Original Article

Development of Normative Data of Functional Reach Test In Young Adults of Lahore; A Cross Sectional Survey

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ABSTRACT

Risk of fall is one of the serious health concern of human beings. Many tests have been developed clinically to measure risk of fall in adults. **Objective:** To develop preliminary normative data of functional reach test (forward reach) in young adults. **Methods:** A cross sectional survey was conducted in different geographical areas of Lahore. A sample of 500 healthy young adults was recruited in study through convenience sampling technique. To measure dynamic balance functional reach test (forward) was used. **Results:** A total sample of 500 young adults were included 22% of participants were females and 78% were males. The mean age of participants was 24± 4 years. The mean score of functional reach test (forward) was 9.87±2.9 inches, the minimum score was 3.20 inches and maximum score was 15.09 inches. There was no statistically significant difference was observed in scores of FRT in across and within the groups of both gender as p-value was > 0.05. There was also weak positive significant correlation between BMI and scores of functional reach test and p<0.05. **Conclusion:** The study provided the normative value of functional reach test (forward) for young adults.

INTRODUCTION

Balance is a state of equilibrium and harmony. It is the ability to stay upright without falling or moving in one direction or another. In humans, balance is often achieved through the use of our sense of sight, which provides us information about our position and the position of our surroundings. When a person is standing still, they are in a state of equilibrium [1,2]. The risk of falling in humans is largely determined by the balance system, which is a set of neural, skeletal, balance is a critical part of our ability to function. Without it, we would likely fall and become injured [3]. The risk of falling is greater in older adults, who have a higher chance of developing a balance disorder such as vertigo and are more likely to require a mobility device such as a cane. However, even young adults can be affected by a loss of balance, and muscular systems that allow humans to stay upright [3,4]. The prevalence of falling in young adults has been linked to several conditions, including aging, injuries, and disease. Aging is associated with a decrease in the strength, size, and function of the nervous system, which can lead to decreased balance and the risk of falling. Injuries, such as broken bones, also affect balance, as they can interfere with the neural, skeletal, and muscular systems that allow humans to stay upright [5]. Balance functional assessments emphasize static balancing,

postural stability, anticipatory response, and functional mobility. Tinetti Performance oriented mobility assessment, beg balance scale, timed walking test timed up and go exam, Multidirectional reach test, and Functional reach test are some of the functional balance standard tests. Duncan and coworkers created the Forward Functional Reach Test to identify people who have balance difficulties. It is simple, quick, reliable, user-friendly, and clinically accessible [6]. It is the distance measured one may extend forward at arm's length while standing on a fixed base of support. They have provided age-related reference values. The functional reach is affected by height and age. It provides baseline and outcome data, as well as being predictive of falls in elderly people. [7] For children, the young, and the elderly in western and other eastern populations, normative functional reach test values are available. [8] A research of 135 healthy people was conducted to establish the standards of Functional Reach Test (FRT) values among people of various backgrounds ranging in age from 20 to 87 years old, as well as to associate the mean of FRT. The average (SD) forward distance for Indian males are 35.70(5.15) cm and 27.82(9.25) cm for Indian females, according to the findings. [9] A research of 350 healthy children is done to establish normal values for lateral reach (LR) and functional reach (FR) in school children, as well as to compare anthropometric parameters to LR and FR values and the relationship between LR and FR scores. The normal mean values of the FR and LR varieties ranged from 22.7 cm to 37 cm and 16.3 cm to 22.5 cm, respectively, according to the results [10]. Body mass index is indicator of fat composition in a human body; core variables of BMI are weight and height. Height considerably associates with both FR and LR. In previous studies normative values of functional reach test had been reported for different populations across different parts of world. A study was conducted on 202 children to establish normative values of forward functional reach for age group of 5- 15 years in Indian children [11]. Normative reference data for the functional reach test is currently unavailable in clinical practice, but it is well-thought-out and based on a western population. However, there are no reference values for functional reach tests. The study's goal was to create normative functional reach test data for young adults.

