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Validity and Reliability of 6 Minute Run Test in Community Adults with Sedentary Behaviour

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ABSTRACT

Background Sedentarism is the new pandemic, hence it has several negative aspects on the health of every individual whose working hours do not allow them to have proper exercises, hence increasing the risk of prospective cardio vascular implications. The standard gold standard physical marker to estimate the cardio vascular health is VO_2 Max. There are so many tests that can predict the value of VO_2 Max. However, the sedentary young adult population remains unaddressed. So, this study has determined the validity and also the reliability of a new tool which is 6 Minute Run Test for the said population. Also, this study had determined the linkages between sedentary behaviour amongst community adults. Objectives To assess the reliability and validity of the 6-minute run test against the 20-meter shuttle run test and to examine the contribution of daily sedentary behaviour to aerobic fitness in sedentary young adults (people ranging from age 18 to 40 years.) Methods A cross-sectional study was conducted among young adults aged 18–40 years recruited from hospital outpatient settings in Jhelum. Participants underwent anthropometric assessment, completed the International Physical Activity Questionnaire and Yale Leisure-time Sedentary Behaviour Questionnaire, performed two 6-minute run tests seven days apart, and one 20-meter shuttle run test. Perceived exertion was recorded using the Borg Rating of Perceived Exertion scale. VO_2 max was estimated from 6-minute run distance. Results The 6-minute run test demonstrated excellent test-retest reliability (Cronbach's $\alpha = 0.87$, ICC = 0.85) and strong concurrent validity with the 20-meter shuttle run test. ($r = 0.69$, $p < 0.001$). Estimated VO_2 max was nearly similar between the two tests (6MRT: 37.83 ± 4.08 ml/kg/min vs 20MST: 38.45 ± 4.31 ml/kg/min; mean difference = −0.62 ml/kg/min, $p = 0.218$). Daily sedentary hours showed moderate negative correlations with VO_2 max estimated by 6MRT ($r = -0.50$) and 20MST ($r = -0.52$), both $p < 0.001$. Conclusions The 6-minute run test is a reliable, valid, and practical field tool for aerobic assessment in resource-limited settings. Prolonged daily sedentary behaviour is the primary modifiable determinant of markedly reduced cardiorespiratory fitness in urban Pakistani young adults.

Keywords: Cardiorespiratory Fitness; Exercise Test; Oxygen Consumption; Pakistan; Reproducibility of Results; Running; Sedentary Behavior; Validation Study; Young Adult

Introduction

To predict the factors contributing to all-cause mortality rate and cardiovascular fitness in community adults is maximal oxygen uptake (VO_2 max) [1]. Increased VO_2 max (1 MET or 3.5 ml/kg/min) by one MET lowers the risk of mortality by 13 to 20% [2]. In sedentary adults, normal ranges of values are 25–40 ml/kg/min; values below 25 ml/kg/min are an indicator of high risk [3]. VO_2 max falls 5 -10 per cent decade in adulthood and is accelerated by lack of physical activity [4]. In 2022, 31 per cent of adults (~1.8 billion) in the world

were not actively enough, an increase of 5 per cent since 2010 and is expected to rise to 35 per cent by 2030 [5] A study reported the prevalence of over 40% in urban Pakistan, which is fueled by screen-based leisure and desk jobs [6]. VO_2 Max is the gold standard of laboratory measurement [7], which reduces VO_2 max and cardiometabolic risk in prolonged sedentary time, but is not affordable and unavailable in most low resource environments. The thesis thus, evaluated, in 107 sedentary Pakistani adults (18 to 40 years) at Imran Hospital and free medical camps. Correlation between daily time spent in sedentary positions and estimated VO_2 max. It also records field feasibility and safety of high-temperature field testing in resource-limiting hot conditions by undertaking the study in the intense hot season.

Objectives of Study

Primary Objectives: The Primary Objectives of this study are stated as follows;

- To assess validity of the six-minute run Test as an estimation tool for VO_2 max in adults with sedentary behavior.
- To determine the test-retest reliability of the 6MRT to estimate VO_2 max in adults with sedentary behavior.

Secondary Objectives: The Secondary Objectives of the study are as follows;

- To evaluate the sedentary behavior in community adults.
- To determine the relationship between aerobic capacity and sedentary behavior.

