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200-Meter Fast Walk Test Normative Data for Young Healthy Individuals-An Observational Study

Gazal T Bahrawi[1], Mohammad A Bakhutma[2], Marilyn Moffat[3]

[1, 3]Department of Physical Therapy, Steinhardt School of Culture, Education and Human Development New York University, USA

[2] Department of Medicine, Umm al-Qura University, Makkah, Saudi Arabia

Abstract: ***Objective**: To determine the normative data for the 200-mFWT for young healthy adults between the ages of 20 and 49 years. **Design**: Descriptive design. **Participants**: Ninety apparently healthy individuals (45 males and 45 females) participated in this study. **Setting**: New York University's Department of Physical Therapy and the LA Fitness Center in Secaucus New Jersey. **Interventions**: The participants were classified into three age groups of 20 to 29, 30 to 39, and 40 to 49 years. **Measures**: Time to perform the 200-mFWT, blood pressure, HR. RR and oxygen saturation before and after the test. **Results**: Slower walking time was affected by increasing age and female gender and also correlated with advancing age, gender, height, weight, and BMI. Blood pressure, HR, RR and perceived exertion were higher following the 200-mFWT. No significant sex difference was found in cardiovascular response to the 200-mFWT. **Conclusions**: Normative data are reported for the 200-mFWT for 20-49 year old healthy adults. Anthropometric variables contributed to the walking time. The cardiovascular parameters changed significantly following the 200-mFWT except for oxygen saturation.*

Keywords: Functional aerobic capacity, 200-meter fast walk test, normative data

1. Introduction

In recent years, walking endurance tests have emerged as an area of scientific investigation in the assessment of functional aerobic capacity. They are safe, are easy to administer, are inexpensive, are feasible in almost any environment, are easy to understand, use a low-impact activity, and can be completed in less time. More importantly, walking is a basic human activity that reflects the physiological requirements for daily activities.[1-3] Walk tests are functional tests that examine the capacity of the individual to engage in daily activities.[3]They are objective tests providing valid and good practical means to assess functional performance, determine overall treatment effectiveness, and evaluate the level of physical exertion.[2, 4] The widespread data acquired from clinical trials of walk tests are used to determine short- and long-term outcomes. Moreover, results of walk tests showed an improvement in cardiovascular fitness by lowering blood pressure, diabetes, and high cholesterol levels.[5, 6]

Many walk tests are commonly used in clinical practice. One type of walking test is the time-based test that includes the 2-minute walk test, 6-minute walk test (6MWT), and 12-minute walk test .[7-9] Another type is the fixed-distance test that includes the 100-meter, 200-meter fast walk test (200-mFWT), 400-meter walk test, half-mile walk test, and 2-km walk test.[10-13] A third type is the velocity-determined walk test that includes the self-paced walk test.[14] The last type is the controlled-pacing incremental test that includes the incremental shuttle walk test.[15]

Few submaximal walk tests have been widely studied and proven to be effective in rehabilitation programs especially in patients with cardiac diseases.[16] The 200-mFWT has been recently used to assess functional exercise capacity, since it examines higher exercise intensity activity than other walk tests do.[17, 18] It has been considered to be the one of the first exercise-training tests that evaluates functional capacities at a higher intensity level.[13] Recent reports have shown that high intensity interval training was more effective than low intensity training in improving the functional aerobic capacity and walking ability in patients suffering from heart failure and coronary artery disease.[19-21] Moreover, the 200-mFWT that demanded higher intensity resulted in higher heart rates and enhanced maximum oxygen consumption (VO_2) than moderate continuous exercise.[21]

