

ASSOCIATION OF PHYSICAL FUNCTIONAL CAPACITY WITH BMI AND STRENGTH IN HYPERTENSIVE ADULTS

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HIGHLIGHTS

- This study focuses on the impact of physical activity participation on the performance measures like 6 minute walk test, step test, strength tests, BMI and TUG test and compare the correlation of each test results.
- This study provided information about the cardiorespiratory fitness level with sedentary lifestyle.
- Effect of hypertension on the quality of life of affected individuals was also observed.

Abstract

Objective:

To determine the correlation of functional capacity with BMI and strength in hypertensive adults via exercise testing by using aerobic endurance, upper and lower limb strength tests and functional capacity and to determine the quality of life in hypertensive adults; To determine the quality of life in hypertensive adults.

Methods:

This analytical cross-sectional study conducted over 6 months from September 2019 to February 2020 at Noor Hussain Hospital Attock, Pakistan. Among 146 hypertensive adults recruited in the study by non-probability purposive sampling,

between 40 and 60 years of age, all were found eligible. The aim of the study and testing methods were explained to the participants and written informed consent was obtained before testing. The study tools were then applied on the participants including 6 minute walk test, upper limb and lower limb strength test, arm curl test, 30 second chair stand test, time up go test and step test. The measures were performed by all the hypertensive adults on the same day individually. 5 minute interval was given between each test. 15D quality of life questionnaire was used for assessing the quality of life status of the participants.

Results:

The value of r (0.281, 0.420) shows moderate positive correlation among 6 MWT with arm curl test and 30s chair stand test whereas moderate negative correlation is seen among 6MWT with BMI, TUG and step test as per value of r (-0.081, -0.590, -0.639).

Conclusion:

According to our study results it is concluded that there is no association of functional capacity with body mass index, time up go and step test. Moderate association of functional capacity with arm curl test and 30 second chair stand test.

Key words: Body Mass Index, Exercise Testing, Hypertension, Step Test, 6-Minute Walk Test

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Introduction

Hypertension is the most important cause for heart diseases. A medical condition where there is an elevated blood pressure in arteries and even slightly elevated blood pressure levels lead to increased risk in cardiovascular diseases or stroke.¹ The prevalence of hypertension has risen, especially in low- and middle-income countries (LMICs). Numbers suggest that 31.1% of adults (1.39 billion) worldwide had hypertension in 2010. The prevalence of hypertension among adults was higher in LMICs (31.5%, 1.04 billion people) than in high-income countries (28.5%, 349 million people).²

Hypertension is present in almost 70% of older adults and despite therapeutic medication. These older adults have a high risk of cardiovascular events and mortality.³ An estimated rate of 1.13 billion populations in the worldwide was suffering from high blood pressure. In the year of 2015, probably one in the four men and one in the five women suffering from had a high blood pressure. Prevalence of hypertension in India known to be 33% in urban and 25% in the rural Indians are suffering from hypertension. 25% rural and remaining 42% of urban Indians are also known of the hypertensive position and 25% Indians who are rural and 38% Indians who are urban are treated for hypertension. 1 10th of rural 15th of Indians who are urban and their high blood pressure is now control.⁴ In Pakistan there is a survey that is national survey assesses that, approximately 18.9% people in Pakistan around the age of 15 years or older are considered as hypertensive.⁵ Despite the increasing prevalence, the

proportions of hypertension awareness, treatment and BP control are low, particularly in LMICs, and few comprehensive assessments of the economic impact of hypertension exist.²

There are several factors predisposing to hypertension. These factors vary from country to country and even there is difference between urban and rural regions of the same place. Urban regions tend to have greater prevalence of hypertension as compared to rural counterparts. Gender differences, age, marital status, educational levels, occupation, socioeconomic status, Body Mass Index (BMI), abdominal obesity, tobacco use, alcohol use, and physical activity are associated with hypertension.⁶ Sedentary lifestyle is also a leading cause for hypertension.⁶ Exercise plays an important role and may reverse the adverse effects of absence of activity. Exercise drops systolic / diastolic pressure by at least 10.5mm Hg of mercury. Exercise not only lowers blood pressure but also decreases other risk factors for cardiovascular problems. Aerobic activity plays an important role in reducing blood pressure.⁷