Materials and Methods

Study Design the Proposed Study is an Observational Study.

Study Setting the Study Took Place in the Rehabilitation Department of Imran Hospital Sohawa, District Jhelum with Multiple Free Medical Camp Sessions.

Study Duration

The study started from 01st December 2024 and ended on 30th November 2025.

Selection Criteria the Study has Inclusion as Well as Exclusion Criteria Described as Below,

Inclusion Criteria the Participants Recruited into this Study According to Following Inclusion Criteria;

- Participants must be in age between 18 and 40 years of both sexes.
- Participants with no physical disability.
- Low Physical Activity according to International Physical Questionnaire and Youth leisure time sedentary behaviour questionnaire.
- Participants with no comorbidities.

Exclusion Criteria

- Participants who have participated in any structured exercise program or intensive physical activity within the last month.
- Patients with known cardiac conditions that can affect the efficacy of the study.
- Pregnant females.
- Participants with cognitive disabilities and language barriers.
- Participants who are currently part of another clinical trial or research study.

Results

No formal a priori power calculation was conducted due to the exploratory nature of the study and logistical constraints. However, based on similar validation and reliability studies of field tests in sedentary adults (typically n = 80–120), we aimed for 100 completed participants. Allowing for an expected 10% dropout (mainly due to the 7-day return visit during hot weather), the recruitment target was set at 110–115 participants. We screened and enrolled 115 sedentary adults. Of these, 8 did not return for the second 6MRT (7% actual dropout), resulting in 107 fully completed cases (54 males, 53 females). All 107 completed both testing days with no missing test data. The mean age of the 107 participants was 30.5 ± 7.3 years (range: 18–40 years).

Discussion

The main goal of this study was to determine whether 6MRT is a valid and reliable tool for the estimation of VO_2 Max in community sedentary adults and prolonged sitting or sedentary behavior actually reduces aerobic capacity [8] in a young urban population and what is the relationship between sedentary behavior with overall aerobic capacity of a sedentary individual [9-61]. The results provide clear and consistent answers to all questions, while also highlighting some unique patterns that deserve attention meticulously. The 6-minute run test was performed remarkably well in study population. When the same individuals were tested again a week later, it demonstrated excellent repeatability and yielded nearly identical fitness estimates to the well-known 20-meter shuttle run test.

Conclusion

The study was able to prove that the 6-minute run test (6MRT) is a very valid and reliable field-based measurement of estimating VO 2max in young adults who are not exercising. The 6MRT demonstrated a high test-retest reliability (Cronbach's 0.87, ICC 0.85) and a good concurrent validity with the established 20-meter shuttle run test

(r = 0.69, p = 0.001), and no significant difference in the estimated VO_2 max between the two tests. These results prove that the 6MRT is a viable, inexpensive, and practical alternative to measure aerobic capacity in resource-constrained environments.

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Conflict of Interest

The authors declare no conflict of interest.

