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Open Access Journal of Pulmonary & Respiratory Sciences
ISSN: 2642-1143

Effects of Course Length on the Six-Minute Walk Test in Healthy Adults: A Pilot Study

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Pilot Study

Volume 6 Issue 1

Received Date: April 27, 2021

Published Date: May 11, 2021

DOI: 10.23880/oajprs-16000140

Abstract

Introduction: The 6 Minute Walk Test (6MWT) is an easy and effective way to measure functional capacity, track progress/regression of interventions, and predict morbidity and mortality. According to the protocol of the American Thoracic Society (ATS), the ideal course length for the 6 MWT is 30m. Unfortunately, most clinics do not have sufficient space to accommodate these guidelines. The purpose of this pilot study is to examine the effects of different course lengths on the 6MWT in healthy adults age 18-30, in addition to adding to the normative data for distanced walked.

Methods: A quasi-experimental design was used. Twenty-one healthy participants were randomly assigned to either the 15m or 20m walk group. Results were analyzed using a one- tailed paired samples t-test.

Results: Both the 15m and 20m groups demonstrated no difference in distance walked when compared to their 30m trial. The mean distance walked in the 15m groups was 544.28m (SD = 46.15), with a 30-m course distance walked as 614.54m (SD = 65.81). The mean distance walked in the 20-m group was 597.37m (SD = 59.92) with a 30-m distanced walked as 614.54m (SD = 65.81).

Discussion: Our study is one of the first to investigate distanced walked in healthy adults aged 18-30. Based on our results, we suggest that clinicians and researchers use their current space, albeit their space is at least 15m with health adults. Further research is warranted to investigate course lengths relationship to distance walked in other population.

Keywords: Course length; Six-minute walk test; Healthy adults

Introduction

The 6 Minute Walk Test (6 MWT) is a simple and effective functional capacity measure that mimics activities of daily living [1-2]. The 6 MWT assesses submaximal exercise tolerance by measuring the distance someone can walk within six minutes at their self-selected speed and has been reported to predict morbidity and mortality in individuals with moderate to severe cardiovascular and lung disease, track progress and regression of therapeutic interventions, and qualitatively provide clinicians and researchers the ability to observe gait asymmetries [1-4]. Self- selected speed and minimal equipment of a stopwatch, chair, and hallway are distinct clinical advantages the 6 MWT has on similar functional capacity measures such as the shuttle and treadmill fitness test and makes the 6 MWT an ideal choice in clinical environments [5-7].

The American Thoracic Society [3] outlined the 6 MWT should be performed indoors, along a flat, straight, and

enclosed hallway of at least 30m where minimal to no traffic is noted. The American Thoracic Society [3] rationalized a shorter hallway would reduce distance walked.

Additional variables, which influenced distance walked, include gender, age, height, weight, perceived exertion, heart rate, fitness, and country of residence [2,5,8]. Each of those aforementioned variables is non-modifiable by the clinician or researcher prior to implementation of an intervention. A modifiable variable for clinicians and researchers is hallway or course length.

Beekman, et al. [1] reported a 49.5m difference when comparing a 30m course with a 10m course in patients with chronic obstructive pulmonary disease population. Ng, et al. [9] found a 14m difference when comparing a 30m course to a 20m course, 41m difference when comparing a 30m course to a 10m course, and a 21m difference when comparing a 20m course to a 10m course. Similarly, Klein, et al. [10] reported a 22.1m difference when comparing a 30m course with a 20m course. Klein, et al. [10] also found performance to be a moderate indicator of distance walked. Gochicoa-Rangel, et al. [11] reported a mean difference of 25m in their healthy control group and 17m in their chronic lung disease group when comparing a 15m and 30m course. Of note, Gochicoa-Rangel, et al. [11] reported a Pearson correlation of 0.85 and 0.96 within their healthy control group and chronic lung disease groups, respectively. Lastly, Trooster, Gosselink, & Decramer [12] found the average distance walked for healthy older adults, aged 50-85 was 631m (SD = 93).

Purpose of the Study

In this pilot study, we wanted to compare the distance walked of a 30m course with a 20m and 15m courses in a healthy, adult population age 18-30. The purpose of this study was to measure the effect of course length on distanced walked in healthy adults age 18-30. We hypothesized, that the longer the course length, the greater the distance walked. This study also sought to add to the normative data for the 18–30-year-old healthy, adult population.

Methods

We performed a prospective study over a four-month period in the Physical Therapy Department at Alabama State University in Montgomery, Alabama.

Study Design

Participants were recruited among college-aged students at Alabama State University and the surrounding community. Information letters outlining the aim of the study were distributed within the University and surrounding communities. A quasi-experimental study design was used. Approval for the study was obtained by the Alabama State University Institutional Review Board.