The 200-mFWT holds a distance (200 meter) constant that's originated from the 600-foot walk test.[22] It was developed to examine high-intensity exercise in healthy individuals.[23] it was found to be well tolerated, reliable, valid and reproducible (ICC = 0.97). It was also found to be responsive to change in patients with coronary artery disease and in healthy elderly subjects.[24-25] The minimum clinically significant difference for this test has not been determined.[26] The 200-mFWT as a high intensity walking activity resulted in improvement in rehabilitation of patients with cardiac disorders.[13, 17,18,24] In addition, it has been used recently as a predictive tool to estimate maximal heart rate for exercise training, since it places more demands on the cardiovascular system than submaximal moderate exercise intensity tests.[27] Gremeaux and colleagues studied the effects of the 6MWT and 200-mFWT in healthy elderly people aged 70 years and more. They found that the 200-mFWT produced a higher heart rate and maximum oxygen uptake. In addition, the gait velocity was higher than that achieved during the 6MWT.[17] In another study, the authors compared the 6MWT and 200-mFWT after a cardiopulmonary exercise stress test and found similar results.[18] The 6MWT has been the gold standard for submaximal testing of aerobic capacity since it is safe, reproducible, inexpensive, reflects functional status, and predicts morbidity and mortality. However, the 6MWT does not measure the tolerance at a higher level of exertion.[28] Therefore, the 200-mFWT has been used as an alternative to 6MWT, since it is based on the philosophy that high intensity interval exercise improves aerobic measures, and some daily activities that require a greater level of effort.[28, 29]

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Physical therapists frequently strive for quality in patient service delivery, therefore, they continually measure vital signs and gait parameters prior to and post exercise to measure functional cardiorespiratory fitness and to determine the effectiveness of exercise programs.[15, 19,25]The most frequent qualitative gait parameters physical therapists use in clinical practice are speed, step length, stride length, and step frequency.[30] Gait speed is considered as a 'vital sign', since it is used by clinicians to make predictions about significant outcomes.[31] Therefore, reference values for slow, normal, and fast walking speeds have been determined for population-based samples of healthy individuals and of individuals with pathology. Valid normative data are important to any clinical interpretations, since they provide the reasonable basis for answering critical questions about the normality of training reactions in patients and can meaningfully affect the clinical decision-making process.[25] Standardization of reference values is necessary for physical therapists and other health providers to compare the performance of patients with the average performance of normal healthy individuals of similar gender and ages with the goals of improving patient and rehabilitation outcomes. Physical therapists use reference values to make conclusions about the normalcy of gait speeds and to determine baseline measures. Since reference values function as standard data in clinical practice, they would aid the physical therapist in interpreting the patient's performance and in improving clinical function.[30, 32-34] In addition, judgments about a person's cardiovascular status, gait speed, and capability to engage in activities of daily living should be compared with normative data for any given population.[35] Comprehensive normative data for walking tests are important and critical for detection of abnormalities and to draw conclusions about the appropriate interventions and outcomes.[36, 37]

No normative data are currently available for the 200-mFWT for healthy people between 20 and 49 years of age. Several studies have determined the normative values for many of the functional walk tests, such as 6MWT.[38] Thus, the aim of this study was to establish the reference values for the 200-mFWT and to determine if differences existed between the varied age groups of 20 to 29, 30 to 39, and 40 to 49.

2. Methods

A total of 90 (45 male and 45 female) apparently healthy adult individuals whose ages ranged between 20 and 49 years participated in this study. Individuals were included in the study if they met the following criteria; able to read and speak English (8th grade level); had normal blood pressure (systolic number between 90 and 120, and diastolic number between 60 and 80), heart rate(ranges from 60 to 100 beats a minute), respiratory rate (ranges from12–20 breaths per minute), and rate of perceived exertion; and normal functional range of motion, normal functional muscle strength, and normal sensation in their upper and lower extremities. Participants were excluded if they had: any history or presence of debilitating musculoskeletal, neuromuscular, or cardiovascular/pulmonary diseases, disorders, or conditions; any deficits in cognition, vision, hearing, or sensation; and any history of pain, surgery, or injury to the lower extremities in the previous six months. Participants were also excluded if they consumed alcohol or drugs that may have altered their motor performance 24 hours prior to the study and if they were female volunteers who were pregnant. The subjects were recruited from New York University's Department of Physical Therapy and from the LA Fitness Center in Secaucus New Jersey. Each participant gave informed consent. The University Committee on Activities Involving Human Subjects (IRB-FY2016-204) approved the study.

Participants were identified as meeting all of the inclusion criteria and not having any of the exclusion criteria of the study through a pre-participation questionnaire. A written informed consent form was obtained from all participants. Participants had their range of motion and strength of both lower extremities tested to assure that both parameters were normal. Data were collected during one session that lasted approximately 30 minutes. The examiner collected data using the standardized procedures for the performance of the 200-mFWT.

