



CORRELATION BETWEEN TWO CHAIR TEST WITH SIX MINUTE WALK TEST IN YOUNG ADULTS

Physiotherapy

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ABSTRACT

Background: The Six-Minute Walk Test (6MWT) is widely used to assess functional capacity and cardiopulmonary reserve, but it has logistical limitations such as space and time requirements. The Two-Chair Test (2CT) is proposed as an alternative that is simpler, space-efficient, and easier to administer. **Objective:** To evaluate the correlation between the 2CT and 6MWT in young adults by analyzing post-exercise changes in physiological parameters, including pulse rate (PR) and arterial oxygen saturation (SpO₂). **Methods:** This prospective crossover study included 300 young adults (mean age 24.14 ± 3.65 years, 163 females and 136 males). Participants underwent both the 2CT and 6MWT in a randomized sequence. PR and SpO₂ were measured at baseline, immediately post-exercise, and during recovery. Correlations between the two tests were analyzed to determine their comparability. **Results:** Baseline SpO₂ levels were high for both tests (99.91% for 2CT and 99.84% for 6MWT), with minimal declines post-exercise and during recovery. Baseline PR was higher in 2CT (82.29 bpm) compared to 6MWT (67.49 bpm). Both tests elicited significant increases in PR post-exercise, with comparable recovery trends. Strong positive correlations were observed between the two tests for PR and SpO₂ across time intervals, confirming their similar physiological impacts. **Conclusion:** The 2CT demonstrated significant correlation with the 6MWT in terms of post-exercise PR and SpO₂ responses, validating its use as an alternative for assessing functional capacity in young adults. Its simplicity and minimal space requirements make it a valuable tool in clinical and resource-limited settings. Future research should focus on extending these findings to older and diseased populations.

KEYWORDS

Two-Chair Test (2CT), Six-Minute Walk Test (6MWT), functional capacity, pulse rate, oxygen saturation, cardiopulmonary reserve.

INTRODUCTION

Functional walk tests are widely used to evaluate functional status, monitor treatment effectiveness, and establish prognosis in clinical settings. Among these, the six-minute walk test (6MWT) is one of the most commonly employed due to its simplicity, cost-effectiveness, and ability to reflect the integrated physiological response of multiple systems, including pulmonary, cardiovascular, and muscular systems. The 6MWT measures the distance walked within six minutes and is considered a submaximal exercise test that correlates well with functional capacity and mobility-related functions. It is extensively validated and used across diverse populations, including young adults, the elderly, and patients with cardiopulmonary diseases. However, the 6MWT has certain logistical limitations, including the need for a 30-meter unobstructed corridor, time constraints, and difficulties in administering it to individuals with severely limited mobility. These challenges highlight the need for alternative tests that are simpler, require minimal resources, and can be conducted in constrained spaces. The Two Chair Test (2CT) has been proposed as a novel substitute for the 6MWT, particularly in settings where space and time are limited. The 2CT involves the participant sitting and moving between two chairs placed 5 feet apart and measuring post-exercise changes in pulse rate (PR) and oxygen saturation (SpO₂). It is simple, reproducible, and cardiopulmonary reserve-specific, making it a potential alternative to the 6MWT.

The 6MWT has demonstrated its utility as a predictor of mortality in conditions like chronic obstructive pulmonary disease (COPD), heart failure, and pulmonary hypertension. It is also used to assess functional capacity before and after interventions, including pulmonary rehabilitation and surgical procedures. Similarly, the 2CT integrates the global physiological response to exercise but measures PR and SpO₂ changes post-exercise rather than distance walked. These parameters may provide critical insights into an individual's cardiopulmonary reserve and recovery response. To date, limited research has been conducted to evaluate the correlation between the 2CT and 6MWT, particularly in young adults. Understanding this relationship is essential to establish the validity of the 2CT as a substitute for the 6MWT. This study aims to address this gap by assessing the performance of the 2CT in comparison with the 6MWT in terms of post-exercise changes in PR and SpO₂ in young adults. The findings could provide a foundation for broader clinical applications of the 2CT, especially in resource-limited settings. The primary aim of this study was to determine the relationship between the 2CT and 6MWT in evaluating functional capacity in young adults. Specifically,