METHODS

A sample of 500 healthy young adult age between 18-32 years were recruited from general community of Lahore. Convenient sampling technique was used for collection of data. The characteristics of participants were healthy young adults both male and female, able to stand independently, able to flex shoulder at 90degree. Healthy individuals with following conditions were excluded from study. Written inform consent was taken from all participants. The study was approved by research ethical committee of Riphah International University, Lahore. To analyze data SPSS version 25.0 was used. The data were checked for its normality by Shapiro Wilk test and $p < 0.05$ so parametric test were used for analysis. To measure the score of functional reach test (forward reach) the descriptive statistics were calculated and data were presented in means and standard deviation. To measure the correlation of FRT scores with gender and BMI Pearson correlation coefficient was computed. To measure the scores of the FRT across three groups of the age ANNOVA was computed. Individuals were assessed for functional reach while stood beside the wall (without touching it), shoulder flexed to 90 degrees, elbow fully extended, and hand fisted. The first mark was made along the meter rod on the wall at the position of the third metacarpal. The participants were then instructed to lean forward as far as they could without taking a step or losing their balance. The third metacarpal was used as a reference along the yardstick on the wall for the second marking. The forward reach distance used for the functional reach test was the difference between two marks.

RESULTS

Out of 500 participants 22 % (108) were males and 78 % (392) were females. The minimum age of participants was 18 years and maximum age was 32 years. The mean and standard deviation of age was 24± 4 years. The mean of BMI of males and females was 22.02± 3.44 and 24.80± 4.39 respectively. The demographics of participants presented in the Table 1.

No of participants	500
Male (n)	108(22%)
Female (n)	392(78%)
BMI kg/m2 males	22.02(3.44)
BMI kg/m2 females	24.80(4.39)
Age in years	24.0(4.0)

Table 1: Demographics of participants

The mean score of the forward functional reach test was 9.87± 2.97 inches, the minimum score was 3.20 inches and maximum score was 15.09 inches. The mean score of the functional reach test (forward reach) was calculated across complete spectrum of age participants and it is presented in the Table 2.

Age in years	Mean+SD	Min	Max
18 (n=9)	9.21±2.8	3.5	13.5
19(n=26)	8.8±2.14	5	14
20(n=13)	10.08±2.44	6	14
21(n=35)	9.62±2.73	5	16
22(n=65)	9.93±2.17	5.2	15.1
23(n=54)	11.15±5.81	5	15.09

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24(n=8)	7.25±2.31	4	10
25(n=125)	9.8±2.39	3.5	15
26(n=61)	10.07±2.54	4	15
27(n=33)	9.93±2.08	6	14.1
28(n=10)	9.81±1.52	7	12.2
29(n=8)	10.61±1.93	8	13
30(n=22)	9.35±2.26	3.2	12.7
31(n=17)	9.1±2.96	3.5	13
32(n=14)	9.8±1.46	6	11

Table 2: Descriptive statistics of scores of Functional Reach test (forward) across Age (18-32 years)

To see the effect of gender in functional reach test the scores of both groups were calculated and there was no significant difference in scores across the groups. The mean score of the functional reach test in males was 9.968± 2.29, and in females was 9.92± 3.13 and the p value was > 0.05 which shows that gender did not affects the score of the functional reach test. The scores are shown in figure. 1. A and 1. B..
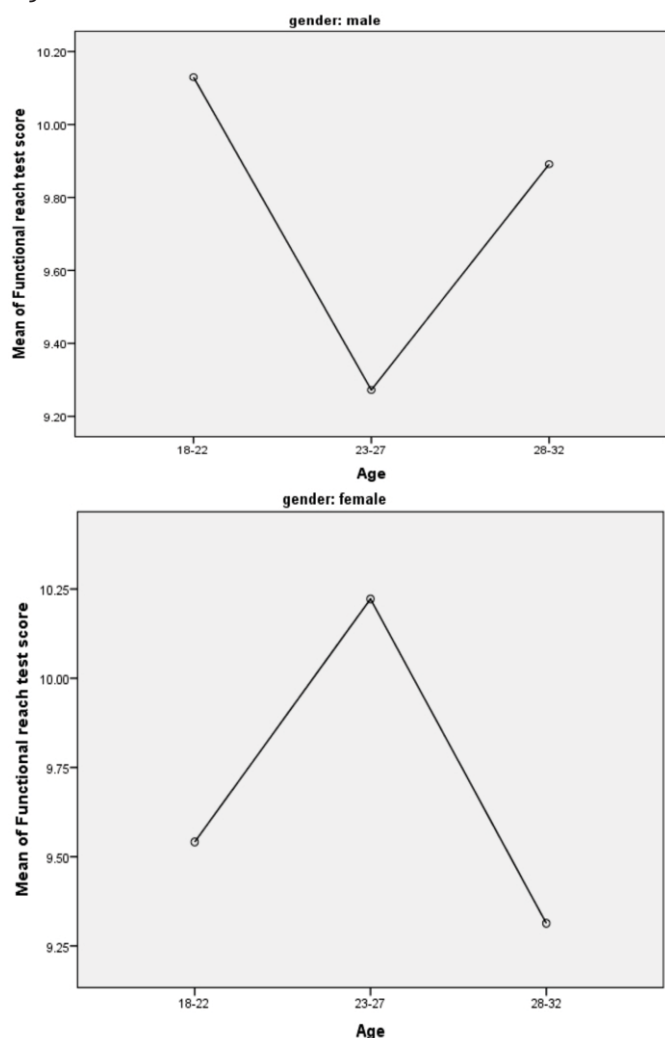

Figure 1: A). Scores of the Functional reach test (forward) in males. B). Scores of the Functional reach test (forward) in females.

