GAVIN PUBLISHERS

OPEN ACCESS

Annals of Case Reports

Johnson S, et al. Ann Case Report 14: 470.

DOI: 10.29011/2574-7754.100470

Case Report

Six-Minute Walk Test: A Study to Evaluate Normal Values in Female Saudi Arabia Population

Saumy Johnson[1*], Hajed M Al-Otaibi[2], Khaled Ali Al-Awam[3]

[1]Assistant Professor in Respiratory Therapy, Inaya Medical College, Riyadh, Saudi Arabia

[2]Assistant Professor and Chair, Department of Respiratory Therapy, King Abdulaziz University, Saudi Arabia

[3]Assistant Professor and Chair, Department of Respiratory Therapy, Inaya Medical College, Saudi Arabia

[*]**Corresponding author:** Saumy Johnson, Assistant Professor in Respiratory Therapy, Inaya Medical College, Riyadh, Saudi Arabia

Citation: Johnson S, Al-Otaibi HM, Al-Awam KA (2020) Six-Minute Walk Test: A Study to Evaluate Normal Values in Female Saudi Arabia Population. Ann Case Report 14: 470. DOI: 10.29011/2574-7754.100470

Received Date: 23 August, 2020; **Accepted Date:** 29 August, 2020; **Published Date:** 04 September, 2020

Abstract

Background: Different ethnic populations have normal values for reference. These values are vital to a precise interpretation of the 6MWT in clinical practice.

Objective: To evaluate normal six-minute walk distance among young Saudi female population.

Design: Cross sectional, Prospective.

Setting: Academic set up.

Patients and Methods: Cross sectional study conducted on female volunteers aged 18-30 years old. 6MWD was done in a 30 meters long corridor. Vital signs were measured before and after the test. MET was calculated from the distance walked.

Main Outcome Measure(s): The primary outcome measure was the 6MWD.

Results: Sixty-nine female volunteers participated in the study. Mean age was 23.00 (1.67) (years) and BMI was 22.67(4.10) kg/m^2. 6MWT mean distance covered was 403.43 (91.62) meters. The Metabolic Equivalent and Maximum Heart Rate (%mHR) achieved were 2.81(0.76) ml/kg/min and 50.41(6.7) %, respectively. Height was found to be positively correlated with 6MWD. The 6MWD was found to be in agreement with the reference equation for Saudi population ($P < 0.05$). There is a significant difference in heart and respiratory rates, $p<0.000$, CI {-14.16- (-4.54)}, {-5.45- (-2.63) respectively.

Conclusion: Height was found to be positively correlated with 6MWD. A large multicenter study is required to confirm the present data and to include a larger age scale.

Keywords: Female; Saudi Arabia; Six-minute walk distance; Six-minute walk test

Abbreviations: 6 MWD: Six-minute walk distance; 6MWT: Six-minute walk test; SRU: Scientific Research Unit; BMI: Body Mass Index; MET: Metabolic Equivalent; %maxHR: Maximum Percentage HR

Introduction

Six-Minute Walk Test (6MWT) is a simple method of evaluating exercise capacity of an individual. Assessment of functional capacity of an individual without any equipment or additional training is a unique to 6MWT [1]. Furthermore, it examines global and integrated responses of pulmonary and cardiovascular systems, systemic circulation, peripheral circulation, blood, neuromuscular units, and muscle metabolism [2]. However, it does not provide parameters about each organ systems compared to other cardiopulmonary exercise tests [1]. 6MWT was found to be more suitable in patients with respiratory disorders compared to 12 min walking [3]. As most of activities of daily living are done in submaximal level of effort makes 6 MWT a superior assessment of daily activities of living.

Different ethnic populations have normal values for reference. These values are vital to a precise interpretation of the 6MWT in clinical practice [4,5]. Many studies have shown that these reference values differ from those for western populations.

Within this context, few researches performed in Arab population. Alameri, H et al demonstrated that Saudi population have a shorter 6MWD compared to other Caucasian population [4]. Zou et al illustrated that reference equations from Caucasian, Canadian and Chilean populations have a tendency to overestimate walking distance of Chinese and Brazilian population while Arabian equations tend to underestimate it [3,6,7-10]. A recent systematic review reported that among different reference equations in healthy population, independent predictors of the 6MWD include height, weight, age and sex. Despite that large differences in predicted 6MWD occur in these researches [11-23]. The present study aims to evaluate normal 6MWD among young female Saudi Arabia population.

