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Original Research Article

The normative reference value of the L test in older adults of age group 60 to 70 years: a cross-sectional study

Priyadarshani Katalkar[1]*, Pooja Yadav[2]

[1]Department of Neurophysiotherapy, MGM College of Physiotherapy, Navi Mumbai, Maharashtra, India
[2]MGM College of Physiotherapy, Navi Mumbai, Maharashtra, India

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***Correspondence:**
Dr. Priyadarshani Katalkar,
E-mail: priyadarshanik@mgmcop.nm.edu.in

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ABSTRACT

Background: Walking speed assessments are thought to predict eventual health outcomes and patient quality of life when assessing the physical mobility of an individual. Such performance measurements are functional and objective which gives us accurate interpretation to anticipate future goals. The L-test is a feasible, easy administration in clinical setup would be quick and effortless for physiotherapist professionals. As there is no normative value of L- the test that could interpret the score of the test, our study focuses on finding the cut-off value in older adults aged 60-70 years.
Methods: We conducted a cross-sectional study from January 2021 to June 2021 in Mumbai, India. A total of 200 participants were selected based on inclusion criteria. The study used an L-shaped path that is 20 meters long which goes 3 meters straight, then a right turn, followed by 7 meters straight. The subjects walked along the marked pathway and the test completion time was noted.
Results: A notable difference was found between the male and female participants with a p value of 0.015 and the test duration for males was 19.15 (16.87-22.64) seconds and for females was 20.22 (18.03-23.94) seconds. A positive weak correlation was found between the body mass index (BMI) and duration. Also, a positive weak correlation was found statistically significant between the age and duration of the test.
Conclusions: The study showed that there is an increased time duration of the L test with advancing age and BMI.

Keywords: L test, Older adults, 20-meter-long path, Gait

INTRODUCTION

Aging is defined as an age-related systemic decline in body function as age advances. It is believed that with progressive aging, various molecular and biological changes take place, therefore leading to a reduction in muscle power, sustenance, a mental capacity affecting the manual ability of an individual and thereby increasing the risk of developing secondary complications.[1] As per census 2011, the overall population of India is 1210.9 million, out of which 103.9 million people are above the age of 60. This means that older adults constitute 8.6% of the total population.[1]

Physical mobility encourages participation in the activities of daily living which helps us to progress in the environment.[1,2] Physical mobility is a combination of various systemic activities executed in a coordinated manner and it depends on the strength of muscle, physical capacity, neuromuscular coordination, and postural control or balance. Impaired mobility and disability can come from any impairment or incoordination of these tasks.[1,2]

Walking speed assessment tests are a good predictor of future health outcomes and patient quality of life when used to assess physical mobility. Studies have shown that performance-oriented objective measurement tests have excellent measurement properties and can predict future function.[3] Laboratory testing procedures accurately

measure multiple components of balance and gait, reliably separate fallers from non-fallers, and predict future falls.[4] However, these techniques are expensive, laborious, and absurd in most clinical settings. Due to this, there was a need to develop walking tests that can be used for the assessment of gait and also balance. Various walking tests are available such as timed up-and-go tests, 2-minute walk tests, and 6-minute walk tests which are used by clinicians in clinical setups to assess the mobility of patients and as an outcome measure for results.[4]

L test is a modified version of the timed up and go (TUG) test, designed to assess the functional gait. TUG test assesses a patient's ability to take a turn only in one preferred direction whereas in the L test the patient can turn either side.[5] The L test is named after the L-shaped walking path of the test. The walking distance is 20 m and requires participants to turn in a clockwise and anticlockwise direction.[6] The L test was developed by physicians who worked with people who had their lower extremities amputated to push the younger, fitter participants during gait activities. The test methods are the same as for the TUG, however, there are two additional tasks: a right and left turn. To perform the test, a person rises from a chair, walks 3 meters, turns right or left, walks 7 meters, turns 180 degrees, and returns to sit. The score is the time duration taken by an individual to complete the distance in seconds. L test is an inevitable, cost-effective, safe, time-efficient, and practical way to evaluate overall functional mobility. L test has a high correlation with other proven tests that measure pure gait speed for longer lengths such as the 10 m walk test, 2-minute walk test, time up, and go test. Standardizing the distance led to the development of a potentially more demanding, yet practical test. Therefore, it has the potential to overcome limited sensitivity and ceiling effects.[7]

L test has been designed earlier for lower limb amputation[8] and has since been evaluated in the following stroke, elderly, Parkinson's.[8-10] In all 3 studies, the L test has shown good reliability. Unfortunately, limited time frames, insufficient space, or inability to interpret results due to a lack of normative reference values have contributed to unsatisfactory assessment and monitoring of physical activity. Because it lacks age-related reference values or a study-based cutoff score, the L test has only limited clinical or preventive utility. There is a dearth of studies on the L test and no literature available on normative values of the L test in the older adults age group 60 to 70 years Indian population. So, we thought that having a cut-off value for the L test in older adults would enable the therapist to assess in healthy young older adults in view of mobility to create a better outcome measure. Also to find any association between age and body mass index (BMI) with L test duration.

