

Article

Short Versus Standard Corridor Six-Minute Walk Test in Older Adults with Controlled Arterial Hypertension: Clinical Agreement and Determinants of Performance

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Abstract

Arterial hypertension (AH) is strongly associated with reduced functional capacity and elevated cardiovascular risk. The Six-Minute Walk Test (6MWT) assesses submaximal exercise capacity; however, the standard 30 m walkway is often unavailable in clinical settings, necessitating the use of shorter corridors. Evidence regarding the agreement between different walkway lengths in hypertensive populations remains limited. This study investigated the agreement between 15 m and 30 m 6MWT protocols in 23 older adults with medically controlled AH (13 men, 10 women; age 74.04 ± 8.89 years) in randomized order. Anthropometric, cardiovascular, physical activity (IPAQ), and health-related quality of life (SF-36) data were collected. Results showed significantly greater walking distances on the 30 m walkway ($p < 0.001$). Moderate agreement was observed between protocols (ICC = 0.65), with Bland–Altman analysis demonstrating systematically higher distances on the 30 m walkway. Age was negatively correlated with performance, while height and SF-36 physical functioning showed positive correlations ($p < 0.05$). Distinct regression models for each protocol suggest walkway-specific performance determinants. Although the 15 m protocol demonstrated acceptable agreement, it should not be used interchangeably with the standard 30 m protocol in older adults with controlled arterial hypertension. Further research is required to better understand the relationship between the two protocols.

Keywords: 6 min walk test; hypertension; corridor length; track length; agreement; predictors; determinants; functional capacity



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1. Introduction

Despite substantial advances in pharmacological management, arterial hypertension (AH) remains a major contributor to cardiovascular morbidity and mortality worldwide. However, less than half of AH cases have been diagnosed and received treatment [1]. Similarly, in Greece, epidemiological data highlight the severity of the disease, as it is estimated that four out of 10 adults suffer from AH, with only one-third of the diagnosed hypertensive patients being able to regulate and control their blood pressure (BP) through treatment [2].

Uncontrolled AH can lead to severe complications, including atherosclerotic disease, angina, myocardial infarction, arrhythmias, and sudden cardiac death. Furthermore, elevated pressure can be a risk factor for strokes and renal failure [1]. In light of these risks, AH necessitates consistent monitoring and appropriate management. A key requirement for effective treatment is a thorough patient assessment, which—particularly in elderly populations—should also incorporate an evaluation of their functional status [3].

The assessment of elderly hypertensive patients should be multidimensional, addressing several factors such as their medical and lifestyle history, physical examination, laboratory testing and functional ability. Unfortunately, issues such as time constraints or high costs may hinder the aforementioned procedures; thus, highlighting the need for simple, rapid, and easily accessible methods for functional assessment. Examples of tools suitable for use in individuals with hypertension include the Duke Activity Status Index (DASI) [4], the Incremental Shuttle Walking Test (ISWT) [5] and the Six-Minute Walk Test (6MWT) [6].

Among the field-based tests used to evaluate functional exercise capacity, the 6MWT test is one of the most widely adopted. It reflects activities performed in daily life while requiring minimal equipment and personnel, and can be readily administered across a range of clinical and research settings [7,8]. Data from a recent meta-analysis further support the validity and reliability of the 6MWT compared to cardiopulmonary exercise testing in individuals with heart failure [9].

Despite the wide acceptability of the 6MWT as a practical measure of functional capacity, its implementation may be restrained by factors such as limited indoor space, time restrictions, and differences in clinical infrastructure. In order to address the aforementioned challenges, alternative configurations are proposed, such as the three-minute walk test (3MWT) and the 6MWT on 10, 15, or 20 m walkways [10–12]; abbreviated walking tests; treadmill-based protocols [13]; and remotely administered assessments [14]. Although these adaptations may act as an adjunct to a conventional 6MWT, the modifications that they apply to test procedures can influence performance outcomes and alter the measurement properties of the test, thus making an evaluation of each modified protocol within the specific population target a prerequisite. Despite the widespread prevalence of arterial hypertension, evidence regarding the validity and comparability of shorter corridor 6MWT protocols in this population remains scarce.

In addition to psychometric properties, it is equally important to identify factors that may influence test outcomes. Previous investigations conducted in cardiovascular and pulmonary populations have demonstrated that demographic characteristics, anthropometric measurements, and patient-reported outcomes may substantially influence walking distance [15,16]. Despite differences in study samples and underlying pathologies, variables such as body mass index (BMI) and age emerge as determinant factors that can affect performance in the 6MWT over a 30 m corridor. However, most available data come from studies employing the standard 30 m walkway, whereas little is known about whether similar results will be derived when shorter corridors are used. This distinction is clinically relevant because shorter walkways require more frequent turns and may introduce additional biomechanical and balance-related demands. Thus, the main aim of this study was (a) to compare the distance covered during the Six-Minute Walk Test (6MWT) on two different walkway lengths (15 m and 30 m), (b) to evaluate the level of agreement between the two protocols, and (c) to explore factors associated with performance in patients with diagnosed and medically controlled arterial hypertension.

2. Materials and Methods

2.1. Study Design

This study employed a randomized crossover design and was conducted at the Department of Physiotherapy, University of Thessaly, over a three-month period (February–April 2025). The study protocol was approved by the Ethics Committee of the Department of Physiotherapy, University of Thessaly (Approval No. 22513/25/21-07-25), and was conducted in accordance with the Declaration of Helsinki.

2.2. Participants

Eligibility criteria included: (a) diagnosed and medically controlled arterial hypertension, (b) age ≥ 18 years, (c) native Greek speakers (required for questionnaire administration), and (d) absence of cognitive impairment. Although adults aged ≥ 18 years were eligible, all participants recruited during the study period were older adults; therefore, the findings primarily apply to this age group.

Exclusion criteria were: (a) implanted cardiac devices (pacemaker/defibrillator), (b) neurological or orthopedic conditions affecting walking ability, (c) uncontrolled hypertension ($>160/100$ mmHg), (d) severe cardiovascular or respiratory disease (e.g., recent myocardial infarction or unstable angina), and (e) severe psychiatric or other conditions affecting participation.