Materials and Methods

A prospective cross-sectional study performed over one year, 2017-2018. Participants were recruited through convenient sampling. Ethical approval was obtained from IRB of Scientific Research Unit (SRU) at Medical College. All participants signed a written consent form. Anthropodermic data including height, weight, and age as well as participants' medical history were collected before the 6MWT. 6MWT procedures were explained to the participants and any questions concerning procedures were answered. Height was measured using a standard gauge calibrated as per manufacturer's standards without shoes by standing on height measurement scale stadiometer. Commercially available electronic weighing machine (TCS-200-RT, China) calibrated as per manufacturer's standards were used for the weight measurement and BMI was calculated as Weight/ Height^2. BMI was categorized according to the World Health Organization definition: BMI <18.5 kg/m^2 - Underweight, BMI 18.5-24.9 kg/m^2 - Normal weight, BMI 25.0-29.9 kg/m^2 - Pre-obesity, BMI 30.0-34.9 kg/m^2 - Obesity class I, BMI 35.0-39.9 kg/m^2 - Obesity class II, BMI Above 40 kg/m^2 - Obesity class III. Inclusion criteria included absence of illness, age > 18 years, and willingness to participate. Exclusion criteria included presence of any chronic diseases, cardiac disorders, respiratory disorders and pregnancy.

Six-Minute Walk Test

6MWT was performed according to ATS guidelines [1]. Walking corridor was 30 meters long. Turnaround point was marked with orange cones and chairs were placed at small interval distance in walkway. Participants were informed to avoid strenuous exercise two hours before test. Only a light meal was allowed before test. Participants were instructed to walk as long as they can during six minutes time limit. Vital signs, oxygen saturation and Borg Dyspnea Scale of were measured prior to starting test. Participants were informed to have a rest and sit on nearby chair if they experience any signs and symptoms such as dizziness, fatigue, leg cramps, chest pain or dyspnea and continue walking after feeling better. Time and distance were recorded as well as encouraging participant by saying "you are doing well; you have 3 min to complete the test". Distance covered in 6 minutes was calculated and documented. After completion of 6 MWT, vital signs and Borg Dyspnea Scale were measured again. Metabolic Equivalent (MET) was calculated using conversion tables for estimating MET based on distance walked. Sample size calculated with 95% Confidence Interval was 119.

Statistical Analysis

Data was analyzed using SPSS software version 25.0 (SPSS, Inc., Chicago, IL). Descriptive data is expressed as a mean ± Standard Deviation (SD). Paired t test was performed for pre-post variables. Variables such as height, weight, age, BMI, oxygen saturation, heart rate and respiratory rate were analyzed with Pearson's correlation. Regression was performed for 6 MWD, age, weight, height, and BMI. $P \leq 0.05$ was considered statistically significant.

Results

Sixty-nine females were recruited. Mean age was 23.00 (1.67) (years) and BMI was 22.67 (4.10) (kg/m^2). 6MWT mean distance covered was 403.43± 91.62 meters. MET was 2.81(0.76) ml/kg/min. Table 1 presents the characteristics of the participants. Table 2 presents 6MWT values before and after. Data shows that there is a significant difference in heart rate and respiratory rates, p<0.000, CI {-14.16- (-4.54)}, {-5.45- (-2.63) respectively. No statistically significant difference in systolic blood pressure, diastolic blood pressure, and SpO_2 was observed. Figure 1 illustrate the significant difference in the vital signs before and after the 6MWT. Percentage of Maximum Heart Rate (%mHR) achieved was 50.41(6.7)%. Table 3 presents Pearson correlation for variables collected during study with 6MWT distance. Figure 2 represents the relationship between 6MWT and other variables. Height and SpO_2 correlated well with 6MWT with significant statistical difference. 6MWD was calculated using reference equation by Alameri, H et al and is compared with measured 6MWD of present participants as seen in Table 4. No significant difference between the two studies was observed.