The participant's age, height, and weight were recorded. For screening purposes, the Back Scratch Test was used to determine upper extremity range of motion. All participants squeezed the investigator's hands as firmly as possible to determine grip strength that is an indication of upper extremity strength. All participants also performed a full squat to determine normal lower extremity range of motion and strength. Sensation for all participants was determined by stroking the skin of the upper and lower extremities with a cotton swab.

Resting vital signs (heart rate, blood pressure, respiratory rate, and oxygen saturation) were taken before starting the procedures. Blood pressure (SBP, DBP) was measured using a Mercurysphygmomanometer with the subject seated comfortably with their back supported, feet on the floor, and test arm at the height of the heart. The cuff was wrapped around the exposed upper arm approximately 2 cm above the elbow. Lightly press the stethoscope's bell over the brachial artery just below the cuff's edge. Rapidly inflate the cuff to 180mmHg, then listen with the stethoscope and simultaneously observe the dial or mercury gauge. The first knocking sound is the subject's systolic pressure. When the knocking sound disappears, that is the diastolic pressure. Heart rate (HR) was recorded by pressing the second and third fingertips firmly, but gently, on the subject's radial artery at the wrist and by counting the beats for 60 seconds. Respiratory rate (RR) was recorded by visually observing how many times the chest rose over 60 seconds while the examiner continued to palpate the radial pulse so the participant was not aware that the respiratory rate was being counted. The pulse oximeter was placed on the subject's second fingertip, and the oxygen saturation was read digitally.[39] The Borg rate of perceived exertion scale (RPE) (Please see Figure 1 for an illustration of the model used) was used to rate the intensity level of the physical activity. The RPE scale of 6-20, which is the most frequently used Borg scale, uses 6 as "no exertion at all" and 20 as "maximal exertion". [40,41]

Participants performed the 200-mFWT by walking twice back and forth on a flat 50-meter long indoor walking pathway. Participants were allowed to slow down and stop for rest if needed. The walk test was performed only once. When the commands "ready, set, and go" were said, the middle button on the stopwatch was pressed and at the same time the subject began to walk as fast as he/she safely could without running. Standardized instructions and verbal encouragement, such as "You're doing well", were strictly given to the participants at mid-distance. The test was terminated if the subjects stopped or asked to stop the test or the subject felt any shortness of breath or any other adverse sensations. The subjects were given the command to stop at the end of the 200 meters, and the second button on the stopwatch was pressed at the same time. Posttest vital signs were taken immediately after completing the walk test. The rate of perceived exertion was assessed using the Borg's scale at the end of the walk. The time to complete the test in seconds was measured. Participants were also asked at the end of the test if they experienced any symptoms of dyspnea, chest pain, or leg pain.

3. Data Analysis

For the purpose of analysis, the participants were classified into the age groups of 20 to 29, 30 to 39, and 40 to 49 years. The pre- and post-test cardiovascular/pulmonary parameters were used for data analysis. Data analysis was carried out using SPSS software (version 21.0). The descriptive statistics of mean and standard deviation were used to summarize for anthropometric variables. The inferential statistics of paired sample t-test, independent t-test, ANOVA, and Pearson's product moment correlation were used to analyze data. The body mass index (BMI) was substituted for height and weight. The alpha level was set at a 5% level of significance.

4. Results

Of 99 participants, 90 (45 males and 45 females) were included in the final analysis. The test was well tolerated, performed without any interruption, and none of the 90 participants required assistance before completing the 200-mFWT. Nine participants were excluded from the study. Of those, 4 were excluded because they had high blood pressure before starting the test, 3 were excluded because they had a high heart rate before starting the test, and 2 were excluded for stopping in the middle of the test. The participants' ages ranged between 20 and 49 years. Table 1 shows the general characteristics of the participants. For all male and female, the estimated mean age, weight, height, and BMI of all participants were 34.41 (SD= 8.85) years, 74.53 (SD= 11.28) kg, 1.72(SD=. 15) m, and 25.85(SD =6.02) kg/m², respectively. Table 1 also displays the independent t-test comparison of the general demographic characteristics between the male and female participants. The male participants had statistically significantly higher mean scores in the measure of height (t (88)=4.57, P = .000). The results also showed that the female participants had significantly higher mean scores in the BMI than the male participants (t (88)= - 2.04, p = .045), which indicated that the female participants tended to have more body fat than the male participants. However, no statistically significant differences were found between the females in the varied age groups in the measure of body adiposity (BMI). No other statistically significant differences were found between male and female participants.