Participants continued their usual antihypertensive medication regimen during the study.

2.3. Experimental Procedure

Anthropometric measurements (height, body weight, and waist circumference) were recorded during the initial assessment. Height was measured using a SOEHNLE 5003 ultrasonic stadiometer (Soehnle Industrial Solutions GmbH, Backnang, Germany) and body weight using a TANITA BC-418MA electronic scale (Tanita Corporation, Tokyo, Japan). Participants stood barefoot in an upright position during measurements.

Participants performed the 6MWT under two conditions: (a) 15 m corridor and (b) 30 m corridor. Both tests were conducted indoors under controlled environmental conditions. Testing was carried out on indoor walkways with level surfaces and clearly defined turning points to ensure consistency across trials.

The order of the two test conditions was randomized to minimize order effects. Participants performed a brief familiarization trial prior to testing to reduce potential learning effects.

Standardized instructions and verbal feedback were provided according to American Thoracic Society (ATS) guidelines [17], and at predefined time points, ensuring consistency between participants and testing conditions. A minimum recovery period of 10 min was provided between tests, and the second assessment was initiated only after heart rate had returned to within ± 10 bpm of the resting heart rate measured prior to testing, ensuring adequate physiological recovery between trials. This recovery criterion was applied to minimize residual fatigue and reduce potential carry-over effects between the two testing conditions.

Vital signs (heart rate, systolic and diastolic blood pressure) and adverse symptoms were monitored before and after each test. Test termination followed ATS recommendations and included chest pain, intolerable dyspnea, dizziness, leg cramps, diaphoresis, or any other safety concern.

The tests were conducted at similar times of day to minimize circadian variability.

Self-reported physical activity was assessed using the Greek version of the International Physical Activity Questionnaire—Short Form (IPAQ-SF), and health-related quality of life was evaluated using the SF-36 questionnaire administered via interview [18–20].

2.4. Outcome Measures

The primary outcome was six-minute walk distance (6MWD), expressed in meters.

Secondary outcomes included demographic and anthropometric variables, hemodynamic responses, physical activity level (IPAQ-SF) [16,17], and health-related quality of life (SF-36) [18].

2.5. Statistical Analysis

Data were analyzed using SPSS version 29. Normality was assessed using the Shapiro–Wilk test. Differences between the two 6MWT conditions were examined using paired *t*-tests. Correlation analyses (Pearson, Spearman, and point-biserial) and linear regression analyses were performed to explore associations between variables and 6MWD. Multicollinearity was assessed using variance inflation factors (VIFs). Agreement between protocols was evaluated using the intraclass correlation coefficient (ICC; two-way mixed, absolute agreement) and Bland–Altman analysis.

A priori sample size calculation was performed using G*Power software (version 3.1.9.7; Heinrich Heine University Düsseldorf, Germany) for a paired-samples *t*-test. Based on previous studies reporting substantial differences between 6MWT corridor lengths, a large effect size (Cohen’s $d = 0.8$) was assumed. A minimum sample of 19 participants was required to achieve 80% statistical power at $\alpha = 0.05$.

Because the primary objective of the study also included assessment of agreement between protocols, intraclass correlation coefficient (ICC) and Bland–Altman analyses were additionally performed. However, the sample size calculation was based on detecting mean differences between protocols rather than achieving a predefined level of precision for agreement statistics. Therefore, the agreement analysis should be considered exploratory and interpreted with appropriate caution.

Statistical significance was set at $p < 0.05$.

3. Results

3.1. Participant Flow

A total of 34 individuals were initially approached, of whom 33 fulfilled the inclusion criteria. Ten participants were excluded due to practical constraints. Consequently, 23 participants provided written informed consent and completed both trials. Following randomization, 14 participants performed the 15 m protocol first, and nine performed the 30 m protocol first (Figure 1).

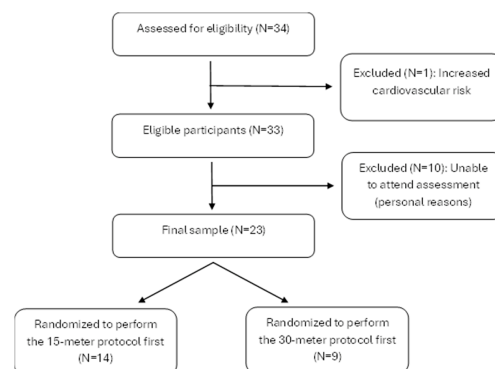


Figure 1. Study flow diagram.

3.2. Baseline Characteristics

Therefore, the study sample predominantly represented older adults with controlled arterial hypertension. Detailed baseline characteristics are presented in Table 1. Physical activity levels (IPAQ-SF) were classified as low ($n = 5$), moderate ($n = 10$), and high ($n = 8$). SF-36 scores indicated higher values in Physical Functioning (PF), Bodily Pain (BP), Role Physical (RP), and Role Emotional (RE), and lower values in General Health (GH), Vitality (VT), and Mental Health (MH). Resting heart rate and blood pressure prior to 6MWT trials were comparable between protocols, with expected post-test increases in heart rate. Hemodynamic responses and 6MWT outcomes are summarized in Table 2.

Table 1. Baseline characteristics of the participants ($n = 23$).

Variable	Value
Demographic characteristics	
Sex, n (%)	
• Male	13 (56.5%)
• Female	10 (43.5%)
Age (years)	74.04 ± 8.89
Anthropometric characteristics	
Weight (kg)	79.78 ± 12.4
Height (cm)	164.65 ± 7.48
Waist circumference (cm)	101.48 ± 13.48
Physical activity (IPAQ-SF), n (%)	
• Low	5 (21.7%)
• Moderate	10 (43.5%)
• High	8 (34.8%)
Health-related quality of life (SF-36)	
Physical Functioning (PF)	80.22 ± 18.31
Role Limitations due to Physical Problems (RP)	78.26 ± 31.36
Bodily Pain (BP)	80.87 ± 17.56
Vitality (VT)	62.83 ± 20.5
Social Functioning (SF)	76.63 ± 25.09
Role Limitations due to Emotional Problems (RE)	78.27 ± 34.24
Mental Health (MH)	66.78 ± 18.03
General Health (GH)	59.42 ± 17.55

Data are presented as mean $\pm$ standard deviation (SD) or n (%).