Characteristics	N (69) Mean ± SD
Age (Years)	23.08 ± 2.02
Height (Meters)	1.58 ± 0.05
Weight (Kg)	58.36 ± 12.94
BMI (kg/m^2)	23.07± 4.64

Table 1: Characteristics of the participants.

Parameter	N (69) Mean ± SD	P value
6MWD in meters	403.43 ± 91.62	
MET (ml/kg/min)	2.81 ± 0.76	
Baseline BP Syst in mm Hg	117.92±15.08	0.30
Post 6MWT BP Sys in mm Hg	119.60 ± 13.49	
Baseline BP Diastolic in mm Hg	75.96 ±11.36	0.051
Post 6MWT BP Dias in mm Hg	78.61 ± 9.39	
Baseline HR in Beats per minute	89.25 ± 13.50	0.000
Post 6MWT HR HR in Beats per minute	99.20±13.29	
Baseline SPO_2 in %	97.75±2.71	0.345
Post 6MWT SPO_2 in %	96.46 ± 10.99	
Pre RR in Breaths per minute	18.65 ± 3.93	0.000
Post RR in Breaths per minute	22.55± 13.29	

Table 2: Six Minute walk test parameters.

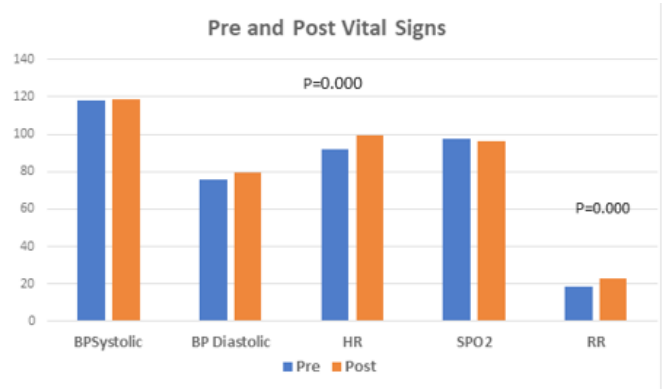

Figure 1: Vital Signs before and after 6 minute walk test.

Variable	r value	P value
Age (Years)	-0.11	NS
Height (Meters)	0.368*	0.02
Weight (Kg)	-0.152	NS
BMI (Kg/m^2)	-0.17	NS
Baseline BP Systolic (mm Hg)	-0.15	NS
Post 6MWT BP Systolic (mm Hg)	-0.02	NS
Baseline DBP (mm Hg)	-0.17	NS
Post 6MWT DBP (mm Hg)	0.15	NS
Baseline HR (Beats/minute)	0.14	NS
Post 6MWT HR (Beats/minute)	0.14	NS
Baseline SPO_2 (%)	0.11	NS
Pre RR (Breaths/minute)	-0.087	NS
Post RR (Breaths/minute)	-0.021	NS
Difference in HR	-0.18	NS
Difference in RR	0.037	NS

Table 3: Univariate correlation coefficients for 6MWT.

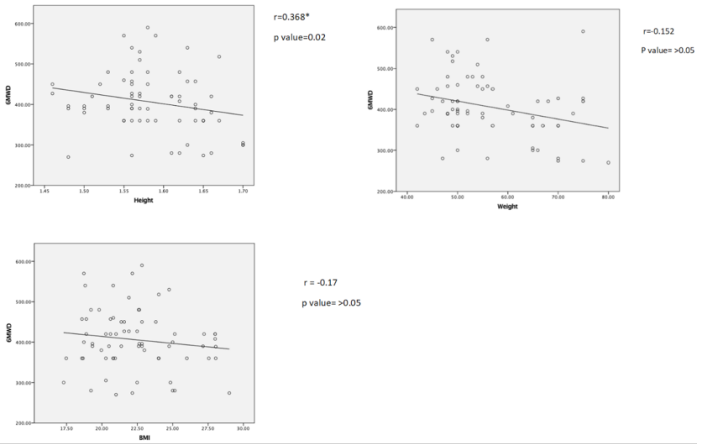

Figure 2: Relation between 6MWD with age, weight, height and BMI.

	Mean ± SD	P value
6MWD predicted [4].	412± 93.67	0.276
6MWD measured	403 ± 91.62	

Table 4: Comparison with reference equation.

