting Balance Score(SBS), Functional Independence Measure (FIM), Berg Balance Scale (BBS), posturography assessment, Barthel Index, The modified Functional Reach Test and Modify the Motor Assessment Scale (MAS) Modify the Motor Assessment Scale (MAS) these scale is modify by V Jrgensen from 9 items MAS to 6 item It assesses static and proactive sitting balance control and takes 10 min to perform, less if the Participants cannot perform all tasks. Scores 1–3 are mainly related to static balance control, while scores 4–6 are mainly related to proactive balance control. The inter-rater reliability was for MAS (kw 0.83–0.91) and the validity was little to moderate[16].

Sitting Balance Measure (SBM) these scale was developed by G Wadhwa for SCI patients. Semi structured interviews and a study of the literature produced thirty-six items. The 24-item scale was developed through qualitative and quantitative content validation using expert opinion and the content validity ratio (CVR) approach. It was then pilot-tested on a purposeful sample of thirty SCI individuals. These studies came to the conclusion that SBM is a reliable scale for evaluating seated balance in SCI patients. SBM has a high level of internal consistency consistency[17].

Hand-Held Dynamometry in Individuals with Spinal Cord Injury in these studies Peak force has been measured as individuals tried to maintain a sitting posture using a hand-held dynamometer (HHD). Intrarater reliability was good to excellent intraclass correlation coefficients, 0.80–0.98[18].

Dynamic sitting balance tests these was developed by Kelly L. Gao et.al on chronic spinal cord injury. These study show moderate to excellent Reliability for both the wheelchair and the unsupported sitting[19].

Verheyden et al-. Aims to evaluate the trunk in patients who have suffered a stroke. The dynamic subscale contains items on lateral flexion of the trunk and unilateral lifting of the hip. To assess the coordination of the trunk, the subject is asked to rotate the upper or lower part of his or her trunk 6 times, initiating the movements either from the shoulder girdle or from the pelvic girdle, respectively. For each item, a 2-, 3- or 4-point ordinal scale is used. On the static and dynamic sitting balance and coordination subscales the maximal scores that can be attained are 7, 10 and 6 points. The total score for TIS ranges between 0 for a minimal performance to 23 for a perfect performance[20].

Conclusion

Since its development in 2010 Psychometric testing has not been done in wide variety of conditions leaving its potential use in question. More studies should be conducted to confirm the usability and Feasibility of this scale.

Reference

1. Wadhwa, G., Aikat, R. Development, validity and reliability of the 'Sitting Balance Measure' (SBM)

in spinal cord injury. Spinal Cord 54, 319–323 (2016)

2. Mancini M, Horak FB. The relevance of clinical balance assessment tools to differentiate balance deficits. Eur J Phys Rehabil Med. 2010;46(2): 239–248.
3. Lo J, Chan L, Flynn S. A systematic review of the incidence, prevalence, costs, and activity and work limitations of amputation, osteoarthritis, rheumatoid arthritis, back pain, multiple sclerosis, spinal cord injury, stroke, and traumatic brain injury in the United States: a 2019 update. Archives of physical medicine and rehabilitation. 2021 Jan 1;102(1):115-31.
4. Kamalakannan S, Gudlavalleti ASV, Gudlavalleti VSM, Goenka S, Kuper H. Incidence & prevalence of stroke in India: A systematic review. Indian J Med Res. 2017 Aug;146(2):175-185
5. Singhal BS. Multiple sclerosis--Indian experience. Annals of the Academy of Medicine, Singapore. 1985 Jan 1;14(1):32-6.
6. Louis-David Beaulieu, Véronique H. Flamand, Hugo Massé-Alarie, Cyril Schneider,Reliability and minimal detectable change of transcranial magnetic stimulation outcomes in healthy adults: A systematic review,Brain Stimulation,Volume 10, Issue 2, 2017,Pages 196-213,
7. Betsy D. M. Chaparro-Rico Test-Retest, Inter-Rater and Intra-Rater Reliability for Spatiotemporal Gait Parameters Using SANE (an easy gait analysis system) as Measuring Instrument. Applied sciences 2020, 10, 5781.
8. Andrade C. The Ceiling Effect, the Floor Effect, and the Importance of Active and Placebo Control Arms in Randomized Controlled Trials of an Investigational Drug. Indian J Psychol Med. 2021 Jul;43(4):360-361.
9. Gorman SL, Radtka S, Melnick ME, Abrams GM, Byl NN. Development and validation of the Function In Sitting Test in adults with acute stroke. J Neurol Phys Ther. 2010 Sep;34(3):150-60.
10. Gorman SL, Harro CC, Platko C, Greenwald C. Examining the function in sitting test for validity, responsiveness, and minimal clinically important difference in inpatient rehabilitation. Arch Phys Med Rehabil. 2014 Dec;95(12):2304-11.
11. Sung J, Ousley CM, Shen S, Isaacs ZJ, Sosnoff JJ, Rice LA. Reliability and validity of the function in sitting test in nonambulatory individuals with multiple sclerosis. Int J Rehabil Res. 2016 Dec;39(4):308-312.
12. Alzyoud J, Medley A, Thompson M, Csiza L. Responsiveness, minimal detectable change, and minimal clinically important difference of the sitting balance scale and function in sitting test in people with stroke. Physiother Theory Pract. 2022
13. Abou L, Sung J, Sosnoff JJ, Rice LA. Reliability and validity of the function in sitting test among non-ambulatory individuals with spinal cord injury. J Spinal Cord Med. 2020 Nov;43(6):846-853.
14. Palermo AE, Cahalin LP, Garcia KL, Nash MS. Psychometric Testing and Clinical Utility of a Modified Version of the Function in Sitting Test for Individuals With Chronic Spinal Cord Injury. Arch Phys Med Rehabil. 2020 Nov;101(11)
15. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, Tugwell P. The Newcastle-

Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses

16. V Jrogensen, B Elfving Assessment of unsupported sitting in patients with spinal cord injury . International Spinal Cord Society 2011, 49, 838–843.
17. Wadhwa G, Aikat R. Development, validity and reliability of the 'Sitting Balance Measure' (SBM) in spinal cord injury. Spinal Cord. 2016 Apr;54(4):319-23.
18. Larson CA, Tezak WD, Malley MS, Thornton W. Assessment of postural muscle strength in sitting: reliability of measures obtained with hand-held dynamometry in individuals with spinal cord injury. J Neurol Phys Ther. 2010 Mar;34(1):24-31.
19. Kelly L. Gao, K.M. Chan, Sheila Purves, William W.N. Tsang,Reliability of dynamic sitting balance tests and their correlations with functional mobility for wheelchair users with chronic spinal cord injury,Journal of Orthopaedic Translation, Volume 3, Issue 1,2015,Pages 44-49.
20. Verheyden G, Nieuwboer A, Mertin J, Preger R, Kiekens C, De Weerdt W. The Trunk Impairment Scale: a new tool to measure motor impairment of the trunk after stroke. Clin Rehabil. 2004 May;18(3):326-34.