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Original Research Article

Functional Capacity Among Healthy Young Females of Saudi Arabia Using 1 Min Sit-To-Stand Test – A Cross Sectional Study

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ABSTRACT

Background: Functional capacity of an individual is denoting their physical fitness which can be assessed using 6-minute walk test, 1min sit-to stand test etc. The objectives of our study are to assess the functional capacity of healthy young females of Saudi Arabia using 1 min STS and to investigate the relationship between age, height, weight, heart rate, rate of perceived exertion with 1 min STS test.

Methods: In this cross-sectional study, a total of 52 young healthy females of Saudi Arabia from 18 to 30 years of age were participated.

Results: Fifty-seven participants were voluntarily enrolled for this study, 5 were excluded and totally fifty-two participants were involved in this study. The average repetitions of 1 min sit-to-stand is 38 reps/min. The Pearson correlation analysis indicated that there is a weak and negative correlation between 1 min STS test repetitions and age ($r=0.142$ $p=0.311$) height ($r=0.122$ $p=0.39$) and weight ($r=0.297$ $p < 0.05$). Weak, positive and significant correlation was observed between HR (T1), percentage of MHR (T1) and 1 min STS test repetitions with ($r=0.303$ $p<0.05$, $r=0.282$ $p<0.05$) respectively. There was a weak and positive correlation between 1 min STS test and Modified Borg scale (T1) ($r=0.167$, $p=0.238$).

Conclusion: This study highlights the difference in performances of 1 min STS test between Saudi population and Western countries. The functional capacity of young adult Saudi females is reduced when compared to the western counterpart. This could be because of high prevalence of physical inactivity.

KEY WORDS: 1 Min Sit-To-Stand Test, Functional Capacity, Physical Activity, Young Females.

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INTRODUCTION

Functional capacity is a key element of physical fitness of an individual and it is essential for the normal day-to-day activities. It is determined by the combined efforts of cardiovascular, pulmonary and skeletal systems [1]. And it can be measured by using various techniques like cardiopulmonary exercise testing using a cycle ergometer or a treadmill. The cardiopulmonary exercise tests are used to measure the maximal oxygen consumption (VO2 max) directly [2].

The devices required to measure VO2 max are costlier and cannot be transported easily.

But, most of the daily activities require sub-maximal efforts not the maximal efforts.

Hence, the term functional capacity is also used to express an individual's capacity to perform submaximal activities [2,3]. 6-minute walk test (6MWT), sit to stand test (STS test), shuttle walk test and timed up and go test, are used to assess the functional capacity of an individual [2].

The 6 MWT is having correlation with the mobility related function, standing balance and walking speed [4].

It requires infrastructure like long corridor which is not always available in primary health care, community-based and population-based settings [5].

In contrast, STS test which calculates the number of times a subject can stand up and sit down on a regular chair for different duration and used widely to measure physical performance and functional capacity of healthy adults [6]. The lower body muscle strength and endurance are important factors in an individual's ability to do the everyday activities [7] and these can be measured by using 1 min STS test [8]. 1 min STS test is moderately correlated with the 6MWT and it can be used as a quick and alternative measurement of functional capacity in healthy young adults [6] and also provides prognostic information [9].

The 1 min STS test can be performed in any health care setting and do not need any special equipment. It needs convenient chair and stopwatch, which is simple to perform for many subjects and requires very minimal time [10].

The 1 min STS test is used to measure the functional capacity young adults and geriatric population in western countries [5,10].

In a population based cross-sectional study conducted in Switzerland determines the reference values for 1 min STS test. The median number of repetitions for young adult women is 47/min (39 - 55/min) [5].

The normative data on the functional capacity of healthy individuals of all age spans and all ethnicity are much needed. No studies have been conducted to check the functional capacity using 1 min STS test in the Saudi Arabian population. So, in this study we evaluated the functional capacity of healthy young females of Saudi Arabia in Jazan region, using 1 min STS test. And we aimed to find out the reference values of 1 min STS test in healthy young females of Saudi Arabia in Jazan region. The reference values of 1 min STS test are based on an individual's age, gender, height, weight and ethnic group. So, we investigated the relationship between these variables and 1 min STS test among the healthy young females of Saudi Arabia in Jazan region.

METHODS:

Study Population: Healthy Saudi female volunteers between the age of 18 and 30 years were included in this cross- sectional study. The study was conducted in Department of Physical Therapy, Jazan University from September 2019 to February 2020. In order to collect a homogeneous sample in terms of physical performance and to eliminate the factors that impair performance on physical tests, exclusion criteria were determined as history of smoking, upper respiratory tract infections within last 4 weeks, cardiovascular and pulmonary diseases, sickle cell anemia, any pain in the back and lower extremities, pregnant women and BMI greater than 35. This study was ethically approved by the Deanship of scientific research, Jazan University and funded under Future scientist program-10 of Jazan University, KSA (Approval number FS10-073).