Table 2. Hemodynamic responses and 6MWT outcomes.

Variable	15 m (Mean $\pm$ SD)	30 m (Mean $\pm$ SD)
Resting hemodynamics		
Pre-test Heart rate (bpm)	74 ± 13	73 ± 12
Pre-test SBP * (mmHg)	137 ± 12	132 ± 18
Pre-test DBP ** (mmHg)	82 ± 9	84 ± 10
6MWT outcomes		
Post-test Heart rate (bpm)	93 ± 17	99 ± 19
Post-test SBP (mmHg)	142 ± 19	142 ± 18
Post-test DBP (mmHg)	83 ± 11	81 ± 11
Distance (m)	388.05 ± 84.31	451.66 ± 76.26

* SBP—systolic blood pressure; ** DBP—diastolic blood pressure.

3.3. Comparison Between Test Conditions

A paired-samples t -test showed that participants walked a significantly greater distance during the 30 m protocol (451.66 ± 76.26 m) compared to the 15 m protocol

(388.05 ± 84.31 m). The mean difference was 63.61 ± 43.59 m ($t = 6.998$, $p < 0.001$), with a large effect size (Cohen's $d = 1.46$) indicating a substantial difference between the protocols.

3.4. Agreement Analysis

Agreement analysis yielded an ICC of 0.653 (95% CI: 0.167 to 0.942). Although the point estimate suggests moderate agreement, the wide confidence interval indicates limited precision and substantial uncertainty regarding the true level of agreement between protocols (ICC = 0.653, 95% CI: -0.167 to 0.942). Bland–Altman analysis demonstrated a mean bias of 63.61 m (solid horizontal line), with wide limits of agreement ranging from -21.83 m to 149.05 m (dashed lines), indicating systematically higher distances during the 30 m protocol and wide inter-individual variability (Figure 2). Additionally, visual inspection of the Bland–Altman plot did not indicate evidence of proportional bias, as the magnitude of disagreement did not appear to systematically increase with higher walking distances.

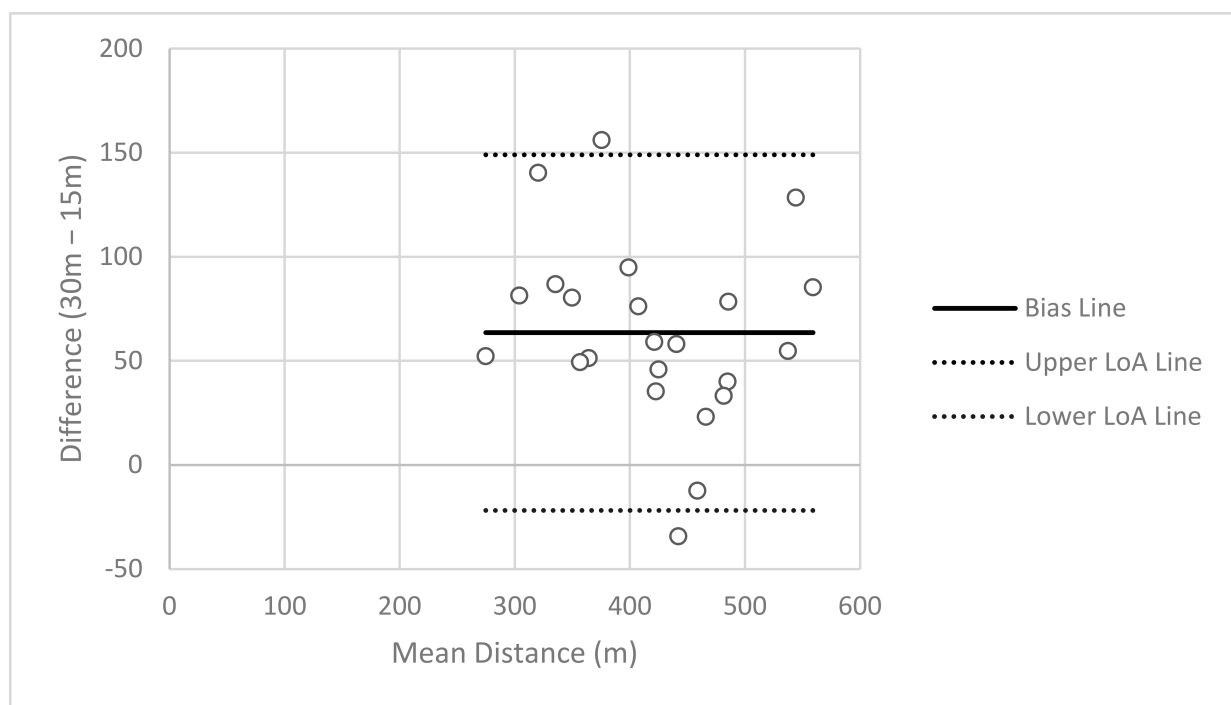


Figure 2. Bland–Altman plot showing agreement between 15 m and 30 m 6MWT protocols. The mean bias was 63.6 m, with limits of agreement ranging from -21.8 m to 149.1 m. The y-axis represents the difference in walking distance between protocols (6MWD30 – 6MWD15), while the x-axis represents the mean distance obtained from the two protocols for each participant. Positive values indicate greater walking distances achieved during the 30 m protocol.

3.5. Correlation and Regression Analysis

Height was significantly correlated with 6MWD on both the 15 m walkway ($r = 0.460$, $p = 0.027$) and the 30 m walkway ($r = 0.413$, $p = 0.050$). Age demonstrated a significant negative correlation with 6MWD on both the 15 m ($r = -0.439$, $p = 0.036$) and 30 m walkways ($r = -0.579$, $p = 0.004$). Regarding quality-of-life measures, the Physical Functioning (PF) domain of the SF-36 was significantly associated with 6MWD on both walkways, whereas the Role Emotional (RE) domain demonstrated a significant association only with performance on the 15 m walkway (Table 3).

Table 3. Correlation analysis results.