this study sought to: (1) evaluate the effects of the 2CT on PR and SpO₂ at various time intervals, (2) assess the effects of the 6MWT on the same parameters, and (3) explore the correlation between the two tests for post-exercise physiological changes. By addressing these objectives, the study aims to validate the 2CT as a practical and efficient alternative to the 6MWT in assessing functional capacity.

MATERIALS AND METHODS

This prospective cross-over study, titled "*Correlation Between Two Chair Test and Six-Minute Walk Test in Young Adults*," was conducted between August 2023 and October 2024 at the College of Physiotherapy, Pt. B. D. Sharma PGIMS Rohtak. Ethical approval was obtained from the Institutional Biomedical Research Ethical Committee (Reference No. BREC/23/TH-Physiotherapy/04), and written informed consent was secured from all participants. A total of 300 young adults were recruited through random sampling using a computer-generated random number table. Participants aged between 18 and 35 years, physically active, and of either gender were included. Individuals unable to provide consent, smokers, or those with medical, psychiatric, or musculoskeletal conditions affecting exercise capacity were excluded. The study aimed to evaluate the correlation between the Two Chair Test (2CT) and Six-Minute Walk Test (6MWT) in terms of post-exercise physiological parameters, including pulse rate (PR) and oxygen saturation (SpO₂). Baseline PR and SpO₂ were measured after participants rested until their vitals stabilized for at least 30 seconds. Participants performed both tests with a 30-minute rest interval between them. The 2CT involved participants alternately sitting and walking between two chairs placed 5 feet apart.

Each participant completed five repetitions at their own pace. PR and SpO₂ were measured immediately after completing the test. Oxygen supplementation was provided in cases of severe desaturation (SpO₂ < 80%) or prolonged recovery times (>30 seconds). The 6MWT was conducted following international guidelines on a marked 30-meter indoor corridor. Participants were instructed to walk as far as possible within 6 minutes, with PR and SpO₂ measured before and after the test. The total distance walked was recorded, and desaturation was defined as SpO₂ < 90%. Outcome measures included post-exercise PR and SpO₂, recorded at 10-second intervals for 2 minutes following each test. Statistical analysis was performed to evaluate the correlation between the 2CT and 6MWT, using PR and SpO₂ as dependent variables. This methodology aimed to establish the validity and reliability of the 2CT as an alternative to the 6MWT in assessing functional capacity in young adults.

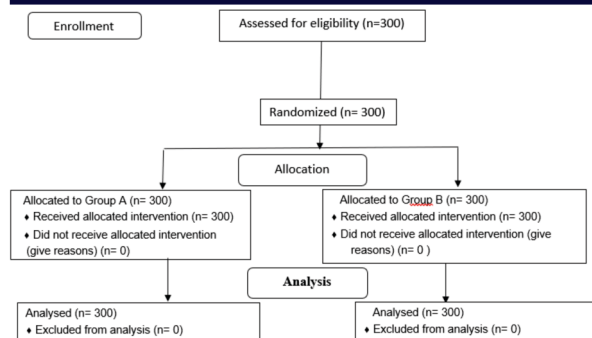


Figure 1.1 Flow Diagram of methodology of the study

RESULT

In the present study, Data was analyzed by using statistical analysis software like SPSS. Mean $\pm$ SD will be calculated for demographic data and outcome variables. Independent Sample T-test and Paired T-test was used to compare difference between mean values obtained from pulse rate and arterial oxygen saturation with two chair test and six minute walk test. Karl Pearson's rank correlation coefficient was used to calculate correlation between two chair test and six minute walk test for post exercise changes in pulse rate and arterial oxygen saturation.