Participants

Twenty-four adults volunteered for the study. Inclusion criteria included: must be between the age of 18-30 and respond to yes to all items on the health questionnaire. Exclusionary criteria included: anyone below 18 years of age, adults older than 30, and anyone who answered no to any item on the health questionnaire.

Protocol

Participants were randomly assigned into two experimental groups, 15m or 20m. In total, each participant completed two 6 MWTs. The 30m 6 MWT served as the control, while their randomly assigned 15m or 20m served as the experimental. Each of their 6 MWT were completed on different days. The order of completion was randomized, and the second test was performed between 2-21 days of the initial testing.

All 6 MWTs were performed in params defined by the American Thoracic Society [3] guidelines. Each participant was provided instructions in the information letter to wear comfortable walking shoes and clothes and to bring an ambulatory walking aid, if warranted in addition to not engaging in any vigorous exercise within two hours of their appointment time. All tests were performed in the same location, a quiet indoor hall with a flat, straight floor. The floor was marked at every five m and traffic cones and a chair were placed to mark the turns of the 6 MWT course.

Each participant sat for ten minutes prior to starting the 6 MWT. After sitting for ten minutes, vitals of blood pressure, heart rate, and respiratory rate were taken. All vitals were taken by the same researcher. In addition, the participants were provided with instructions of the 6 MWT and a physical copy of the modified Borg scale. Verbal encouragement and vital monitoring were completed as outlined in the 6 MWT protocol. Lastly, vitals were taken immediately after the completion of the 6 MWT.

Data Analysis

The difference between the 15m course and 30m course distance walked was analyzed using a one-tailed, paired t-test. The difference between the 20m course and 30m course were analyzed using a one-tailed, paired t-test. *P*-values were to be considered significant if less than 0.05.

Results

An initial sample of twenty-four participants from the College of Health Science at Alabama State University, between the ages of 18 and 30, volunteered to participate in this study. Three participants data were excluded due to failure of participants to follow the outlined protocol.

Demographic

Demographic characteristics of all twenty-one participants are summarized in Table 1, including age, sex, and race-ethnicity. Cardiorespiratory vitals are summarized in Tables 2 & 3.

Characteristic	
Mean age[a]	24.5 (1.78)
Sex[b]	
Male	8 (38)
Female	13 (62)
Race/Ethnicity[c]	
African American	5 (24)
Asian	0 (0)
Hispanic, Latino, or Spanish Origin	0 (0)
Middle Eastern or North African	0 (0)
Native Hawaiian or Pacific Islander	0 (0)
White (Non-Hispanic)	16 (76)

Table 1: Characteristics And Demographics Of All Participants.
[a]Mean age with Standard Deviation in parenthesis.
[b]Number of participants who identify as the aforementioned sex and percentage within parenthesis. No
[c]participants identified outside of male and female.
Number of participants who identify with the race/ethnicity category and percentage within parenthesis.

Participants[a]	Before 6MWT[e]		Change following 6MWT[e]	
Vitals	15m	30 m	15m	30 m
Heart Rate[b]	67 (9.34)	68 (11.21)	90.2 (16.01)	86 (14.20)
Respiratory Rate[c]	16.7 (3.13)	16.18(3.51)	19.5 (4.91)	19.3 (5.39)
Borg Exertion[d] Scale	0.7 (0.64)	0.36 (0.67)	2.18 (1.45)	2.3 (1.89)

Table 2: Mean Cardiorespiratory Vitals For 15m And 30m.
[a]n = 11 participants.; [b]Heart rate is measured in beats per min.; [c]Respiratory rate is measured in breaths per min.
[d]Borg exertion scale is measured from 0-10.; [e]Parenthesis denotes standard deviation

Participants[a]	Before the 6MWT[e]		Change following 6MWT[e]	
Course Distance	20 m	30 m	20 m	30 m
Heart Rate[b]	74.8 (8.0)	68.6 (6.5)	101.7 (15.4)	94.8 (19.6)
Respiratory Rate[c]	15.5 (5.2)	15.2 (4.5)	18.8 (4.4)	19.2 (3.9)
Borg Exertion[d]	0.2 (0.3)	0.2 (0.4)	2.8 (1.6)	2.7 (1.8)

Table 3: Mean Cardiorespiratory Vitals For 20m And 30m.
[a]n = 10 participants.; [b]Heart rate is measured in beats per min.
[c]Respiratory rate is measured in breaths per min.; [d]Borg exertion scale is measured from 0-10.
[e]Parenthesis denotes standard deviation

Analysis

There were eleven participants in group one, 15m course length (Table 4). The mean distance walked for the 15m course was 544.28m (SD = 46.15) and the mean distance walked for the 30m course was 562.31m (SD = 28.37). A one-tailed, paired t-test was conducted to determine if healthy adults walked further on the 30m course when compared to the 15m course. The distance walked served as the dependent variable. The results of the one-sample t-test was not significant, t(10) = -1.71, p = .06. The effect size (d = 47) was small. Thus, the results suggest that course length does not affect distanced walked in health adults (Table 4).