Variable	6MWT ₁₅		6MWT ₃₀	
	<i>p</i>	<i>r</i>	<i>p</i>	<i>r</i>
Age (years)	0.036	−0.439	0.004	−0.579
Height (cm)	0.027	0.460	0.05	0.413
PF	0.031	0.449	0.022	0.474
RE	0.011	0.52	0.067	0.389
Weight	0.211	0.271	0.3	0.226
Waist Circumference	0.617	0.11	0.671	0.094
Sex	0.25	−0.25	0.907	−0.026
IPAQ	0.272	0.239	0.19	0.283

Note: Pearson correlation was used for continuous normally distributed variables, Spearman correlation for non-normally distributed variables, and point-biserial correlation for dichotomous variables.

Multiple linear regression analyses were performed via the enter method to identify independent predictors of 6MWD performance in both corridor lengths. For the 30 m corridor, the regression model explained 55.8% of the variance in walking distance ($R^2 = 0.558$, $p = 0.001$). Age and the Physical Functioning (PF) domain of the SF-36 emerged as significant independent predictors of 6MWD₃₀, whereas height did not retain statistical significance in the final model (Table 4). Multicollinearity diagnostics demonstrated acceptable values, with VIF ranging from 1.02 to 1.18.

Table 4. Multiple linear regression analysis for predictors of 6MWD in the 30 m corridor.

Variable	Unstandardized B	SE	Standardized β	t	<i>p</i>	Tolerance	VIF
Constant	264.21	344.5	-	0.77	0.453	-	-
Age (years)	−4.51	1.42	−0.53	−3.17	0.005	0.85	1.18
Height (cm)	2.50	1.69	0.25	1.47	0.156	0.85	1.18
PF *	1.37	0.64	0.33	2.14	0.046	0.98	1.02

* Physical Functioning domain of the SF-36 questionnaire. Note: Dependent variable = 6MWD₃₀; $R^2 = 0.558$; Adjusted $R^2 = 0.488$; $p = 0.001$.

For the 15 m corridor, the regression model explained 42.1% of the variance in 6MWD performance ($R^2 = 0.421$, $p = 0.035$). In the 15 m corridor model, no independent statistically significant predictors were identified. Although age, height, PF, and the Role Emotional (RE) domain were entered into the model based on their initial correlations with 6MWD₁₅, none of the variables remained statistically significant independent predictors in the final analysis (Table 5). Multicollinearity remained within acceptable limits (VIF = 1.20–1.93).

Table 5. Multiple linear regression analysis for predictors of 6MWD in the 15 m corridor.

Variable	Unstandardized B	SE	Standardized β	t	<i>p</i>	Tolerance	VIF
Constant	−187.93	448.09	-	−0.42	0.68	-	-
Age (years)	−2.11	1.91	−0.22	−1.11	0.28	0.80	1.26
Height (cm)	3.92	2.21	0.35	1.77	0.094	0.84	1.20
PF *	0.35	1.11	0.08	0.32	0.757	0.55	1.81
RE **	0.76	0.61	0.31	1.23	0.234	0.52	1.93

* Physical Functioning domain of the SF-36 questionnaire. ** Role limitations due to Emotional Problems domain of the SF-36 questionnaire. Note: Dependent variable = 6MWD₁₅; $R^2 = 0.421$; Adjusted $R^2 = 0.293$; $p = 0.035$.

4. Discussion

4.1. Principal Findings

The main findings of this study were that performance in the 6MWT was significantly influenced by the length of the walking corridor, with participants consistently achieving greater distances in the longer (30 m) protocol compared to the shorter (15 m) protocol. Although a moderate level of agreement was observed between the two testing conditions, the presence of systematic differences and variability between measurements indicates that the two protocols do not produce interchangeable results.

Age and aspects of health-related quality of life, particularly physical functioning and role limitations, were consistently associated with walking performance across both protocols. Additionally, regression analyses identified the previous variables as independent predictors of 6MWT performance, highlighting the multifactorial nature of functional capacity in older adults with controlled arterial hypertension.

4.2. Comparison with Previous Literature

4.2.1. Agreement

Agreement between different corridor lengths in the 6 min walk test (6MWT) has been explored in several studies, with findings generally indicating that shorter walking distances tend to produce systematically lower values compared to the standard 30 m protocol, primarily due to the increased number of turns required [21]. Although correlations between protocols are often high—suggesting that individuals maintain their relative performance ranking—agreement analyses frequently reveal important limitations in their interchangeability. Previous studies have primarily reported strong correlations between different 6MWT protocols, indicating consistent ranking of individuals across conditions [22,23]. However, correlation alone does not imply agreement, and studies employing agreement analyses (e.g., Bland–Altman) have demonstrated that substantial absolute differences may exist between protocols, limiting their interchangeability.

However, beyond statistical considerations, the magnitude of the observed difference between protocols also appears to be clinically meaningful. The mean difference in walking distance observed in the present study (63.61 m) exceeded commonly reported minimal clinically important difference (MCID) thresholds for the 6MWT, which range from approximately 25 to 35 m. This suggests that the influence of corridor length is not only statistically significant but also large enough to affect the clinical interpretation of functional capacity. Consequently, results obtained from different corridor lengths should not be considered directly interchangeable, particularly when the 6MWT is used to monitor disease progression or evaluate treatment effects over time.

Discrepancies between corridor lengths are primarily attributed to methodological differences related to the walking environment. Shorter corridors necessitate more frequent turns, which interrupt walking continuity and require repeated deceleration and acceleration phases. This effect has been consistently reported as a key factor reducing total walking distance, as participants spend a proportion of the test time performing non-linear movement rather than forward progression. In contrast, longer corridors allow for more sustained, rhythmic walking, thereby facilitating higher walking speeds and greater total distance covered [17,24,25].