Table 1: Anthropometric data of all participants and by gender (N=90)

Variables	Males n=(45) Mean ± SD	Females n=(45) Mean ± SD	All participants Mean ± SD	t-cal	Sig.
Age (y)	34.31 ± 9.08	34.51 ± 8.73	34.41 ± 8.85	- .11	.915
Weight (Kg)	76.19 ± 7.91	72.53 ± 12.59	74.36 ± 10.65	1.65	.10
Height (m)	1.78 ± .15	1.65 ± .11	1.72 ± .15	4.57	.000
BMI (Kg/m²)	24.53 ± 4.71	27.05 ± 6.81	25.79 ± 6.99	- 2.03	.045

Note: BMI = Body Mass Index; y = years; Kg = kilograms; m = meters; Sig = significance; α = 0.05.

The one-way ANOVA and LSD post-hoc multiple comparison of age and anthropometric parameters of the participants across different age distributions are summarized in Table 2. From the results, significant differences were observed in the anthropometric variables of the participants according to age categories (P=. 000). Significant differences were observed in the weight among the participants in the varied age groups(F (2, 87)=3.56), P=. 033). Post-hoc multiple comparisons revealed that participants between 40 and 49 years of age had statistically significantly higher weights than the participants between 20 and 29 years of age. However, no significant differences were found in BMI between both genders in the different age distributions. No other statistically significant differences were found in those participants between the ages of 20-29 and 30-39 years.

Table 2: Summary of one-way ANOVA and LSD post-hoc multiple comparison of the general characteristics among the participants in the different age groups (mean (SD) N = 90)

Variables	20-29 (y)	30-39 (y)	40-49 (y)	F ratio	Sig
Age (y)	24.67 ± 2.48	33.30 ± 2.32	45.27 ± 2.75	503.415	.000
Weight (Kg)	71.02 ± 10.91	73.94 ± 10.51	78.12 ± 9.51	3.56	.033
Height (m)	1.72 ± .15	1.73 ± .15	1.70 ± .14	.233	.793
BMI (Kg/m2)	24.74 ± 6.49	25.23 ± 5.65	27.42 ± 5.65	1.73	.184

Note: N= Number, BMI = Body Mass Index; y = years; Kg = kilograms; m = meters; Sig=significance; α = 0.05.

Participants completed the 200-mFWT on average in 102.98 seconds. Table 3 shows that no statistically significant interaction effect was found between gender and the different age groups on the mean walk time, F (2,84) =. 567, P =. 569. A statistically significant main effect was observed on time due to gender, F (1,84) = 21.23, P =. 000, as well as a statistically significant main effect on time due to the age group, F (2,84) = 77.07, P = .000. According to the results of the Tukey HSD post-hoc test, on average the participants between the ages of 20 to 29 years spent less time on the 200-mFWT; followed by the participants between the ages of 30 to 39 years; and finally the participants between the ages of 40 to 49 years indicating that the older subjects walked slower than the younger subjects. The mean value of the times for the male participants was 100.27 ± 9.35 seconds, and the mean value of the time for the female participants was 105.69 ± 9.06 seconds. According to the results of the one-way ANOVA in both genders, the effect of age on the mean walked time was meaningful as the male or female get older, he/she spend more time in completing the test. For the males in different age group, there was a statistically significant difference in the mean walked time F (2,42) = 38.13, P = .000. For 20-29 year old males, the mean time to complete the 200-mFWT was 91.60 seconds; for 30-39 year old males, the mean time to complete was 99.47 seconds; and for 40-49 year old males, the mean time to complete was 109.73. The table 3 also shows that for the females in each aged group there was a statistically significant difference, F (2,42) = 39.57 P = .000. For 20-29 year-old females, the mean time to complete the 200-mFWT was 98.33 seconds; for 30-39 year old females, the mean time to complete was 103.20 seconds; and for 40-49 year old females, the mean time to complete was 115.53 seconds. According to the results of both LSD and Tukey HSD post-hoc test, the male participants between the ages of 20 to 29 years had statistically lower times for the 200-mFWT; followed by the male participants between the ages of 30 to 39 years; and finally the male participants between the ages of 40 to 49 years. A similar pattern was found in the female participants, in that the older age group spent more time on completing the 200-mFWT.