References

1. Senanayake SP, Dabare P, Silva ARN, Pushpika S, Maddumage R, et al. (2024) A Validation Study to Assess the Concurrent Validity of the Beep Test as a Proxy for Cardiopulmonary Endurance, Using VO_2 Max as the Criterion Standard. European Journal of Sport Sciences 3(1): 38-42.
2. Crowley E, Powell C, Carson BP, W Davies R (2022) The effect of exercise training intensity on VO_2 max in healthy adults: an overview of systematic reviews and meta-analyses. Translational sports medicine 2022(1): 9310710.
3. BUTTAR KK, KACKER S, SABOO N (2022) Normative Data of Maximal Oxygen Consumption (VO_2) population 13: 14.
4. Dupuy EG, Besnier F, Gagnon C, Breton J, Vincent T, et al. (2023) Cardiorespiratory fitness moderates the age-related association between executive functioning and mobility: evidence from remote assessments. Innovation in Aging 7(1): igac077.
5. (2024) Organization WH. Nearly 1.8 billion adults at risk of disease from not doing enough physical activity. World Health Organization Published June, p. 26.
6. Shah SAA, Rajpar S, Azim A, Khanzada AQ, Yousuf N, et al. (2025) DIGITAL SEDENTARISM AND MENTAL HEALTH: CAN PHYSICAL ACTIVITY OFFSET THE PSYCHOLOGICAL TOLL OF SCREEN-BASED LIFESTYLES IN URBAN PAKISTAN?. International Journal of Social Sciences Bulletin 3(5): 443-450.
7. Lee J, Zhang X (2021) Physiological determinants of VO_2 max and the methods to evaluate it: A critical review. Science & Sports 36(4): 259-271.
8. Pinto AJ, Bergouignan A, Dempsey PC, Roschel H, Owen N, et al. (2023) Physiology of sedentary behavior. Physiological Reviews 103(4): 2561-2622.
9. Thyfault JP, Du M, Kraus WE, Levine JA, Booth FW, et al. (2015) Physiology of sedentary behavior and its relationship to health outcomes. Medicine and science in sports and exercise 47(6): 1301-1305.
10. Boulay M, Hamel P, Simoneau J, Lortie G, Prud'Homme D, et al. (1984) A test of aerobic capacity: description and reliability. Can J Appl Sport Sci 9(3): 122-6.
11. Wagner PD (1996) A theoretical analysis of factors determining VO_2 max at sea level and altitude. Respiration physiology 106(3): 329-343.
12. Laukkanen JA, Pukkala E, Rauramaa R, Mäkikallio TH, Toriola AT, et al. (2010) Cardiorespiratory fitness, lifestyle factors and cancer risk and mortality in Finnish men. European journal of cancer 46(2): 355-363.
13. Wagner PD (2012) Muscle intracellular oxygenation during exercise: optimization for oxygen transport, metabolism, and adaptive change. European journal of applied physiology 112(1): 1-8.
14. Tanaka H, Monahan KD, Seals DR (2001) Age-predicted maximal heart rate revisited. Journal of the american college of cardiology 37(1): 153-156.
15. Magder S (2016) Volume and its relationship to cardiac output and venous return. Critical care 20(1): 271.
16. Rowell LB (1991) Blood pressure regulation during exercise. Annals of medicine 23(3): 329-333.
17. Pickering TG, Harshfield GA, Kleinert HD, Blank S, Laragh JH, et al. (1982) Blood pressure during normal daily activities, sleep, and exercise: comparison of values in normal and hypertensive subjects. Jama 247(7): 992-996.
18. Williams N (2017) The Borg rating of perceived exertion (RPE) scale. Occupational medicine 67(5): 404-405.
19. Martins LCG, Lopes MVdO, Diniz CM, Guedes NG (2021) The factors related to a sedentary lifestyle: A meta-analysis review. Journal of advanced nursing 77(3): 1188-1205.
20. Alcover S, Ramos-Regalado L, Girón G, Muñoz-García N, Vilahur G, et al. (2025) HDL-Cholesterol and Triglycerides Dynamics: Essential Players in Metabolic Syndrome. Antioxidants 14(4): 434.
21. Damayanti LS (2025) The impact of sedentary behavior on blood glucose levels in type 2 diabetes mellitus patients: A literature review. Journal of Evidence-based Nursing and Public Health 2(1): 34-52.
22. Fasipe B, Li S, Laher I (2023) Exercise and vascular function in sedentary lifestyles in humans. Pflügers Archiv-European Journal of Physiology 475(7): 845-856.
23. Cobos-Palacios L, Muñoz-Úbeda M, Gallardo-Escribano C, Ruiz-Moreno MI, Vilches-Pérez A, et al. (2022) Adipokines profile and inflammation biomarkers in prepubertal population with obesity and healthy metabolic state. Children 9(1): 42.
24. Cavallo FR, Golden C, Pearson-Stuttard J, Falconer C, Toumazou C, et al. (2022) The association between sedentary behaviour, physical activity and type 2 diabetes markers: a systematic review of mixed analytic approaches. PLoS One 17(5): e0268289.
25. Shibata A, Ishii K, Owen N, Oka K (2025) Sedentary Behavior and Health Consequences: A Systematic Scoping Review of Prospective and Longitudinal Studies in Japan. Journal of Epidemiology 36(1): 1-19.
26. Singh H, Esht V, Shaphe MA, Rathore N, Chahal A, et al. (2023) Relationship between body mass index and cardiorespiratory fitness to interpret health risks among sedentary university students from Northern India: A correlation study. Clinical Epidemiology and Global Health 20(1): 101254.
27. Yohannes M (2017) EXERCISE FOR HEALTH HAZARDS ASSOCIATED WITH TOO MUCH SITTING. Editorial Board 6(2):145.
28. Biddle SJ, Bennie JA, Bauman AE, Chau JY, Dunstan D, et al. (2016) Too much sitting and all-cause mortality: is there a causal link?. BMC public health 16(1): 635.
29. Tomkinson GR, Lang JJ, Blanchard J, Léger LA, Tremblay MS, et al. (2019)