Demographic Presentation Of Data

Table 1.1: Age Wise Distribution Of Young Adults

Age Group	Frequency	Percentage
18-25	181	60.3
26-30	108	36
31-35	11	3.7

Table 1.2 Gender Wise Distribution Of Young Adults

Gender	Frequency	Percentage
Male	137	45.7%
Female	163	54.3%

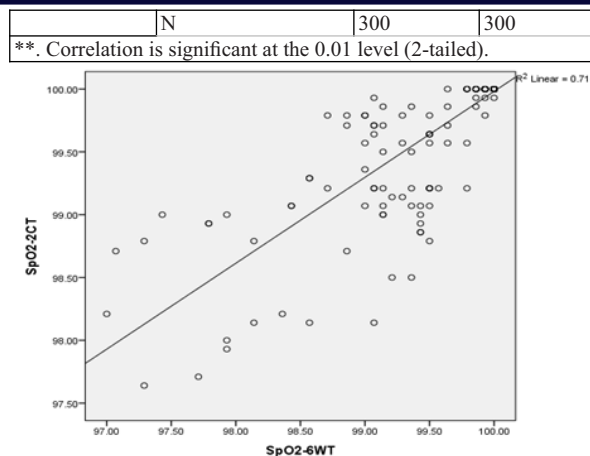
A total of 300 participants aged 18 to 35 years were included in the study, with the majority (60.3%) between 18 and 25 years of age. Of these, 163 (54.3%) were females, and 136 (45.3%) were males. Statistical analysis using SPSS software revealed the mean $\pm$ standard deviation (SD) for oxygen saturation (SpO₂) and pulse rate (PR) during the Two Chair Test (2CT) and Six Minute Walk Test (6MWT) at various time intervals.

Table 1.3: Comparison Of Mean (Mean $\pm$ S.D.) Values Of Oxygen Saturation (SpO₂) In 2CT And 6MWT At Different Time Intervals

Time	Test Type						t-value	p-value
	2CT			6WT				
	N	Mean	SD	N	Mean	SD		
Pre SPO ₂ (%)	300	99.91	.41	300	99.84	.50	1.865	.063
Just after ex.	300	99.71	.45	300	99.68	.68	.637	.524
10s	300	99.74	.84	300	99.67	.64	1.148	.251
20s	300	99.70	.69	300	99.70	.69	.059	.953
30s	300	99.72	.66	300	99.68	.76	.635	.526
40s	300	99.73	.62	300	99.63	.75	1.832	.067
50s	300	99.73	.66	300	99.65	.75	1.394	.164
60s	300	99.77	.53	300	99.68	.71	1.892	.059
70s	300	99.76	.56	300	99.67	.69	1.680	.093
80s	300	99.76	.60	300	99.66	.73	1.776	.076
90s	300	99.73	.61	300	99.72	.68	.189	.850
100s	300	99.85	.48	300	99.76	.64	1.951	.052
110s	300	99.77	.62	300	99.80	.57	.479	.632
120s	300	99.84	.53	300	99.75	.60	1.953	.051

Table 1.4: Correlation Of Mean $\pm$ S.D. Values Of Oxygen Saturation (SpO₂) Values Of 2CT And 6MWT

Correlations			
		SpO ₂ -2CT	SpO ₂ -6WT
SpO ₂ -2CT	Pearson Correlation	1	.845**
	p-value		.000
	N	600	300
SpO ₂ -6WT	Pearson Correlation	.845**	1
	p-value	.000	