The recent prescriptions of the exercise for the management of high blood pressure is the cardiac mode i.e. at least 20 to 60 minutes, 3 to 5 days each week by 40 to 70% of extreme uptake of the oxygen. The resistance exercises not known to be the appropriate exercise treatment mode.⁸ Cardiorespiratory fitness is a strongest interpreter of the hypertension risk, with each of the maximal metabolic equivalent unit related with a 19% lower risk. Each base line body mass index unit related to be with a 9% higher hypertension risk. However, the association of BMI importantly reduced when fitness was also involved in the model.⁹ Tesfaye, Fikru et.al found that body mass index thoroughly related with blood pressure.¹⁰

Older women suffering from hypertension the

functional capacity changed with 2 minute walk test and good for healthy older adults. The association among the TUG, functional capacity and 2-minute walk test concluded that there is an adjacent association among functional mobility and endurance in the cardiovascular system and risky functional flexibility exists when the endurance in the cardiovascular system is worse.¹¹ This study focuses on the impact of physical activity participation on the performance measures like 6-minute walk test, step test, strength tests, BMI and TUG test and compare the correlation of each test results. It will give information about the level of functionality, quality of life in hypertensive population and determine the individual's cardiorespiratory fitness level that otherwise look healthy and are living more of sedentary lifestyle. These factors could influence the morbidity and mortality of the affected individuals which would be necessary to determine the level of intervention required for improving their physical independence and functional status. To the best of researcher knowledge no such study has been conducted in Pakistan until now focusing on these aspects of hypertensive population.

To collect the data **WHO Patients Questionnaire for hypertensive patients, 15D Quality of life Questionnaire¹³** and **Self Structured Questionnaire** was developed which was filled by the patients. After this a few series of tests were performed by the patients with a 5-minute interval given between each test. The tests are as follows:

Arm curl test for upper limb strength and endurance:

During the test, patient holds the weight in relaxed grip, while sitting position on the chair with a backrest. Evade full extension to the side of the chair, due to the danger of the injury

experience in patients with under-diagnosed osteoporosis. Participants were told to start the movement from weight positioned on thigh. Then supinating during flexion was directed so that the palm of the hand faced the bicep at the end of concentric phase. Left and right hand strength was measured separately. Mean results were based on left and right hand score. If the valuation of strength in one hand was impossible to assess because of motor system disturbances for example pain the score as 0.

30 sec chair stand test leg power and endurance:

Test procedure contains standing from sitting position to a standing with full extension in knees and hips without pushing off with the arms. The patient can also use his or her arms to stand. Then the repetitions should be counted, when the participant is in the full standing position during the 30 seconds and if the participant is in the middle of the position which is standing when the 30 seconds have gone then you should count it as a stand. And in the end you should write down the number of repetitions the patient stands in the 30 seconds Tests score the was number of repetition contained of standing and sitting phase performed in 30 seconds.

TUG for dynamic balance evaluation:

The time up go test is guideless test which is used to measure individual mobility and it involves both of the static and dynamic balance. The patient's start in the seated position and then in standing position after walk (3 meters) then he/she turns around and then back to chair and then in the end sits down. If the scores of individual is ten seconds or less it shows that the mobility is normal, if the score are 20-30 seconds it's mean that the person requires support and specifies additional interventions and investigation. If the score is 30 seconds or more then the person may be prone to fall.

The TUG and 30STS tests were reliable and valid tests to assess physical performance in hypertensive personnel.¹⁴

Step test to assess aerobic fitness: In step test patients first step up and then down after on and then off and after the aerobic type tests for 3 minutes is performed in this way the heart rate increases also evaluate the recovery rate of heart throughout the minute instantly as ensuing the step test exercise. It is very important that as the time passes you should inform the individual (i.e. 5 minutes, 10 minutes, 20 seconds left) with remaining 30 seconds, then retell his or her to quickly sit down on the chair and the main point came to take the individual heart rate. After sitting down of individual you should place your fingers on the radial artery (not thumb) rhythm will be noticed then count till 5 seconds after the completion of test. The one minute count reveals the recovery rate of heart.

6 minute walk (6MW) test to evaluate functional capacity of individuals: The 6 minute walk is an effective and reliable method of measuring functional ability with variable level of physical capacity and retest reliability mainly when a practice trial is given before the test trial. Before testing, participants will be educated about testing with standardized phrases. Walk as far as possible for 6 minutes. Every minute, stimulated subjects to continue walking i.e. keep up the good work, you are doing good and informed them of the time elapsed. After the test, participants' walking distance will be measured in meters.