Discussion

Present study is considered one of a few studies that have evaluated 6MWT in female Saudi Arabia population with age group 18-30 years. Current study shows that 6MWD among this population is 403.43 (91.62) meters. This is shorter than other normal reference value of different ethnic population [5,24-26]. Furthermore, findings show that age is negatively correlated with 6MWD but is not statistically significant. Small sample size could be a contributing factor. On the other hand, height is statistically significant and correlated well with 6MWD. In contrast, there was a negative correlation between BMI and 6MWD. Moreover, there was a significant difference between the HR and RR before and after the 6 MWT. This could be attributed to cardiopulmonary effects of the 6MWT. Study result is on agreement with previously published similar investigations. 6 MWD is comparable with the available

reference equation for Saudi Arabia population [4]. However, in comparison to other ethnic groups such as Caucasian and Asian population, present 6MWD is less than other ethnic groups. Thus, present data strongly suggest that using Caucasian or Asian population reference values would lead to an overestimation among female Saudi Arabia population with age group 18-30 years [27].

Differences may be caused by differences in anthropometric factors; demographic data; race and the level of physical activity. Low physical activity or physical inactivity has been reported in literature in oil producing Arab countries such as Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates [28]. which accounts for increased mortality and morbidity. In Saudi Arabia, physical activity is found to be 6.1% in male and 1.9% in female; respectively [29]. Our participants reached a maximum percentage HR (%maxHR) of 50.41± 6.7% of their maximum predicted HR. Chetta A et al reported 67±10% of their maximal predicted heart rate in their study6 which is higher than our observation. Participants in Alameri et al study reached %maxHR of 47% which is lesser than our observation. Participants studied by Zou et al reached an average %maxHR of 59% which is close to our findings. Limitations of this study include: first; we did not include individuals more than the age of 30 so results cannot be generalized for age group other than 18-30 years. Second, small sample size. Third; present investigation was conducted in a female college cohort group. Therefore, male participants were not recruited.

Conclusion

6MWD among female Saudi Arabia with ages between 18-30 years is 403.43 (91.62) meters. Height was found to be positively correlated with 6MWD. A large multicentre study is required to confirm the present data and to include a larger age scale.