Correlation Of Mean Values Oxygen Saturation (SpO₂) Values Of 2CT and 6MWT

For SpO₂, mean values across all time points for both tests were statistically non-significant ($p > 0.05$). In the 2CT, the mean SpO₂ ranged from 99.91 ± 0.41 at pre-exercise to 99.84 ± 0.53 at 120 seconds post-exercise. Similarly, in the 6MWT, the mean SpO₂ ranged from 99.84 ± 0.50 at pre-exercise to 99.75 ± 0.60 at 120 seconds. The comparison of Δ SpO₂ between the two tests also revealed no significant differences ($p > 0.05$). Pearson's correlation analysis showed a strong positive relationship between SpO₂ values in the 2CT and 6MWT across all time points, with correlation coefficients ranging from 0.370 to 0.723. The strongest correlation ($r = 0.723$) was observed at 70 seconds, with a robust overall correlation ($r = 0.845$) between mean SpO₂ values of the two tests. For PR, mean values across time intervals were also statistically non-significant ($p > 0.05$). In the 2CT, PR increased from a pre-exercise mean of 82.29 ± 12.33 to 92.32 ± 13.67 at 120 seconds post-exercise. In the 6MWT, PR increased from a pre-exercise mean of 67.49 ± 11.18 to 88.62 ± 15.93 at 120 seconds.

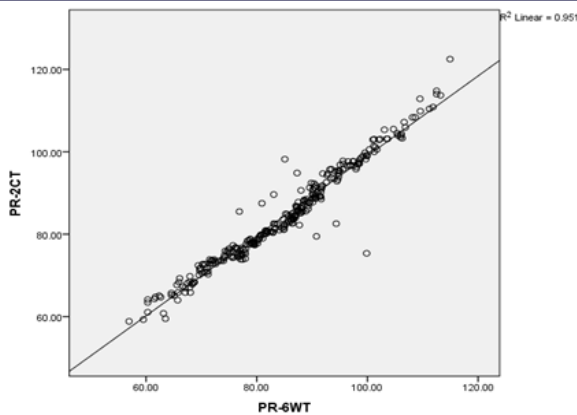
Table 1.5: Comparison Of Mean (mean $\pm$ S.D.) Values Of Pulse Rate (PR) In 2CT And 6MWT

Time	Test Type						t- value	p- value
	2CT			6WT				
	N	Mean	SD	N	Mean	SD		
Pre PR (bpm)	300	82.29	12.33	300	67.49	11.18	14.12	.088
Just after ex.	300	81.79	15.56	300	70.57	12.68	11.27	.078
10s	300	81.16	13.64	300	73.31	11.99	7.57	.089
20s	300	82.06	12.38	300	75.51	11.64	7.36	.091
30s	300	81.03	12.11	300	78.16	11.91	3.33	.093
40s	300	81.97	11.80	300	80.31	12.40	1.680	.094
50s	300	83.20	12.27	300	82.85	12.72	.346	.729
60s	300	84.72	12.56	300	85.86	13.39	1.072	.284
70s	300	85.84	12.73	300	88.80	13.86	2.722	.087
80s	300	87.13	12.87	300	76.53	14.35	11.50	.079
90s	300	88.70	12.90	300	75.52	14.65	13.65	.080
100s	300	90.15	12.99	300	82.10	15.13	8.031	.082
110s	300	91.26	13.31	300	81.80	15.50	10.41	.083
120s	300	92.32	13.67	300	88.62	15.93	4.67	.091

Table 1.6: Correlation of mean (mean $\pm$ S.D.) values pulse rate (PR) values of 2CT and 6MWT

Correlations			
		PR-2CT	PR-6WT
PR-2CT	Pearson Correlation	1	.975**
	p-value		.000
PR-6WT	N	600	300
	Pearson Correlation	.975**	1
	p-value	.000	
		300	300

** . Correlation is significant at the 0.01 level (2-tailed).



Correlation Of Mean (mean $\pm$ S.D.) Values Pulse Rate (PR) Values Of 2CT And 6MWT

The comparison of Δ PR between the tests was statistically significant ($p < 0.05$), indicating notable variations in PR responses. Pearson's correlation analysis revealed a strong positive relationship between PR values of the 2CT and 6MWT across time intervals, with coefficients ranging from 0.654 to 0.948. The strongest correlation ($r = 0.948$) was observed at 50 seconds, with an overall correlation of $r = 0.975$ between mean PR values of the two tests.