From a biomechanical and physiological standpoint, turning introduces additional demands that extend beyond simple locomotion. Directional changes require increased neuromuscular coordination, balance control, and lower-limb strength, particularly during the phases of braking and re-acceleration. These actions increase the mechanical workload and reduce movement efficiency, especially in populations with impaired motor control or reduced functional reserve [11,26]. Moreover, a factor that needs to be addressed is balance

capacity, since it may potentially influence the observed differences in 6MWD between the different corridor lengths. The 15 m protocol requires substantially more turning maneuvers than the standard 30 m protocol, increasing the demands on dynamic balance, postural control, and movement coordination. Older adults, and particularly those with arterial hypertension, may experience age-related declines in balance and gait stability [27]. Consequently, participants with balance deficits may be disproportionately affected by the increased turns required by the 15 m protocol, which may further reduce walking distance relative to their performance on the 30 m treadmill. Although balance was not directly assessed in the present study, it is possible that some inter-individual differences in postural stability may have contributed to part of the variability observed in the agreement analysis. Moreover, frequent turning has been associated with increased energy expenditure due to the need for repeated force generation and stabilization, which may accelerate fatigue and limit performance. Disruptions to the normal gait pattern, such as those caused by frequent changes in direction and repeated accelerations, further contribute to increased energy expenditure by reducing the efficiency of the energy-conserving mechanisms of walking [28].

4.2.2. Factors Influencing Performance

The agreement observed between different 6 min walk test (6MWT) protocols appears to be influenced by a range of individual-level factors, including demographic, anthropometric, behavioral, and cardiovascular characteristics. Although these factors are well-established determinants of 6MWT performance, their relative contribution may vary depending on corridor length, thereby contributing to differences in agreement between testing conditions.

Age is one of the most consistent predictors of 6MWT performance, with increasing age associated with reduced walking distance across populations. This decline is primarily attributed to reductions in aerobic capacity, muscle strength, and neuromuscular coordination [16,29]. In shorter corridors, the impact of age may be further amplified due to the increased frequency of turns, which require rapid adjustments in balance and motor control. Older individuals often adopt modified movement strategies characterized by slower, multi-step turns instead of efficient pivoting and therefore may experience greater difficulty maintaining walking efficiency under these conditions, leading to disproportionate reductions in performance compared to longer corridors [26].

Anthropometric characteristics, particularly height and body weight (or body mass index), have been widely reported as determinants of 6MWT performance, with greater height facilitating longer stride length and better walking economy, and higher body mass increasing mechanical load and energy expenditure [29,30]. However, in the present study, no significant associations were observed for body weight-related variables. This discrepancy may be attributed to the small sample size and limited variability of the population. Although shorter corridors theoretically increase metabolic cost due to repeated deceleration and re-acceleration [12], this effect was not evident in the current findings.

Sex differences have also been reported in the literature, with males generally demonstrating higher 6MWT performance compared to females, mainly due to differences in muscle mass, stride length, and aerobic capacity [30]. In this study, no significant association was observed between sex and 6MWT performance in either corridor condition, which may be explained by the relatively preserved functional status of the sample and the controlled clinical setting, potentially attenuating sex-related differences.

Physical activity levels represent another factor that has attracted researchers' interest regarding their relationship with the 6MWT, and findings in the literature are inconsistent. Higher levels of habitual physical activity are generally associated with better functional

capacity and increased walking distance [31,32]. However, in some clinical populations, this relationship appears weak or non-significant, potentially due to disease-related limitations and the discrepancy between self-reported physical activity and objective functional capacity [33]. The absence of a significant association between IPAQ and 6MWD in the present study may be partly explained by the distribution of participants across physical activity levels, which may have limited variability within the sample. Additionally, the restricted sample size and the reliance on self-reported physical activity may have reduced the ability to detect meaningful associations between habitual activity and objective functional performance.

Health-related quality of life, particularly domains related to physical functioning, has also been shown to correlate with 6MWT performance [34,35]. These associations suggest that perceived physical limitations are reflected in objective functional capacity. Furthermore, the results of this study suggest that in shorter corridors, additional domains, such as emotional or psychological factors, may play an equally prominent role, as the increased complexity of the task could influence confidence, pacing strategy, and perceived exertion. This may contribute to variability in performance and reduced agreement between protocols.

Finally, cardiovascular parameters, such as heart rate and blood pressure responses, have shown inconsistent associations with 6MWT performance depending on the studied population. Positive relationships have been reported in both hypertensive individuals and healthy older adults, suggesting that even in the absence of severe disease, hemodynamic responses may contribute to functional walking capacity [6,29]. However, in the present context of relatively mild and pharmacologically controlled hypertension, such associations were not evident, indicating a reduced sensitivity of 6MWT performance to acute cardiovascular responses. This pattern suggests that when cardiovascular impairment is limited, performance in the test is more strongly determined by mechanical and neuromotor factors rather than hemodynamic constraints.

The regression analyses suggest that functional capacity during the 6MWT is influenced by a multidimensional interaction of demographic, anthropometric, and health-related quality-of-life factors rather than by physiological characteristics alone. The variation observed between the predictive models of the two walkway configurations indicates that corridor length may influence the determinants of walking performance and that the 15 m and 30 m protocols may not rely entirely on identical underlying mechanisms. In particular, shorter walkways may place greater demands on pacing strategy, balance control, coordination, and repeated acceleration–deceleration during turns, potentially increasing the influence of psychosocial and perceptual factors on test performance [26]. These findings support the notion that functional exercise capacity assessed through the 6MWT is affected not only by cardiovascular and musculoskeletal function but also by the individual's perceived physical and emotional health status. Nevertheless, the absence of statistically significant independent predictors in the 15 m model should be interpreted cautiously. Performance in shorter corridors seems to be influenced by a more complex interaction of factors that could not be fully captured within the present sample. Although the overall model explained a meaningful proportion of variance, the limited sample size may have reduced statistical power, increasing the likelihood of Type II error and limiting the detection of independent associations.

4.3. Clinical Implications

From a clinical perspective, the findings of this study have direct implications for the use of the 6 min walk test (6MWT) in environments with limited space. In small clinics or rehabilitation settings where a standard 30 m corridor is not feasible, the 15 m protocol

may be a practical alternative for assessing functional capacity. However, its use should be considered a modified version of the test rather than a direct substitute, as corridor length significantly influences performance outcomes.