Measurements and procedure: The aim of the study and testing methods were explained to the participants and written informed consent was obtained before testing. All participants were examined for musculoskeletal & neurological function, active range of motion, presence of any pain before the testing.

Demographic and anthropometric measurements: Information regarding the age, weight, height, BMI were collected. Weight and height were measured using calibrated weighing machine and stadiometer to the nearest kilogram (kg) and centimeter (cm). BMI was calculated as the ratio between the weight and the square of height (kg/m2).

Sit-to-stand test: Bohannon's 2012 guidelines [10] were followed for STS test. A standard

(45 CMS) chair with no arm rest was used to test for all participants. Each participant was instructed to come forward to sit in the chair to keep their feet parallel at least as wide as their hips and fold their arms across the chest. Then the participants are instructed to stand up until the knee and hip goes for complete extension and sit down the chair. The participants are instructed to complete as many sit-to-stand cycles as possible in 60 seconds at self-paced speed. All participants were motivated and they were informed when 30 sec and 15 sec were left. The number of completed sit to stand repetitions were recorded.

In addition, rate of perceived exertion (RPE) using Borg scale, and heart rate were recorded before and immediately after the STS test.

Data Analysis: The data were analyzed using SPSS version 16.0 (SPSS Inc. Chicago, IL, USA). The distribution of data was examined prior to analysis using Kolmogorov-Smirnov test. The data were presented as a mean ± standard deviation (SD) for continuous variables and as frequency and percentage for noncontinuous variables. The analysis of variance (ANOVA) was utilized to check the effect of age in STS repetitions. Post hoc analysis was used to compare the differences between each age group and BMI group. Pearson/Spearman correlation analysis to analyze the relationship between age, height, weight, heart rate, Borg scale and STS values. The results were considered significant with $p < 0.05$.

RESULTS

The demographics and test results of study participants are summarized in table 1. Fifty-seven participants were voluntarily enrolled for this study, 5 were excluded because of sickle cell anemia, low back painand hypertension. Fifty-two participants were involved in this study.

The mean age was 23.1 ± 3.4 years and the mean values of height, weight and BMI were 155 ±5.8 cm, 53.9 ± 7.8 kg and 22.4 ± 3 kg/m2. According to the body mass index classification of World Health Organization [11] 7 participants (14%) were underweighted (below 18.5 Kg/m2), 34 participants (65%) were normal (18.5 – 24.9 Kg/m2) and 11 participants (21%) were pre obese (25-29.9 Kg/m2). The modified Borg scale scores of the participants were 'zero' before 1 min STS test. Participants reached 50 to 59 % of their maximum predicted heart rate at the end of the test. All participants had the same ethnicity.

The results One way ANOVA showed that there is a significant effect of BMI in 1 min STS repetitions ($F(2,49) = 3.95$, $p<0.05$). The post-hoc analysis showed that underweight category (n=7, mean=43.71, sd=6.58) has more repetitions in 1 min STS test than normal (n=34, mean=38.5, sd=7.75) and pre-obese categorizes (n=11, mean=33.55, sd=7.55). In contrast the age is not having a significant effect on 1 min STS test repetitions ($F(11,40) = 0.67$, $p=0.758$).

Table 2 shows the correlation of 1 min STS with demographic and other variables. The Pearson correlation analysis indicated that there is a weak and negative correlation between 1 min STS test repetitions and age ($r=0.142$ $p=0.311$) height ($r=0.122$ $p=0.39$) and weight ($r=0.297$ $p < 0.05$). Weak, positive and significant corre-lation was observed between HR (T1), percentage of MHR (T1) and 1 min STS test repetitions with ($r=0.303$ $p<0.05$, $r=0.282$ $p<0.05$) respectively. There was a weak and positive correlation between 1 min STS test and Modified Borg scale (T1) ($r=0.167$, $p=0.238$).

Table 1: Demographic data and test results of participants (n=52)

Age (years)	23.1±3.4
Height (cm)	155±5.8
Weight (kg)	53.9±7.8
BMI (Kg/m^2)	22.4±3 kg/m^2
HR (T_0)	88±5
HR (T_1)	108.6±9.8
% of MHR (T_1)	55.2±5
Modified Borg scale (T_0)	0
Modified Borg scale (T_1)	2.3±0.92
1 min STS test repetitions	38.2±8

BMI – Body mass index
HR – Heart rate
T0 – Measurement taken at the beginning of the test.
T1 – Measurements taken at the end of the test.
% of MHR – Percentage of maximum predicted heart rate

Table 2: Correlation of participant's demographic data, heart rate and Borg scale score with STS test repetitions (n=52).