METHODS

We conducted a cross-sectional study from January 2021 to June 2021 in Mumbai and Navi Mumbai. The sample size was calculated using 95% confidence interval, population size 90% and margin error of 5%. A total of 200 participants were included using convenient sampling method. For this study ethical approval was taken from the institutional ethics committee (MGM/COP/IRRC/08/2021). Upon the ethical approval for this study, meetings were carried out with the management of the senior citizen club and geriatric homes for their permission to carry out research among senior citizens of the age group 60 to 70 years. Asymptomatic healthy individuals aged 60-70 years with or without co-morbidities like diabetes mellitus or hypertension and are on medications with test values under control were approached. Also, the participants were expected to have corrected vision and hearing, ambulation with or without the walking aid or manual assistance, and a mini-mental state examination (MMSE) scale score of 27 and above. Our study excluded participants who underwent any major recent surgeries, or who may have musculoskeletal, cardiorespiratory, or neurological deficits. Individuals with any psychiatric issues or having difficulty understanding were also excluded. After obtaining permission, participants meeting the inclusion were recruited for the study. They were informed regarding the objective, procedures, and benefits of the study with the consent form and COVID screening form. All of the participants signed a written consent form. Demographic details were taken including the comorbidities and the medications taken. Anthropometric evaluation including weight and height was obtained. The weight was measured by a digital weighing machine and height was measured in centimeters against the wall while standing without shoes. BMI was calculated by dividing body mass by the square of body height and is expressed in units of kg/m^2. MMSE scale was used to assess the cognition of the participants and to check balance issues falls efficacy scale was used. The vitals were measured. The pulse rate was measured by palpating the radial artery for 1 minute. The respiratory rate was measured for 1 minute. The auscultatory method of measuring the blood pressure by using a sphygmomanometer was used. A pulse oximeter was used to measure SpO_2. L test was demonstrated and the trial was given followed by an actual test. The participants were commanded to get up from the chair, ambulate the marked path of L- a shaped hallway that is 3 meters straight, then take a right turn followed by walking up straight for 7 meters and return along the same path and sit down on the chair.[9] A break of 2 minutes was given after the test and the same was repeated, the best performance time was recorded. After the completion post vitals were recorded.

The statistical analysis was done using statistical package for the social sciences (SPSS) software. The demographic characteristics and anthropometric values were summarized by calculating means and standard deviation. The confirmation of normality was given by using the Shapiro-Wilk test. As data was freely distributed, a non-parametric test – Spearman product-moment correlation was applied.

RESULTS

According to descriptive statistics, out of 200 participants, 110 were males and 90 were females. Around 52.17% of the total participants had no co-morbidity, 16.30% of participants were hypertensive and 15.21% were diabetic.

The normal distribution of data was confirmed by using the Shapiro-Wilk test. As the data was freely distributed. We had to calculate the median and interquartile range for the L test duration in the age group of 60-70 years old. The L test value in the age group 60 to 70 years is 19.66 (17.17-23.19) seconds (Table 1). In intergroup comparison, a non-parametric test Mann-Whitney U test was used and we found a substantial difference in L test duration. We achieved 19.15 seconds for males (16.87-22.64) and females were 20.22 seconds (18.03-23.94).

The relationship between the BMI and the duration of the test was explored by a non-parametric test - Spearman's rank correlation coefficient. The study found statistically significant with a positive weak correlation (p=0.000 and r=0.250) (Figure 1). Likewise, the same test was used to explore the relationship between age and duration of the test. The study found statistically highly significant with a positive weak correlation (p=0.000, r=0.447) (Figure 2).

Table 1: Descriptive statistics of the participants.

S. no.	Variables	Mean±SD	Median	Inter-quartile range	Frequency (%)
1	Age				
	M	65.17±3.08	-	-	-
	F	64.44±3.00			
2	BMI				
	M	24.62±3.23	-	-	-
	F	25.52±4.32			
3	Gender				
	M				110 (55)
	F	-	-	-	90 (45)
4	L test	-	19.66 sec	17.17-23.19	-
	M	-	19.15 sec	16.87-22.64	-
	F	-	20.22 sec	18.03-23.94	-

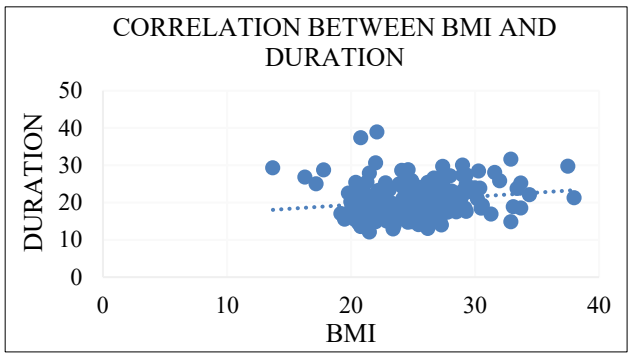


Figure 1: Depicts the correlation between BMI and duration.