A key consideration in interpretation is that differences between protocols may exceed the minimal clinically important difference (MCID) reported for the 6MWT (approximately 25–35 m). This indicates that variations due solely to test configuration may be large enough to affect clinical decision-making, particularly when monitoring disease progression or evaluating treatment effects. Therefore, clinicians should avoid a direct comparison of results obtained from different corridor lengths, as this may lead to misinterpretation of functional status.

When implementing the 6MWT in practice, it is recommended that the same corridor length and protocol conditions are used consistently for follow-up assessments within the same patient. If shorter corridors are unavoidable, results should be interpreted with caution and ideally adjusted using population-specific reference values or prediction equations. Standardized reporting of test conditions is also essential to ensure comparability across settings and studies.

4.4. Methodological Considerations

This study presents several methodological strengths that support the interpretation of its findings. The use of a randomized crossover design minimized inter-individual variability and allowed direct within-subject comparison between the 15 m and 30 m 6MWT protocols. Standardized testing procedures were applied across all participants, including consistent instructions and controlled measurement conditions, which enhances internal validity. Additionally, the inclusion of multiple relevant covariates (demographic, anthropometric, behavioral, quality of life, and cardiovascular parameters) provides a comprehensive evaluation of factors influencing performance.

Though it needs to be mentioned that despite the randomization of the order of testing and the provision of a minimum recovery period of 10 min between assessments, both 6MWT protocols were performed on the same day. Consequently, the possibility of an incomplete physiological recovery and the presence of residual fatigue may have affected performance during the second test despite the recovery time applied. Although heart-rate recovery criteria were applied before initiating the second test, the potential influence of same-day repeated testing cannot be completely excluded.

In addition to the potential influence of same-day repeated testing, several other methodological limitations should be acknowledged when interpreting the findings of the present study. First, the restricted sample size ($n = 23$) reduces statistical power and may limit the generalizability of the findings. Second, the single-center design restricts external validity, as results may reflect specific local characteristics of the studied population and setting. Third, although a randomized crossover design was used to minimize order effects, no formal familiarization trial was performed prior to testing. Consequently, a potential learning effect between the first and second 6MWT administrations cannot be completely excluded, despite the random allocation of protocol order. Additionally, given that balance capacity and postural stability were not formally assessed, any differences in balance performance may have influenced walking efficiency and may have contributed to variability in the distance achieved during the 15 m protocol. Therefore, the potential role of balance as a determinant of performance cannot be excluded. Consequently, the findings cannot be readily generalized to younger adults with arterial hypertension, as variability in disease severity and functional capacity may alter responses to different corridor lengths. Additionally, the study was powered to detect differences in walking distance between protocols rather than to estimate agreement parameters with high precision. Consequently,

the relatively small sample size may have reduced the stability of the regression models and may also have contributed to the wide confidence interval observed for the ICC and the broad limits of agreement in the Bland–Altman analysis. Therefore, the agreement findings should be interpreted cautiously and confirmed in larger studies specifically powered for agreement analyses. Process-related variables such as the exact interval between the two protocols, walking speed, cadence, number of turns, and perceived exertion (RPE) were not recorded. These variables may have provided further insight into the mechanisms underlying performance differences between corridor lengths.

4.5. Future Research

Larger studies specifically designed and powered for agreement analyses are needed to provide more precise estimates of ICC values and Bland–Altman limits of agreement between different 6MWT corridor lengths. In addition, studies should include younger and middle-aged adults with arterial hypertension as well as older populations to determine whether the observed agreement patterns are consistent across age groups. Further validation against established reference standards is also necessary, with particular emphasis on gold-standard assessments of functional capacity, like cardiopulmonary exercise testing (CPET), to determine the extent to which the 15 m 6MWT reflects true or submaximal aerobic capacity. Additionally, multicenter studies would be especially valuable, as they would allow for greater heterogeneity in clinical practice settings and reduce potential site-specific bias.

Finally, future studies should also investigate the contribution of balance and turning efficiency as determinants of 6MWT performance across different corridor lengths in this population. This would provide further insights into the factors leading to the observed discrepancies while enhancing the clinical evaluation of 6MWT results in settings where smaller treadmills are used.

These findings highlight the importance of protocol standardization when interpreting 6MWT results in clinical practice. The 15 m protocol may be useful when space limitations preclude the use of the standard 30 m walkway, but results should not be used interchangeably.

5. Conclusions

In conclusion, the findings of this study demonstrate that corridor length significantly influences performance during the 6 min walk test in older adults with medically controlled arterial hypertension. Therefore, the present findings should primarily be interpreted within the context of older adults with controlled arterial hypertension. Participants achieved consistently greater walking distances on the 30 m corridor compared with the 15 m configuration, while agreement analysis indicated that the two protocols cannot be considered interchangeable. Functional capacity during the 6MWT appears to be influenced by multiple interacting factors, including age, anthropometric characteristics, and aspects of health-related quality of life, with some determinants differing according to walkway length. The shorter corridor likely imposes additional biomechanical and neuromotor demands due to the increased frequency of turns, contributing to reduced walking efficiency and greater variability in performance. Although the 15 m protocol may represent a practical alternative in settings with limited space, clinicians should interpret results cautiously and avoid direct comparison with standard 30 m values. Further research with larger and more heterogeneous populations is required to better clarify the mechanisms underlying performance differences between corridor lengths and to further validate the clinical applicability of shorter 6MWT protocols.