These findings demonstrate that the 2CT and 6MWT elicit similar physiological responses in terms of SpO₂ and PR, with strong positive correlations observed between the two tests. These results support the potential use of the 2CT as a viable alternative to the 6MWT for assessing functional capacity and recovery response, particularly in settings with logistical constraints.

DISCUSSION

The present study compared the physiological responses of the Two-Chair Test (2CT) and the Six-Minute Walk Test (6MWT) in young adults, focusing on oxygen saturation (SpO₂) and pulse rate (PR) as indicators of cardiorespiratory fitness. The findings support the utility of both tests in assessing exercise-induced physiological changes and provide valuable insights for clinical and functional fitness evaluations.

Oxygen Saturation (SpO₂) Dynamics

The study demonstrated consistently high SpO₂ levels across both the 2CT and 6MWT, with minimal declines immediately post-exercise and rapid recovery thereafter. These results align with existing literature highlighting the robustness of SpO₂ as a marker of aerobic capacity in young adults with no significant cardiorespiratory limitations. For instance, the slight but transient post-exercise decline observed in this study mirrors findings by Bhattacharyya et al. (2020), who noted the reliability of simpler tests like the 2CT for assessing oxygen dynamics.

The comparable SpO₂ responses between the 2CT and 6MWT reinforce the hypothesis that shorter, space-efficient tests like the 2CT can serve as effective alternatives to traditional endurance tests such as the 6MWT. This finding aligns with prior research by Gurses et al. (2018) and Rehman et al. (2019), which emphasized the practicality and clinical relevance of shorter functional tests. The absence of statistically significant differences in SpO₂ fluctuations ($p > 0.05$) between the two tests further underscores their equivalence in evaluating oxygen transport and utilization during physical activity.

Pulse Rate (PR) Response and Correlation

Pulse rate analysis revealed expected trends of increased PR immediately following exercise, with subsequent stabilization. Both the 2CT and 6MWT elicited comparable cardiovascular responses, as evidenced by non-significant differences in PR changes and strong positive correlations ($r > 0.7$) across time intervals. The higher baseline PR in the 2CT group compared to the 6MWT group may reflect differing pre-test conditions or variations in participant readiness, but this discrepancy did not affect the overall comparability of the tests.

These results corroborate findings from previous studies, including Bhattacharyya et al. (2020) and Gill et al. (2022), which highlighted

the reliability of simple functional tests like the 30-Second Chair Stand Test (30CST) in capturing cardiovascular responses. The close correlation ($r = 0.975$) between mean PR values in the 2CT and 6MWT supports their interchangeable use in clinical settings, particularly for populations where endurance tests may be impractical or contraindicated.

Clinical Implications

The equivalence of the 2CT and 6MWT in assessing SpO₂ and PR has significant clinical implications. The 2CT, as a shorter and less resource-intensive test, holds promise for use in settings with limited space or equipment, such as outpatient clinics and telemedicine platforms. Its feasibility makes it a valuable tool for monitoring real-time cardiorespiratory health in patients with pulmonary or cardiovascular conditions.

The findings further validate the use of functional tests to guide rehabilitation planning and evaluate treatment efficacy. For instance, the rapid recovery of SpO₂ and PR observed in the study indicates effective cardiovascular regulation and aerobic fitness, suggesting that these metrics could serve as benchmarks for assessing functional improvement over time.

CONCLUSION

In conclusion, the findings of present study lead us to accept the alternative hypothesis that there is significant correlation between two chair test with six minute walk test in terms of post exercise impact on pulse rate and saturation pressure of oxygen in young adults.

Limitations Of The Study

The study primarily focused on young adults aged 18 to 35, which may not represent the physiological and psychological responses of geriatric populations, limiting the applicability of the findings to all age groups. One limitation of this study is that it does not assess functional capacity using the two chair test (2CT) and the six minute walk test (6MWT). Future research will be conducted to address this.