Table 3: Summary of one-way ANOVA and two-way ANOVA of the mean values for the time of the 200-mFWT of all of the participants by gender and age.

Variables	20-29 (y)	30-39 (y)	40-49 (y)	Total	*F* ratio	*Sig*
Time (s)M	91.60 ± 5.12	99.47 ± 4.09	109.733 ± 7.39	100.27 ± 9.35	38.13	.000
F	98.33 ± 4.29	103.20 ± 5.35	115.53 ± 6.51	105.69 ± 9.06	39.57	.000
M+F	94.97 ± 5.77	101.33 ± 5.05	112.63 ± 7.45	102.98 ± 9.55	77.067	.000
Gender (M vs. F)					21.227	.000
Gender*group age					.567	.569

Note: y = years; M = Male; F = Female; s = seconds; Sig = Significance; * = interaction between two variables; α = 0.05.

In bivariate analyses, significant correlations between the time and age, weight, height, and BMI are presented in Table 4. A significant positive, direct correlation was found between time and age, weight, and BMI, suggesting the time increased with increased age (r =. 759, P =. 000), weight (r =. 266, P = .011), and BMI (r = .304, P =. 004) respectively. A significant negative relationship was noted between time and height (r = -.219, P =. 038) so that taller participants had faster times, and those at the extremes of fat mass had slower times.

Table 4: Pearson's product moment correlation matrix of the relationships between velocity and time of 200-mFWT and the dependent variables (age, weight, height, and BMI)

	Velocity (m/s)	Weight (kg)	Height (m)	BMI (Kg/m^2)	Gender	Age (y)	Time (sec)
Velocity (m/s)	-	R = -.252* p = .017	r = .222* p = .036	r = -.295** p = .005	r = -.295** p = .005	r = -.747** p = .000	r = -.994** p = .000
Weight (kg)	r = -.252* p = .017	-	r = -.005 p = .983	r = .665** p = .000	r = -.173 p = .103	r = .218* p = .039	r = .266* p = .011
Height (m)	r = .222** p = .036	r = -.005 p = .960	-	r = -.726** p = .000	r = -.438** p = .000	r = -.002 p = .984	r = -.219* p = .038
BMI (Kg/m2)	r = -.295** p = .005	r = .665** p = .000	r = -.726** p = .000	-	r = .212* p = .045	r = .122 p = .251	r = .304** p = .004
Age (y)	r =-.747** p = .000	r =. 218* p = .039	r = -.002 p = .983	r = .122 p = .251	r = .011 p = .915	-	r = .759** p = .000
Time (sec)	r = -.994** p = .000	r =. 266* p = .011	r = -.219* p = .038	r = -.304** p = .004	r = . 285** p = .006	r = -.759** p = .000	-
Gender	r = -.295** p = .005	r = -.173 p = .103	r = -.438** p = .000	r = .212* p = .045	-	r = .011 p = .915	r = . 285** p = .006

Note: BMI = Body Mass Index; y = years; Kg = kilograms; m = meters; sec = seconds, * Indicates significant at the 0.05 level, ** Indicates significant difference at the 0.001 level, α=0.05.

A linear hierarchical multiple regression analysis (see Table 5) was used to evaluate the predictive value of the different factors (age, gender, and BMI) on the walk time. Controlling for gender and BMI, for every year increase in age, there was an associated increase in walk time of .795 seconds on average. Controlling for age and BMI, on average females had a higher walk time than males by 4.61 seconds. Controlling for age and gender, for every kg/m^2 increase in BMI, there was an associated increase in walk time of .259 seconds, on average. The regression model was statistically significant (F(3,86) = 60.38, P =. 000) indicating that age, gender, and BMI collectively predicted walked time. The regression equation is as follows: Predicated time = 66.64 + .795 (age in y) + 4.61 (gender) + .259 (BMI kg/m^2). This model accounted for 67.8% of the total variance in time based on the 200-mFWT.

Table 5: Factors associated with 200-mFWT time: Multivariate linear regression, age, gender, and BMI

Variables	*Beta*	*Sig*
Age (y)	.795	.000
Gender	4.61	.000
BMI (Kg/m^2)	.259	.012

Note: y = years; Kg = Kilograms; m = meters; Sig = Significance.