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Abbreviations

The following abbreviations are used in this manuscript:

AH	Arterial Hypertension
WHO	World Health Organization
BP	Blood Pressure
DASI	Duke Assessment Status Index
ISWT	Incremental Shuttle Walking Test
6MWT	Six-Minute Walk Test
3MWT	Three-Minute Walk Test
6MWD	Six-Minute Walk Distance
COPD	Chronic Obstructive Pulmonary Disease
BMI	Body Mass Index
ATS	American Thoracic Society
IPAQ	International Physical Activity Questionnaire
IPAQ-SF	International Physical Activity Questionnaire—Short Form
SF-36	36—Item Short Form Health Survey
ICC	Intraclass Correlation Coefficient
VIF	Variance Inflation Factor
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
SD	Standard Deviation
PF	Physical Functioning
RP	Role Limitations due to Physical Problems
VT	Vitality
SF	Social Functioning
RE	Role Limitations due to Emotional Problems
MH	Mental Health
GH	General Health
MCID	Minimal Clinically Important Difference
CPET	Cardiopulmonary Exercise Testing
SPSS	Statistical Package for the Social Sciences

References

1. WHO. Hypertension. Available online: <https://www.who.int/news-room/fact-sheets/detail/hypertension> (accessed on 6 August 2025).
2. Stergiou, G.S.; Palatini, P.; Parati, G.; O'Brien, E.; Januszewicz, A.; Lurbe, E.; Persu, A.; Mancia, G.; Kreutz, R. 2021 European Society of Hypertension practice guidelines for office and out-of-office blood pressure measurement. *J. Hypertens.* **2021**, *39*, 1293–1302. [\[CrossRef\]](#) [\[PubMed\]](#)
3. Benetos, A.; Petrovic, M.; Strandberg, T. Hypertension Management in Older and Frail Older Patients. *Circ. Res.* **2019**, *124*, 1045–1060. [\[CrossRef\]](#) [\[PubMed\]](#)
4. Olatunbosun, T.; Awotidebe, T.; Adedoyin, R.; Fasakin, O.; Ogunyemi, S.; Olawoye, A.; Odunlade, A. Clinical Cardiology Correlation between Self-Reported Daily Activity and Submaximal Walk Test in the Assessment of Functional Capacity among Patients with Hypertension. *Int. J. Clin. Oncol.* **2021**, *8*, 238. [\[CrossRef\]](#) [\[PubMed\]](#)
5. Nascimento, L.L.N.; Carvalho, Y.F.; Santos, B.V.O. Incremental shuttle walk test can have maximum response characteristics for the assessment of exercise capacity in hypertensive women elderly in primary care. *Eur. J. Prev. Cardiol.* **2025**, *32*, zwaf236.305. [\[CrossRef\]](#)
6. Ramos, R.A.; Guimarães, F.S.; Cordovil, I.; de Sa Ferreira, A. The six-minute walk distance is a marker of hemodynamic-related functional capacity in hypertension: A case-control study. *Hypertens. Res.* **2014**, *37*, 746–752. [\[CrossRef\]](#) [\[PubMed\]](#)
7. Rasekaba, T.; Lee, A.L.; Naughton, M.T.; Williams, T.J.; Holland, A.E. The six-minute walk test: A useful metric for the cardiopulmonary patient. *Intern. Med. J.* **2009**, *39*, 495–501. [\[CrossRef\]](#) [\[PubMed\]](#)
8. Holland, A.E.; Spruit, M.A.; Troosters, T.; Puhan, M.A.; Pepin, V.; Saey, D.; McCormack, M.C.; Carlin, B.W.; Sciurba, F.C.; Pitta, F.; et al. An official European Respiratory Society / American Thoracic Society technical standard: Field walking tests in chronic respiratory disease. *Eur. Respir. J.* **2014**, *44*, 1428–1446. [\[CrossRef\]](#) [\[PubMed\]](#)
9. Pepera, G.; Antoniou, V.; Karagianni, E.; Batalik, L.; Su, J.J. Validity and Reliability of the Six-Minute Walking Test Compared to Cardiopulmonary Exercise Test in Individuals with Heart Failure Systematic Review and Meta-Analysis. *J. Clin. Med.* **2025**, *14*, 8303. [\[CrossRef\]](#) [\[PubMed\]](#)
10. Ng, S.S.; Tsang, W.W.; Cheung, T.H.; Chung, J.S.; To, F.P.; Yu, P.C. Walkway length, but not turning direction, determines the six-minute walk test distance in individuals with stroke. *Arch. Phys. Med. Rehabil.* **2011**, *92*, 806–811. [\[CrossRef\]](#) [\[PubMed\]](#)
11. Nusdwinuringtyas, N.; Triangto, K.; Alwi, I.; Yunus, F. The Validity and Reliability of Six Minute Walk Test in a 15 Meter Track. *Indones. J. Phys. Med. Rehabil.* **2021**, *10*, 57–66. [\[CrossRef\]](#)
12. Kubo, H.; Asai, T.; Fukumoto, Y.; Oshima, K.; Koyama, S.; Monjo, H.; Tajitsu, H.; Oka, T. Value of the 3-min walk test and its association with motor functions in older adults. *Physiother. Theory Pract.* **2024**, *40*, 144–152. [\[CrossRef\]](#) [\[PubMed\]](#)
13. Nevelikova, M.; Dosbaba, F.; Pepera, G.; Felsoci, M.; Batalikova, K.; Su, J.J.; Batalik, L. Validity and reliability of automated treadmill six-minute walk test in patients entering exercise-based cardiac rehabilitation. *Ann. Med.* **2023**, *55*, 2304664. [\[CrossRef\]](#) [\[PubMed\]](#)
14. Pepera, G.; Karanasiou, E.; Blioumpa, C.; Antoniou, V.; Kalatzis, K.; Lanaras, L.; Batalik, L. Tele-Assessment of Functional Capacity through the Six-Minute Walk Test in Patients with Diabetes Mellitus Type 2: Validity and Reliability of Repeated Measurements. *Sensors* **2023**, *23*, 1354. [\[CrossRef\]](#) [\[PubMed\]](#)
15. Andrianopoulos, V.; Wagers, S.S.; Groenen, M.T.; Vanfleteren, L.E.; Franssen, F.M.; Smeenk, F.W.; Vogiatzis, I.; Wouters, E.F.; Spruit, M.A. Characteristics and determinants of endurance cycle ergometry and six-minute walk distance in patients with COPD. *BMC Pulm. Med.* **2014**, *14*, 97. [\[CrossRef\]](#) [\[PubMed\]](#)
16. Pepera, G.; Ingle, L.; Sandercock, G. Predictors of the 6-minute walk test in patients with chronic heart failure. *Br. J. Card. Nurs.* **2015**, *10*, 454–459. [\[CrossRef\]](#)
17. Crapo, R.O.; Casaburi, R.; Coates, A.L.; Enright, P.L.; MacIntyre, N.R.; McKay, R.T.; Johnson, D.; Wanger, J.S.; Zeballos, J.R.; Bittner, V.; et al. ATS statement: Guidelines for the six-minute walk test. *Am. J. Respir. Crit. Care Med.* **2002**, *166*, 111–117. [\[CrossRef\]](#) [\[PubMed\]](#)
18. Papathanasiou, G.; Georgoudis, G.; Papandreou, M.; Spyropoulos, P.; Georgakopoulos, D.; Kalfakakou, V.; Evangelou, A. Reliability Measures of the Short International Physical Activity Questionnaire (IPAQ) in Greek Young Adults. *Hell. J. Cardiol. HJC Hellēnikē Kardiol. Ep.* **2009**, *50*, 283–294.
19. Papathanasiou, G.; Georgoudis, G.; Georgakopoulos, D.; Katsouras, C.; Kalfakakou, V.; Evangelou, A. Criterion-related validity of the short International Physical Activity Questionnaire against exercise capacity in young adults. *Eur. J. Cardiovasc. Prev. Rehabil.* **2010**, *17*, 380–386. [\[CrossRef\]](#) [\[PubMed\]](#)
20. Pappa, E.; Kontodimopoulos, N.; Niakas, D. Validating and norming of the Greek SF-36 Health Survey. *Qual. Life Res.* **2005**, *14*, 1433–1438. [\[CrossRef\]](#) [\[PubMed\]](#)
21. Pepera, G.; Sandercock, G. Does Turning Affect Shuttle Walking Test Performance in Cardiovascular Disease Patients? A Narrative Review. *Crit. Rev. Phys. Rehabil. Med.* **2021**, *33*, 15–27. [\[CrossRef\]](#)