The study was aimed to investigate the scores of FRT among three different age groups and impact of FRT scores on increasing age. The Annova test was used to find the difference of scores of FRT in three different age groups of both genders. The participants were divided into three age groups 18-22 years, 23-27 years and 28-32 years across both genders. The scores of functional reach test in males was 10.12± 2.40, 9.27± 2.48, 9.89± 1.84 respectively. The scores of functional reach test in females was 9.54± 2.37, 10.22± 3.51 and 9.92 ±3.13 respectively. There was no statistically significant difference was observed in scores of FRT in across and within the groups of both gender as p value was > 0.05. Therefore, it reject the hypothesis that FRT scores declines with increasing age. The p values are shown in Table 3.

FRT	p-value
Males	>0.05
Males Between Groups	>0.05
Males Within Groups	
Females	>0.05
Females Between Groups	>0.05
Females Between Groups	

Table 3: p-value of the scores of Functional Reach Test (forward) and Age groups (18-22 years, 23-27 years and 28-32 years)

The Pearson correlation was calculated between gender and total score of functional reach test (forward), there was weak positive significant correlation between scores of both genders and p value was p<0.05. There was also weak positive significant correlation between BMI and scores of functional reach test and p<0.05. The co relations are shown in Table 4.

Functional reach test	Co - relation of FRT and gender and BMI
Gender male	r=-0.029 , p<0.05
Gender Females	r=-0.005 , p<0.05
BMI	r= - 0.002, p<0.05

Table 4: Correlation of functional reach test with gender and body mass index

DISCUSSION

The human postural control system is a system that enables a body to control its position and orientation in space, by moving its center of mass so that it is not displaced by the surrounding environment, while using other parts of the body as a support [1]. There was no decrease in FRT (forward) score with increasing age. This trend was attributed to the fact balance system did not decline between age 18- 40 years [7]. Human postural control system is the anterior-posterior balance control system of the body. It works to prevent falls by regulating how the body positions itself to preserve postural stability in spite of challenges imposed by the environment. The system also allows the body to act quickly on any

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imbalance, allowing it to regain a stable posture quickly. Postural control is fully mature in adults and, it is maintained by feedback, anticipatory and feed forward mechanism [7]. To observe the difference of FRT scores across three age groups of adults we calculated Annova. There was no statistically significant difference was found in scores of FRT (forward) in three different age groups. The results were owned to the fact that postural control did not decline in adults [7]. We computed correlation between scores of FRT, and BMI. The results of negative correlations between FRT and BMI r= -0.002 [11,12]. The balance achieved by humans during walking, running, locomotion, and other movement is a dynamic balance between the forces of gravity acting on a body and the kinetic energy of the body's motion [12]. The body's efficiency in achieving this balance is the result of complex interactions between the body's structure and the forces its structure presents to the forces of gravity. The human body achieves dynamic balance through the integration of muscles and other systems [13]. The study aimed to develop normative value of functional reach test (forward) in young adults. The study showed the descriptive statistics of FRT (forward) scores between age 18-32 years. The results of test presented in means and standard deviation and minimum and maximum. The mean score of the FRT (forward) test had been varied across different ethnicity and geographical distribution, the difference in scores of FRT (forward) reach had occurred because of huge variation in age [14-17]. The mean score FRT (forward) test in present study was consistent with the study [6,18-20]. Anthropometric measurements changes in different regions and these measurements significantly impact FRT score. BMI is strongly correlated with health, but it does not take into account other factors that may influence health, such as fitness and postural control. The core elements of anthropometric measurements are height, weight and body mass index [6,19,20]. The study investigates the difference between postural control across gender. In present study there was no significant effect of gender on the mean score of FRT and the findings were similar as reported previously [18, 21,22].

CONCLUSION

The study developed normative data of forward functional reach test in healthy adults of Lahore the study found negative corelation between FRT (forward reach) and age of participants. in addition, the study reported weak positive correlation between FRT (forward reach) and gender of participants.

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