References

1. ATS Committee on Proficiency Standards for Clinical Pulmonary Function Laboratories (2002) ATS statement: guidelines for the six-minute walk test. Am J Respir Crit Care Med 166: 111-117.
2. Solway S, Brooks D, Lacasse Y, Thomas S (2001) A qualitative systematic overview of the measurement properties of functional walk tests used in the cardiorespiratory domain. Chest 119: 256-270.
3. Butland RJA, Pang J, Gross ER, Woodcock AA, Geddes DM (1982) Two-, six-, and 12-minute walking tests in respiratory disease. BMJ 284: 1607-1608.
4. Alameri H, Al-Majed S, Al-Howaikan A (2009) Six-min walk test in a healthy adult Arab population. Respiratory Medicine 103: 1041-1046.
5. Rahman SAA and Alnegimshi AA (2014) Normative values of six-minute walk distance for healthy Saudi girls. World Appl Sci J 32: 1721-1730.
6. Zou H, Zhang J, Chen X, Wang Y, Lin W, et al. (2017) Reference Equations for the Six-Minute Walk Distance in the Healthy Chinese Han Population, Aged 18-30 Years. BMC Pulm Med 17: 119.
7. Chetta A, Zanini A, Pisi G, Aiello M, Tzani P, et al. (2006) Reference values for the 6-min walk test in healthy subjects 20-50 years old. Respir Med 100: 1573-1578.
8. Gibbons WJ, Fruchter N, Sloan S, Levy RD (2001) Reference values for a multiple repetition 6-minute walk test in healthy adults older than 20 years. J Cardpulm Rehabil 21: 87-93.
9. Osses AR, Yanez VJ, Barria PP, Palacios MS, Dreyse DJ, et al. (2010) Reference values for the 6-minutes walking test in healthy subjects 20-80 years old. Revista medica de Chile 138: 1124-1130.
10. Iwama AM, Andrade GN, Shima P, Tanni SE, Godoy I, et al. (2009) The sixminute walk test and body weight-walk distance product in healthy Brazilian subjects. Braz J Med Biol Res 42: 1080-1085.
11. Singh SJ, Puhan MA, Andrianopoulos V, Hernandes NA, Mitchell KE, et al. (2014) An official systematic review of the European Respiratory Society/American Thoracic Society: measurement properties of field walking tests in chronic respiratory disease. Eur Respir J 44: 1447-1478.
12. Casanova C, Celli BR, Barria P, Casas C Cote, de Torres JP, et al. (2011) The 6-min walk distance in healthy subjects: reference standards from seven countries. Eur Respir J 37: 150-156.
13. Dourado VZ, Vidotto MC, Guerra RL (2011) Reference equations for the performance of healthy adults on field walking tests. J Bras Pneumol 37: 607-614.
14. Hill K, Wickerson LM, Woon LJ, Abady AH, Overend TJ, et al. (2011) The 6-min walk test: responses in healthy Canadians aged 45 to 85 years. Appl Physiol Nutr Metab 36: 643-649.
15. Soares MR and Pereira CA (2011) Six-minute walk test: reference values for healthy adults in Brazil. J Bras Pneumol 37: 576-583.
16. Ben Saad H, Prefaut C, Tabka Z, Mtir AH, Chemit M, et al. (2009) 6-minute walk distance in healthy North Africans older than 40 years: influence of parity. Respir Med 103: 74-84.
17. Jenkins S, Cecins N, Camarri B, Williams C, Thompson P, et al. (2009) Regression equations to predict 6-minute walk distance in middle-aged and elderly adults. Physiother Theory Pract 25: 516-522.
18. Masmoudi K, Aouicha MS, Fki H, Dammak J, Zouari N (2008) The six-minute walk test: which predictive values to apply for Tunisian subjects aged between 40 and 80 years? Tunis Med 86: 20-26.
19. Camarri B, Eastwood PR, Cecins NM, Thompson PJ, Jenkins S (2006) Six-minute walk distance in healthy subjects aged 55-75 years. Respir Med 100: 658-665.
20. Poh H, Eastwood PR, Cecins NM, Ho KT, Jenkins SC (2006) Six-minute walk distance in healthy Singaporean adults cannot be predicted using reference equations derived from Caucasian populations. Respirology 11: 211-216.
21. Gibbons WJ, Fruchter N, Sloan S, Levy RD (2001) Reference values for a multiple repetition 6-minute walk test in healthy adults older than 20 years. J Cardiopulm Rehabil 21: 87-93.
22. Enright PL, McBurnie MA, Bittner V, Tracy BP, McNamara R, et al. (2003) The 6-min walk test: a quick measure of functional status in elderly adults. Chest 123: 387-398.
23. Troosters T, Gosselink R, Decramer M (1999) Six minute walking distance in healthy elderly subjects. Eur Respir J 14: 270-274.
24. Enright PL and Sherrill DL (1998) Reference equations for the six-minute walk in healthy adults. Am J Respir Crit Care Med 158: 1384-1387.

25. Fernandes L, Mesquita AM, Vadala R, Dias A (2016) Reference Equation for Six Minute Walk Test in Healthy Western India Population. Journal of clinical and diagnostic research: JCDR 10: CC01-CC04.

26. Britto RR, Probst VS, Dornelas de Andrade AF, Samora GAR, Hernandes NA, et al. (2013) Reference equations for the six-minute walk distance based on a Brazilian multicenter study. Braz J Phys Ther 17: 556-563.

27. Kim AL, Kwon JC, Park I, Kim JN, Kim JM, et al. (2014) Reference equations for the six-minute walk distance in healthy korean adults, aged 22-59 years. Tuberculosis and respiratory diseases 76: 269-275.

28. R Mabry, MJ Koohsari, F Bull, N Owen (2016) A systematic review of physical activity and sedentary behaviour research in the oil-producing countries of the Arabian Peninsula BMC Public Health 16: 1003.

29. Al-Nozha MM, Al-Hazzaa HM, Arafah MR, Al-Khadra A, Al-Mazrou YY, et al. (2007) Prevalence of physical activity and inactivity among Saudis aged 30-70 years. A population-based cross-sectional study. Saudi Med J 28: 559-568.