The paired t-test comparisons of cardiovascular parameters and RPE at baseline and after the 200-mFWT are presented in Table 6. A statistically significant increase was found in systolic blood pressure (SBP), diastolic blood pressure (DBP), HR, RR, and PRE following the 200-mFWT (*t* = -20.68, *P* = .000), (*t* = - 6.95, *P* = .000), (*t* = -20.72, *P* = .000), (*t* = -22.95, *P* = .000) and (*t*= - 8.82, *P* = .000) respectively. Oxygen saturation was not significantly increased after the 200-mFWT (*t* = -1.59, *P* =. 115). The independent t-test was used to compare the mean difference of cardiovascular response and the RPE between male and female participants, and the results are presented in Table 7. No statistically significant differences were found in the means of the cardiovascular parameters and the RPE between male and female participants with the 200-mFWT. Based on the mean difference given in the group statistics output, the results showed that male participants had higher blood pressures (SBP and DBP) and oxygen saturation levels than female participants, whereas female participants had higher respiratory rates and heart rates with no statistically significant difference. According to the one-way ANOVA, no statistically significant differences in the mean difference of cardiovascular parameters and RPE were found among the varied age groups. In bivariate analyses (see Table 8), the mean difference of cardiovascular parameters and the RPE for the 200-mFWT did not vary significantly with age, weight, height, and BMI.

Table 6: Paired t-test comparison of cardiovascular parameters and rate of perceived exertion following 200-mFWT

Variables	*Pre-test Mean ± SD*	*Post-test Mean ± SD*	*Mean Diff*	*T-cal*	*Sig.*
SBP (mmHg)	118.93 ± 8.79	137.94 ± 10.78	-19.01 ± 8.72	-20.68	.000
DBP (mmHg)	77.21 ± 8.68	82.41 ± 8.27	-5.20 ± 7.1	-6.95	.000
HR (bpm)	74.99 ± 12.05	119.91 ± 24.24	-44.92 ± 20.57	-20.72	.000
RR (bpm)	14.82 ± 3.59	27.56 ± 5.68	-12.01 ± 5.20	- 22.95	.000
O_2 sat	98.09 ± 2.21	98.48 ± .80	-.39 ± 2.32	-1.59	.115
RPE	7.94 ± 1.46	9.76 ± 2.63	-1.81 ± 1.95	- 8.82	.000

Note: SBP = Systolic blood pressure; DBP = Diastolic blood pressure; HR = Heart rate; RR = Respiratory rate; O_2 sat = Oxygen saturation; RPE = Rate of perceived exertion; Mean diff = meandifference; mm Hg = millimeters of mercury; bpm = beats per minute; bpm = breaths per minute; α = 0.05.

Table 7: Independent t-test and one-way ANOVA comparison of cardiovascular response (mean change) and the rate of perceived exertion (mean change) to 200-mFWT by sex

Variables	Males Mean Diff± SD	Females Mean Diff± SD	*T-cal*	*Sig.*	*F* ratio	*Sig.*
SBP(mmHg)	19.49 ± 8.4	18.53 ± 9.10	.518	.606	.127	.881
DBP (mmHg)	5.44 ± 7.17	4.96 ± 7.10	.325	.746	.028	.973
HR (bpm)	41.60 ± 20.36	48.24 ± 20.47	-1.544	.126	.606	.548
RR (bpm)	12.56 ± 5.44	12.91 ± 5.13	-.319	.751	.814	.447
O_2 sat	.56 ± 3.20	.22 ±. 77	.679	.500	1.030	.361
RPE	1.69 ± 1.99	1.93 ± 1.92	-.59	.555	2.128	.125

Note: M= male; F=Female; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; HR = Heart rate; RR = Respiratory rate; O_2 sat = Oxygen saturation; RPE = Rate of perceived exertion; Mean diff = meandifference; Diff= difference; mm Hg = millimeters of mercury; bpm = beats per minute; bpm = breaths per minute; α=0.05.