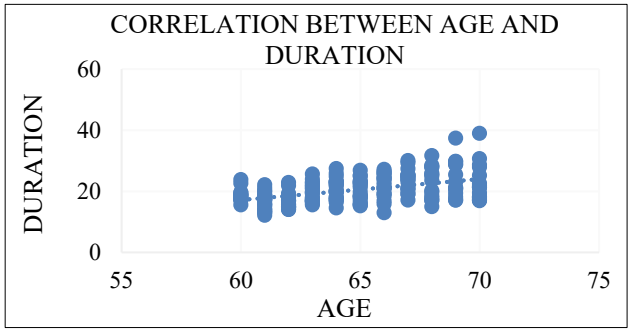


Figure 2: Depicts the correlation between age and duration.

DISCUSSION

L test is a quick and easy test but it is not widely used by clinicians due to the lack of normative reference value for the test. L tests have shown good intro and inter-rater reliability and concurrent validity and thus suggest the "L" test is a clinical measure thought to be used for assessing the balance in older adults.[10]

Our study aimed to find a normative cut-off value for the L test in older adults aged 60-70 years. We also correlated age and BMI with the time duration of the test. No of the participants recruited for this study were 200 of which 110 were males and 90 were females with mean ages of 65.17±3.08 and 64.44±3.00 respectively. The mean BMI for male participants was 24.62±3.23 and 25.52±4.32 for female participants. The duration calculated was 19.66 (17.17-23.19) seconds. Gender-wise time duration for male participants was 19.15 (16.87-22.64) seconds for females 20.22 (18.03-23.94) seconds. We also found a significant correlation between age and BMI with test time duration.

In this study, we found that the time duration of the L test in males was less compared to females of the same age group and the difference was statistically significant with a p value of 0.015. There is no specific explanation for this gender-based difference in the time duration between males and females considering demographic data however

muscle strength is less in females and several studies, it was found that older women are more prone to be disabled than older males. It is a well-known fact that males outperform females in physical performance.[11] Men showed good walking speed as compared to females, leading them to attain lesser L test duration. Also, Seung-Uk et al of South Korea, in the year 2011 concluded that women walked with shorter step lengths when they were asked to walk at the same speed as compared to men. However, the geographical representation of participants may also have a significant impact on the test duration.[11]

In this study, we found that as age advances the duration required to complete the test also increased. A study by Balogun et al of Texas, America in the year 1994 included a total of 1280 healthy participants aged 6–85 years and concluded that balance performance deteriorates with increasing chronological age in both males and females. They also concluded that in males the balance performance peak deteriorates in the third decade of life whereas in females the balance performance worsens in the fourth decade of life and then after there is a progressive decline in balance performance. With advancing age, the physical performance of an individual reduces because there occurs a decline in muscular strength, endurance, and sensory processing to carry out good physical performance.[12]

Advancing age leads to delayed response time, slow nerve conduction velocity, and delayed somatosensory interactions, leading to imbalance in older adults. A dynamic balance is required for walking and performing daily activities. This stability is affected by decreased muscle power and age-related compensations at extremities and vertebral column leading to a 17% to 20% reduction in gait velocity and stride length. The impaired balance can also lead to a decline in performance on the walking test.[12]

In this study, we found that with increased BMI, the duration of the L test also increased. Samson et al of Netherlands in the year 2000 concluded that the height and weight of the individual affect the TUG test performance. The anthropometric measurements are responsible for varied gait parameters.[13] As the height of a healthy person increases, the gait parameter such as stride length also increases which implies increased ambulatory speed and shorter L test duration. It has been found that decreased gait velocity, postural control, and increased TUG duration in overweight sedentary middle-aged adults tend to show an increased rate of risk of falls.[14] There were a few limitations of the study, equal distribution of participants of various ages and BMI categories were not studied. A small sample size with a narrow age gap was also one of the limitations. The subjects were not stratified based on age and gender so that a better linear relationship could be studied. We would suggest, that it may be appropriate to use stratified sampling and multi-sectoral selection of participants to improve the accuracy and representativeness of the results for future studies. Our strengths are that we found a cut-off value for L-test, which is easy to administer and can be a good predictor for reduced performance. Also, this study shows us the variability in values concerning age, gender, height, and geographical representation.

CONCLUSION

The normative reference value for the L test in the older adults of the age group 60 to 70 years was found to be 19.76 (17.40-23.50) seconds which provides a cut-off value for patient performance to be compared.

Gender-wise time duration for male participants was 19.15 (16.87-22.64) seconds and for females it was 20.22 (18.03-23.94) seconds. From this study, we also concluded that with increasing age and BMI, the L test duration also increases.

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