	1 min STS test repetitions	
	r	*p*
Age	-0.142	0.311
Height	-0.122	0.39
Weight	-0.297	*<0.05*
HR(T_1)	0.303	*<0.05*
% of MHR (T_1)	0.282	*<0.05*
Modified Borg scale (T_1)	0.167	0.238

HR – Heart rate
T1 – Measurements taken at the end of the test.
% of MHR – Percentage of maximum predicted heart rate.

DISCUSSION

In this study, we evaluated the functional capacity of healthy young females using 1 min STS test. This test has been studied exclusively in different healthy populations in European region. In a study conducted in European population reported the average repetitions of 1 min STS test is 47 (39-55reps/min) repetitions for women aged 20 to 29 years [5]. In the present study, the average repetitions of 1 min STS test are 38 repetitions (32 – 44 reps/min), which is not similar to the aforementioned study.

This may be because of high prevalence of physical inactivity and low level of physical fitness among healthy young Saudi population (43.3% - 99.5%), this is due to major lifestyle changes in recent years in Saudi Arabia [12] Coggan et.al, [13] mentioned that decrease in physical activity leads to decreased functional capacity. A study which measures the physical performances emphasized that STS test evaluates i) a person's ability to raise from a chair, ii) the muscle strength of the trunk and lower extremities, iii) the physical performance of the individual [14]. In literatures it is reported that 1 min STS test is also significantly correlated (r = 0.068) with 1 RM leg press [15,16]. Many studies in exercise physiology showed that there is a relationship between muscle strength and physical performance [1,2,14]. These factors could be the reason for reduced number of repetitions in 1 min STS test among healthy young Saudi females than their European counterpart.

In a study conducted in healthy Saudi population, there were significant positive correlation between 6MWT and height (r=0.485), weight (r = 0.219) of the participants while other variables like female gender, age are negatively correlated [17].

In another study, which investigated the relationship between 6MWT and 1 min STS test, they concluded that 1 min STS test is moderately correlated with 6MWT (r = 0.647) [6]. In contrast, our study shows that there is a negative correlation between 1 min STS test with height, weight, age, BMI of the participants. And positive correlation with heart rate and Borg scores of fatigue after 1 min STS test (Table 2). This could be because of low level of physical fitness among young Saudi females and a smaller number of participants in our study.

In our study, the median of Borg fatigue score after 1 min STS test is 4 which is same as like the median scores of 6MWT of healthy young Saudi adult population [6]. Ritchie et al, [15] Rocco et al, [18] concluded that 1 min STS test is inexpensive, space efficient and easy to administer. Ozalevli et al, [19] conducted a study on measuring functional capacity on COPD patients and concluded that the 1 min STS test can be an alternative for 6 MWT. Zanini et al, [20] states that 1 min STS test is a reliable and valid to assess the lower limb muscle performance and significantly correlates with 6MWT. Thus, our results do not contradict previous studies, as 1 min STS test is moderately correlated with 6MWT and physical demand of the 1 min STS test is similar to the 6MWT. This supports the previous study findings which shows that 1 min STS test and 6MWT are consistent in assessing the functional capacity of an individual.

This study was limited by several factors. We did not include male population of similar age and broad range age groups We did not assess daily physical activity, peripheral muscle strength. The sample size of the present study is very small and this may not be representative for the whole age span of young Saudi female population because we included the volunteers from the age 18 to 30. We recommend future studies

1. To include general population with wide age groups to get the reference values for different regions of Saudi Arabia.

2. To assess factors associated with functional capacity among heathy young adults and individuals with diseases.

3. Increase the sample size.

CONCLUSION

This study highlights the differences in performances of 1 min STS test between Saudi Arabia and Western population. The 1 min STS test is physically demanding as like 6MWT and it can be used to assess the functional capacity. The functional capacity of young adult Saudi female is less when compared to the western countries. This study represents the first study in 1 min STS test in Saudi Arabia that will help to proceed further to get the complete reference values of all age groups and its impact in the society.

Clinical significance: This study assessed the functional capacity of healthy young females, Jazan region, Saudi Arabia. So, this test values can be used as reference values for the same population. And we recommend to use this test in place of 6MWT especially when there are restrictions like area/space and time.

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Conflicts of interest: **None**

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