The 20-m shuttle run: assessment and interpretation of data in relation to youth aerobic fitness and health. Pediatric exercise science 31(2): 152-163.

30. Biernat E, Stupnicki R, Lebiedziński B, Janczewska L (2008) Assessment of physical activity by applying IPAQ questionnaire. Physical Education and Sport 52(2): 83-89.
31. Cabanas-Sánchez V, Martínez-Gómez D, Esteban-Cornejo I, Castro-Piñero J, Conde-Caveda J, et al. (2018) Reliability and validity of the youth leisure-time sedentary behavior questionnaire (YLSBQ). Journal of science and medicine in sport 21(1): 69-74.
32. Balboa-Castillo T, Muñoz S, Serón P, Andrade-Mayorga O, Lavados-Romo P, et al. (2023) Validity and reliability of the international physical activity questionnaire short form in Chilean adults. PloS one 18(10): e0291604.
33. Atencio-Osorio MA, Carrillo-Arango HA, Correa-Rodríguez M, Rivera D, Castro-Piñero J, et al. (2021) Youth leisure-time sedentary behavior questionnaire (YLSBQ): reliability and validity in Colombian University students. International journal of environmental research and public health 18(15): 7895.
34. Spittaels H, Verloigne M, Gidlow C, Gloanec J, Titze S, et al. (2010) Measuring physical activity-related environmental factors: reliability and predictive validity of the European environmental questionnaire ALPHA. International Journal of Behavioral Nutrition and Physical Activity 7(1): 48.
35. Arifin WN (2018) A Web-based Sample Size Calculator for Reliability Studies. Education in medicine journal 10(3): 67-76.
36. Maxwell SE (2000) Sample size and multiple regression analysis. Psychological methods 5(4): 434-458.
37. Chaparro-Rico BD, Cafolla D (2020) Test-retest, inter-rater and intra-rater reliability for spatiotemporal gait parameters using SANE (an eaSy gAit aNalysis systEm) as measuring instrument. Applied Sciences 10(17): 5781.
38. Karlsen A, Racinais S, Jensen M, Nørgaard S, Bonne T, et al. (2015) Heat acclimatization does not improve VO_2 max or cycling performance in a cool climate in trained cyclists. Scandinavian Journal of Medicine & Science in Sports 25: 269-276.
39. Owen N, Healy GN, Matthews CE, Dunstan DW (2010) Too much sitting: the population health science of sedentary behavior. Exercise and sport sciences reviews 38(3): 105-113.
40. Smith L, Hamer M, Ucci M, Marmot A, Gardner B, et al. (2015) Weekday and weekend patterns of objectively measured sitting, standing, and stepping in a sample of office-based workers: the active buildings study. BMC public health 15(1): 9.
41. Biddle SJ, Marshall SJ, Gorely T, Cameron N (2009) Temporal and environmental patterns of sedentary and active behaviors during adolescents' leisure time. International journal of behavioral medicine 16(3): 278-286.
42. Ferguson T, Curtis R, Fraysse F, Lagisetí R, Northcott C, et al. (2021) Annual, seasonal, cultural and vacation patterns in sleep, sedentary behaviour and physical activity: a systematic review and meta-analysis. BMC public health 21(1): 1384.
43. Hue O (2011) The challenge of performing aerobic exercise in tropical environments: Applied knowledge and perspectives. International Journal of Sports Physiology and Performance 6(4): 443-454.
44. Franklin BA (2011) Health implications of low cardiorespiratory fitness, too little exercise, and too much sitting time: changing paradigms and perceptions. American Journal of Health Promotion 25(4): exi-exv.
45. O'Donoghue G, Perchoux C, Mensah K, Lakerveld J, van Der Ploeg H, et al. (2016) A systematic review of correlates of sedentary behaviour in adults aged 18–65 years: a socio-ecological approach. BMC public health 16(1): 163.