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Declaration

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Conflict of interest: None declared

Ethical approval:

REFERENCES

- Gurses HN, Zeren M, Kulli HD, Durgut E. The relationship of sit-to-stand tests with 6-minute walk test in healthy young adults. *Medicine*. 2018;97(1).
- Rehman ST, Khan MA, Qureshi MA. Correlation of sit to stand test with six minute walk test in chronic obstructive pulmonary disease patients. *IJMRHS*. 2019;8(12):86-91.
- Bhattacharyya P, Saha D, Paul M, Ganguly D, Mukherjee B, et al. Two chair test: a substitute of 6 min walk test appear cardiopulmonary reserve specific. *BMJ Open Res*. 2020;7.
- Gill S, Hely R, Page RS, Hely A, Harrison B, Landers S. Thirty second chair stand test: Test-retest reliability, agreement and minimum detectable change in people with early-stage knee osteoarthritis. *Physiother Res Int*. 2022;27:1-7.
- Van STEL HF, BOGAARD JM, RIJSENBEEK-NOUWENS LH, COLLAND VT. Multivariable assessment of the 6-min walking test in patients with chronic obstructive pulmonary disease. *AJRCCM*. 2001;163(7):1567-71.
- Pinto-Plata VM, Cote C, Cabral H, Taylor J, Celli BR. The 6-min walk distance: change over time and value as a predictor of survival in severe COPD. *Eur Respir J*. 2004;23(1):28-33.
- Harada ND, Chiu V, Stewart AL. Mobility-related function in older adults: assessment with a 6-minute walk test. *Arch Phys Med Rehabil*. 1999;80(7):837-41.
- Van Gestel AJ, Clarenbach CF, Stöwhas AC, Rossi VA, Sievi NA, et al. Predicting daily physical activity in patients with chronic obstructive pulmonary disease. *PLoS One*. 2012;7(11).
- Kervio G, Carre F, Ville NS. Reliability and intensity of the six-minute walk test in healthy elderly subjects. *MSSE*. 2003;35(1):169-74.
- Zanini, Andrea, et al. The one repetition maximum test and the sit-to-stand test in the assessment of a specific pulmonary rehabilitation program on peripheral muscle strength in COPD patients. *Int J Chron Obstruct Pulmon Dis*. 2015: 2423-2430.
- Solway S, Brooks D, Lacasse Y, Thomas S. A qualitative systematic overview of the measurement properties of functional walk tests used in the cardiorespiratory domain. *Chest*. 2001 Jan 1;119(1):256-70.
- Ansdell P, Thomas K, Hicks KM, Hunter SK, Howatson G, Goodall S. Physiological sex differences affect the integrative response to exercise: acute and chronic implications. *Experimental physiology*. 2020 Dec;105(12):2007-21.
- Bonilla AV, González-Custodio A, Timón R, Cardenosa A, Camacho-Cardenosa M, Oleina G. Training zones through muscle oxygen saturation during a graded exercise test in cyclists and triathletes. *Biology of Sport*. 2022;40(2):439-48.
- Wickham KA, McCarthy DG, Spriet LL, Cheung SS. Sex differences in the physiological responses to exercise-induced dehydration: consequences and mechanisms. *Journal of applied physiology*. 2021 Aug 5.
- Bohannon RW, Crouch R. Minimal clinically important difference for change in 6-minute walk test distance of adults with pathology: a systematic review. *Journal of evaluation in clinical practice*. 2017 Apr;23(2):377-81.

16. Martín-Escudero P, Cabanas AM, Fuentes-Ferrer M, Galindo-Canales M. Oxygen saturation behavior by pulse oximetry in female athletes: breaking myths. *Biosensors*. 2021 Oct 14;11(10):391.
17. Geiger R, Strasak A, Trembl B, Gasser K, Kleinsasser A, Fischer V, Geiger H, Loeckinger A, Stein JI. Six-minute walk test in children and adolescents. *The Journal of pediatrics*. 2007 Apr 1;150(4):395-9.