There were ten participants in group two, 20m course length (Table 4). The mean distance walked for the 20m course was 597.37m (SD = 59.92) and the mean distance walked for the 30m course was 614.54m (SD = 65.81). A one-tailed, paired t-test was conducted to determine if healthy adults walked further on the 30m course when compared to the 20m course. The distance walked served as the dependent variable. The results of the one-tailed, paired t-test was not significant, t(9) = -1.50, p = .08. The effect size (d = .27) was small. Thus, the results suggest that course length does not affect distanced walked in healthy adults (See Table 4).

Participants	Group 1[a]		Group 2[b]	
Course Distance	15 m	30 m	20 m	30 m
Distance Walked[c]	544.28 (46.15)	562.31 (28.37)	597.37(59.92)	614.54 (65.81)
P Value	0.06		0.08	
Effect Size	0.47		0.27	

Table 4: 6MWT Distance Walked.
[a]Group 1, n = 11 participants
[b]Group 2, n = 10 participants
[c]Distance walked as measured in m. Parenthesis denotes standard deviation.

Discussion

Overall, healthy adults did not walk further on a 30m course when compared to either a 15m course (p = .06) or a 20m course (p = .08). Our results are in contrast with previously reported scholars who found course length to affect distance walked [1,9-11]. Although our study is inconsistent with previously reported literature, our study is one of the few that used healthy adults. Beck, et al. [1] concluded there was a difference in course length, when they compared a 10m course to a 30m course. The discrepancy between our results and theirs may be a result of a meaningful difference between 15m and 10m, in addition to the sample population of participants of COPD when compared to our study of healthy adults. Overall, Beck, et al. [1] reported a shorter distance walked than our participants. Ng, et al. [9] also concluded there was a difference in course length when comparing a 20m course to a 30m course. The discrepancy between our results and theirs may be attributed to the sample population of participants of adults with stroke when compared to our study with healthy adults. Similar to Beck, et al. [1], Ng, et al. [9] reported an overall lower distanced ambulated than our participants. Gochicoa-Rangel, et al. [11], one of the few scholars to use healthy adults as a control group, were in agreement with our results when they concluded a 15m distance can be used in patients with chronic lung disease. Gochicoa-Rangel, et al. [11] explained that if test administrators maintain intra-rater reliability by ensuring the same person is conducting the test, results can be interpreted as valid.

One explanation on why course length had no affect is due to the sample size of healthy adults aged 18-30. Our study was one of the first to focus on this age group. In agreement with Gochicoa-Rangel, et al. [11], we suspect the guidelines published in 2002 and 2014 concluded the 30m course as the optimum course due to lack of published data demonstrating the validity and reliability of a shorter course distance. Another explanation why course length had no affect is the intra-rater reliability of our study. During our study, the same researcher conducted each portion, for each of the twenty-one participants. As Gochicoa-Rangel, et al. [11] the use of multiple test administrators may skew results. Lastly, since we allowed participants to complete each trial of the 6 MWT on separate days, this strengthened our internal validity [13-15].

Clinicians and researchers should note the additional factors such as height, weight, gender, age, body mass index, heart rate, perceived exertion, prior level of physical activity and socioeconomic status may predict or effect 6 MWT distance [2,5,8]. Mylius, et al. [8] highlighted in their systematic review of children and adolescents that due to the lack of homogeneity of study designs an ideal single reference value is impossible. A positive correlation has been reported with the male sex, height, prior physical activity level, heart rate, and perceived exertion, while a negative correlation has been reported with age and weight [2,8]. Lastly, Almeida, et al. [5] argued participants from countries with a higher percentage of low socioeconomic conditions may walk

further, when compared to more affluent countries.

Based on our pilot data, there is support for clinicians can use their available space, albeit their space is at least 15m, when performing the 6 MWT on healthy adults aged 18-30.

Additional studies are warranted to continue to add to the body of evidence supporting or refuting in patients with cardiopulmonary conditions and neuromusculoskeletal conditions, in addition to age stratifications.

Conclusion

In our pilot study, course length did not affect distance walked in healthy adults aged 18- 30. These results are inconsistent with previous studies which outlined course length affected distance ambulated *[*1,9-11*]*. One explanation for this inconsistency is our sample size of age 18-30, healthy adults. Additional studies are warranted to continue to add to the normative data of health adults and to support or refute our conclusion of course length not affecting distance walked.

Limitations

A limitation of this study was that we used a convenience sample. Another limitation when interpreting the results is the lack of generalizability due to this being a pilot study. Lastly, the homogeneity of our sample may have influenced our results.

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