46. Leuschner M, Grauduszus M, Friesen D, Ferrari N, Klaudius M, et al. (2024) The 6-minute Run Test: Validation and Reference Equations for Adults. International journal of sports medicine 45(03): 222-230.
47. Williams CA, Oades PJ (2021) Exercise and respiratory diseases in paediatrics: Routledge.
48. Harber MP, Myers J, Bonikowske AR, Muntaner-Mas A, Molina-Garcia P, et al. (2024) Assessing cardiorespiratory fitness in clinical and community settings: Lessons and advancements in the 100th year anniversary of VO_2 max. Progress in Cardiovascular Diseases 83: 36-42.
49. Dos Santos M, Ferrari G, Lee DH, Rey-López JP, Aune D, et al. (2022) Association of the "weekend warrior" and other leisure-time physical activity patterns with all-cause and cause-specific mortality: a nationwide cohort study. JAMA Internal Medicine 182(8): 840-848.
50. Brawner CA, Keteyian SJ (2025) In: Eds. Sedentary During the Week, but Active on the Weekend... Is the "Weekend Warrior" Pattern of Activity a Good Recommendation? Mayo Clinic Proceedings; Elsevier.
51. Weston G, Zilanawala A, Webb E, Carvalho L, McMunn A, et al. (2024) Work hours, weekend working, nonstandard work schedules and sleep quantity and quality: findings from the UK household longitudinal study. BMC public health 24(1): 309.
52. Jha JP, Chaudhary HP, Pun DB, Joshi LR, Amgain K, et al. (2025) Physical activity, sleep pattern and screen usage in undergraduate health-science students of Nepal–a cross-sectional study. medRxiv.
53. Morgan TL, Fortier MS, Jain R, Lane KN, Maclaren K, et al. Original mixed methods research Development of the Whole Day Matters Toolkit for Primary Care: a consensus-building study to mobilize national public health guidelines in practice.
54. Ayala E (2021) Clinical Determinants of VO_2 max Response to Endurance Training: Heritage Family Study: University of South Carolina.
55. O'Brien MW, Shivgulam ME, Petterson JL, Wu Y, Frayne RJ, et al. (2022) Habitual sedentary time and stationary time are inversely related to aerobic fitness. Sports medicine and health science 4(4): 260-266.
56. Redondo-Flórez L, Ramos-Campo DJ, Clemente-Suárez VJ (2022) Relationship between physical fitness and academic performance in university students. International journal of environmental research and public health 19(22): 14750.
57. Alhumary FM, Rahayu T, Akhiruyanto A, Junaidi S, Setyawati H, et al. (2025) Evaluating the impact of Physical Education on sedentary lifestyles in Indonesian students. Retos: nuevas tendencias en educación física, deporte y recreación (67): 1174-1190.
58. Teh WL, Abdin E, PV A, Siva Kumar FD, Roystonn K, et al. (2023) Measuring social desirability bias in a multi-ethnic cohort sample: its relationship with self-reported physical activity, dietary habits, and factor structure. BMC Public Health 23(1): 415.
59. Aftab A, Habibullah S, Bhutta NI (2021) Effects of fragility fracture integrated rehabilitation management hip fracture in pakistani older adults: soi: 21-2017/re-trjvol05iss01p192. The Rehabilitation Journal 5(01): 192-197.
60. Lim S-K, Beom J, Lee SY, Kim BR, Ha Y-C, et al. (2025) Efficacy of Fragility Fracture Integrated Rehabilitation Management in Older Adults with Hip Fractures: A Randomized Controlled Trial With 1-Year Follow-Up. Journal of the American Medical Directors Association 26(1): 105321.

61. Vluggen TP, van Haastregt JC, Tan FE, Verbunt JA, van Heugten CM, et al. (2021) Effectiveness of an integrated multidisciplinary geriatric rehabilitation programme for older persons with stroke: a multicentre randomised controlled trial. BMC geriatrics 21(1): 134.

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