22. Cheng, D.K.; Nelson, M.; Brooks, D.; Salbach, N.M. Validation of stroke-specific protocols for the 10-meter walk test and 6-minute walk test conducted using 15-meter and 30-meter walkways. *Top. Stroke Rehabil.* **2020**, *27*, 251–261. [[CrossRef](#)] [[PubMed](#)]
23. An, S.H.; Kim, E.J.; Yang, S.P.; Choi, S.J.; Lee, J.M. Comparative reliability, concurrent and convergent validity, and predictive value of the 6-min walk test over 15 and 30 m in patients with subacute stroke. *Int. J. Rehabil. Res.* **2025**, *48*, 187–193. [[CrossRef](#)] [[PubMed](#)]
24. Klepper, S.E.; Muir, N. Reference values on the 6-minute walk test for children living in the United States. *Pediatr. Phys. Ther.* **2011**, *23*, 32–40. [[CrossRef](#)] [[PubMed](#)]
25. Zawat, A.; Nagarwala, R.; Dabaghav, R. Effect of Walking Course Length on 6MWT: An Experimental Study. *Indian J. Respir. Care* **2023**, *12*, 67–70. [[CrossRef](#)]
26. Thigpen, M.T.; Light, K.E.; Creel, G.L.; Flynn, S.M. Turning difficulty characteristics of adults aged 65 years or older. *Phys. Ther.* **2000**, *80*, 1174–1187. [[CrossRef](#)] [[PubMed](#)]
27. Hajebrahimi, F.; Tarakci, D.; Özbek, H.; Budak, M.; Algun, C. Effect of hypertension on muscle strength, balance, and mobility in older adults. *J. Exerc. Ther. Rehabil.* **2024**, *11*, 47–55. [[CrossRef](#)]
28. Waters, R.L.; Mulroy, S. The energy expenditure of normal and pathologic gait. *Gait Posture* **1999**, *9*, 207–231. [[CrossRef](#)] [[PubMed](#)]
29. Jenkins, S.; Cecins, N.; Camarri, B.; Williams, C.; Thompson, P.; Eastwood, P. Regression equations to predict 6-minute walk distance in middle-aged and elderly adults. *Physiother. Theory Pract.* **2009**, *25*, 516–522. [[CrossRef](#)] [[PubMed](#)]
30. Bumrungkittikul, J.; Thirapatarapong, W. Independent predictors and equation of six-minute walk test in post-cardiac surgery. *Heart Lung J. Crit. Care* **2023**, *58*, 134–138. [[CrossRef](#)] [[PubMed](#)]
31. Almeida, V.P.; Ferreira, A.S.; Guimarães, F.S.; Papathanasiou, J.; Lopes, A.J. Predictive models for the six-minute walk test considering the walking course and physical activity level. *Eur. J. Phys. Rehabil. Med.* **2019**, *55*, 824–833. [[CrossRef](#)] [[PubMed](#)]
32. Breda, C.A.; Rodacki, A.L.; Leite, N.; Homann, D.; Goes, S.M.; Stefanello, J.M. Physical activity level and physical performance in the 6-minute walk test in women with fibromyalgia. *Rev. Bras. Reumatol.* **2013**, *53*, 276–281. [[CrossRef](#)] [[PubMed](#)]
33. Sezgin, N.H.; Acar, S.; Savci, S.; Ozcan Kahraman, B.; Tanriverdi, A.; Köken Avşar, A.; Birlik, A.M. Determinants of Six-Minute Walk Test Performance in Women with Systemic Sclerosis. *J. Musculoskelet. Neuronal Interact.* **2023**, *23*, 489–497. [[CrossRef](#)] [[PubMed](#)]
34. Lee, A.L.; Button, B.M.; Ellis, S.; Stirling, R.; Wilson, J.W.; Holland, A.E.; Denehy, L. Clinical determinants of the 6-Minute Walk Test in bronchiectasis. *Respir. Med.* **2009**, *103*, 780–785. [[CrossRef](#)] [[PubMed](#)]
35. Baptista, V.C.; Palhares, L.C.; Oliveira, P.P.M.D.; Silveira Filho, L.M.; Vilarinho, K.A.D.S.; Severino, E.S.B.D.O.; Lavagnoli, C.F.R.; Petrucci, O. Teste de caminhada de seis minutos como ferramenta para avaliar a qualidade de vida em pacientes submetidos à cirurgia de revascularização miocárdica. *Braz. J. Cardiovasc. Surg.* **2012**, *27*, 231–239.

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