Table 8: Pearson's product moment correlation matrix of the relationships between cardiovascular response (mean change) and the rate of perceived exertion (mean change) to 200mFWT and the dependent variables (age, weight, height, and BMI)

	Weight (kg)	Height (m)	BMI (Kg/m²)	Age (y)
Systolic (mmHg)	r = -.018 p = .867	r = .017 p = .871	r = .007 p = .944	r = -.050 p = .637
Diastolic (mmHg)	r = -.002 p = .987	r = .070 p = .515	r = -.004 p = .970	r = -.028 p = .791
HR (bpm)	r = -.203 p = .055	r = -.116 p = .277	r = -.017 p = .872	r = -.110 p =. 300
RR (bpm)	r = -.157 p = .140	r = .043 p = .686	r = -.140 p = .189	r = .147 p = .167
O_2 sat	r = .057 p = .593	r = .131 p = .218	r = -.058 p = .584	r =.171 p = .107
RPE	r = -.052 p = .628	r = .033 p = .759	r = -.016 p = .880	r = .014 p = .893

Note: SBP = Systolic blood pressure; DBP = Diastolic blood pressure; HR = Heart rate; RR = Respiratory rate; O_2 sat = Oxygen saturation; RPE = Rate of perceived exertion; Mean diff = meandifference; mm Hg = millimeters of mercury; bpm = beats per minute; bpm = breaths per minute; y = years; Kg = kilograms; m = meters; sec = seconds, * Indicates significant at the 0.05 level, ** Indicates significant difference at the 0.01α=0.05.

5. Discussion

The 200-mFWT has been used to examine the effect of high-intensity exercise in individuals with cardiorespiratory diseases. In the last decade, studies have used the 200-mFWT in cardiac rehabilitation and have compared the effect of the 200-mFWT with other walk tests in patients with cardiorespiratory diseases. [13,17,18,27] However, the literature did not provide normative reference values for the 200-mFWT in healthy individuals between the ages of 20 and 49.

This study established normative values for the 200-mFWT for time in healthy young individuals between 20 to 49 years of age and concluded that differences existed among the participants in the different age groups of 20 to 29, 30 to 39, and 40 to 49 years. The 200-mFWT has been showed to be technically useful and safe. The instructions of "walk as fast as possible without running" were simple and easy to follow. Fatigue due to outside factors was not seen before starting the testing.

In addition to the normative data, the study showed the effect of age and gender on time. This study also determined the responses in terms of selected cardiovascular parameters - SBP, DBP, RR, HR, and oxygen saturation - to the 200-mFWT.

A meaningful difference was found in the 200-mFWT time amongst males and females. Females had a significantly higher mean walking time than males, which meant that male's participants walked faster than female participants. Oja et al. used different walking tests in their study, and their findings supported the results of this study that walking time for males was lower than that for females.[12] Mbada and colleagues observed a significant difference in the 6MWT distance between males and females.[42] The mean walking time for the 200-mFWT in this study was 105.69 ± 9.06 seconds for females and 100.27 ± 9.35 seconds for males. The physical differences between males and females probably resulted in the walking time differences. Normally, females tend to have more body fat, whereas males tend to have more lean muscle mass. In addition, females tend to have shorter legs, longer trunk, and consequently shorter stride length than males. This latter tendency, was supported in this present study with the findings that males had statistically significantly higher mean scores in the measures of height (t (88)=4.57, $p<$ .0005) and significantly lower BMI than the female participants (t (88)= - 2.04, $p<$ .045).[42.43]

A statistically significant main effect was found on the mean walking time not only between gender but also among the varied age groups, F (2,84) = 77.067, $p<$ .0005, and the findings showed that the time increased with increasing age. Bohannon studied the variables that help to explain gait velocity in older adults and found that individuals walked faster when they are younger.[57] Therefore, the findings related to gender and age for the 200-mFWT in this study were similar to those found for other walk test studies among healthy individuals.[37, 57,66]

The time for the 200-mFWT was significantly correlated with age, weight, height, and BMI. Mbada et al established normative data for the 6MWT for apparently healthy adult Nigerian individuals and reported similar results, which supported the results of this study that age and other demographic characteristics meaningfully impact walking time.[42] Age was the main factor in this study that affected the 200-mFWT results in healthy subjects. Casanova et al. also found that age was the variable that influenced walking performance on the 6MWT distance when they identified new normative data for healthy subjects from seven countries.[8] In addition to age; other factors influenced the results of the 200-mFWT, such as gender and BMI. The regression analysis indicated that these variables explained about 67.8% of the total variance in time for the 200-mFWT.

The results of the correlation and regression analyses in this present study provide some valuable information in understanding the 200-mFWT. The results of the correlation analysis showed a significant negative correlation between gait speed and age, weight, and BMI. This finding was consistent with previous studies.[8, 34,42] In addition, the study concurred with the outcomes of other studies that a positive relationship exists between velocity and height, suggesting that the taller the person is, the faster he/she will walk.[33, 34] Thus, we can conclude that individuals walk faster when they are younger, male, and taller.

A further finding of this present study was the statistically meaningful changes in cardiovascular responses - SBP, DBP, HR, and RR - following the 200-mFWT. In addition, a meaningful difference was observed in the rate of perceived exertion following the 200-mFWT. However, no significant difference was observed in oxygen saturation following the 200-mFWT. In addition, no statistically meaningful difference was detected due to gender in the cardiovascular responses and the rate of perceived exertion following the 200-mFWT. Previous studies with healthy subjects and with patients with cardiac disease supported the results of this study in terms of SBP, DBP, RR, and HR.[17, 18] Casillas et al. found that the 200-mFWT could be used as an assessment tool in predicting a significant improvement in HR in patients with cardiac disease.[27] Gremeaux et al. evaluated the difference between two types of walking tests (6-minute walk test and 200-meter fast walk test) after a cardiorespiratory exercise test in healthy elderly subjects and reported that the peak oxygen consumption was higher after one trial of the 200-mFWT than one trial of the 6MWT, which is contrary to the results of this study that found no significant different in oxygen consumption before and after the 200-mFWT.[17]

The present study found no gender effects on cardiovascular parameters after the 200-mFWT. However, Wheatley et al. found gender differences in that females showed a trend for higher HR than males and males showed a trend for higher SBP in response to submaximal exercise.[44] Jones also found that females tended to have higher heart rates than males after submaximal exercise.[45] Dimkpa et al. assessed the gender differences in systolic blood pressure after ergometer exercise and found that the males had higher SBP after exercise than females.[46] All these studies opposes the results of our study about the effect of gender on cardiovascular parameters

Walk tests have been increasingly used in clinical settings to assess functional capacity, and the results will be increasingly used as predictor of outcomes.

The limitations of this study include that factors other than the demographic variables that are known to influence gait speed, such as motivational factors and learning effect, were not addressed. The possible influence of habitual physical activity on walking ability was not assessed in this study. Lastly, this study only established normative data for the 200-mFWT in healthy individuals.

In conclusion, this study established normative data for the 200MFWT in healthy young individuals between the ages of 20 and 49 years. For 20-29 year old males, the mean time to complete the 200-mFWT was 91.60 seconds; for 20-29 year old females, the mean time to complete was 98.33 seconds; and for 20-29 year old combined males and females, the mean time to complete was 94.97 seconds. For 30-39 year old males, the mean time to complete the 200-mFWT was 99.47 seconds; for 30-39 year old females, the mean time to complete was 103.20 seconds; and for 30-39 year old combined males and females, the mean time to complete was 101.33 seconds. For 40-49 year old males, the mean time to complete the 200-mFWT was 109.733 seconds; for 40-49 year old females, the mean time to complete was 115.53 seconds; and for 40-49 year old combined males and females, the mean time to complete was 112.63 seconds.

Our data indicated that age and physical characteristics had a meaningful impact on the performance of the 200-mFWT. Predictive models based on age, gender, and BMI explained 67.8% of the total variance in walking time. Finally, our findings suggest that the 200-mFWT is an appropriate test for examination of cardiorespiratory fitness as it induced significant cardiovascular response and exertion in healthy individuals.

6. Clinical Messages

- The 200-mFWT is a high-intensity walk test that was well tolerated by all individuals.
- The 200-m fast walk time was affected by increasing age.
- Young, tall males walked faster than the other young adults.

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8. Conflict of interest

None

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Figure 1. RPE scale (Rating of perceived exertionscale, Borg 1970)

How hard do you feel this exercise is?	
6	
7	very, very light
8	
9	very light
10	
11	fairly light
12	
13	somewhat hard
14	
15	hard
16	
17	very hard
18	
19	very, very hard
20	