Results

The gathering of statistics consists of hypertensive adult's age ranged from 40 to 60 years in which 71 (48.6%) male and 75 (51.4%) females were included. The other variables of interest from demographics include gender, age,

BP-pre and -post, HR-pre and -post, spo2-pre and -post, mean and standard deviation are given in the Table 1. It was noted that the BP and HR of the hypertensive adults increased after the tests.

As per the Body Mass Index by World Health Organization, the adults categorized as hypertensive were below 18.5 kg/m² that are in the category of underweight.

After the collection of data, normality of data was assessed by Shapiro Wilk test. Data was not normally distributed thus Spearman test was applied for the correlation of functional capacity with body mass index, arm curl test, lower limb strength test, TUG, step test in hypertensive adults. SPSS version 21 was used to analyze data. The relationship between the variables of functional capacity (distance in meters), upper and lower limb strength test, time up go test and step test has been demonstrated via Table 1. A positive correlation was seen between 6MWT and Arm Curl Test and 30 second chair stand test where as a negative correlation was observed between 6MWT with BMI, Time up and Go test and Step test.

Table 1: Descriptives and correlation between functional limitation with different study variables

Variables	Mean ± SD	Correlation (r)
Age	53.12±5.90	
6MWT(meter)	224.65±80.13	
BMI	27.27±2.14	-0.081
Arm curl test	11.527±2.87	0.281**
30sec chair stand test	10.774±1.74	0.420***
Time up to go test	12.32±.51	-0.590***
Step test	3.56±0.51	-0.639***

p-value less than 0.05 it is flagged with one star (*). p-value less than 0.01 is flagged with two stars (**). p-value less than 0.001 is flagged with three stars (***)�.

Table 2 shows the frequencies of 15 D HRQOL questionnaire which was applied to assess the quality of life of the hypertensive participants in the study.

Table 2: 15 D Quality of life Questionnaire Frequencies

QOL	Excellent	Very good	Good	Fair	Poor
Mobility	146(100%)	0	0	0	0
Vision	70(47.9%)	76 (52.1%)	0	0	0
Hearing	146(100%)	0	0	0	0
Breathing	123(84.2%)	23(15.8%)	0	0	0
Sleeping	84(57.5%)	55(37.7%)	7(4.8%)	0	0
Eating	146(100%)	0	0	0	0
Speech	146(100%)	0	0	0	0
Exertion	105(71.9%)	41(28.1%)	0	0	0
Usual activities	132(90.4%)	14(9.6)	0	0	0
Mental function	146(100%)	0	0	0	0
Discomfort	98(67.1%)	48(32.9%)	0	0	0
Depression	59(40.4%)	72(49.3%)	15(10.3%)	0	0
Distress	59(40.4%)	72(49.3%)	15(10.3%)	0	0
Vitality	42(28.8%)	89(61.0%)	15(10.3%)	0	0
Sexual activity	103(70.5%)	40(27.4%)	3(2.1%)	0	0

Discussion

The result of present study indicate a weak negative correlation between 6-Minute Walk Test and Body Mass Index, Time Up and Go Test and Step test. Whereas, positive correlation was seen between 6-Minute Walk Test and Arm Curl Test and 30 second chair stand test.

The outcomes of the 6-MWT and the TUG test for aerobic capacity showed inverse relation, thus it can be stated that the hypertensive population with longer TUG test performance times cover a shorter distance in the 6MWT; and those with shorter TUG test performance times cover a greater distance in the 6MWT. These results propose that there is an innate relationship between cardiovascular endurance and functional mobility and that, with less cardiovascular endurance, there is a poor functional mobility and vice versa by Chandler JM

.¹⁵ According Chhajed BS et al study was done among older hypertensive women, the 6MWT and TUG showed a negative correlation, thus it can be assumed that there is a close relationship between cardiovascular endurance and functional mobility by Gao Y et al.¹⁶ In contrast to these outcomes, a study done to observe correlation between 6MWT, 2MST and TUG among Hypertensive Older Individuals which had the outcomes suggesting that there exists a high correlation between 6MWT and TUG. This is in contrast to the results of the present study where TUG and 6-MWT showed negative correlation by Chhajed BS et al.¹⁷

The study by Coresh J et al reported show that, age was negatively associated with the upper limb strength test and 6-minute walk test (functional capacity). Body Mass Index was negatively associated with upper limb strength test, lower limb strength test and 6 minute walk test (functional capacity). There is no apparent association of used functional tests with weight and height. The Lower limb strength was strongly, positively associated with the upper limb strength and the result of 6-minute walk test (functional capacity) was positively associated with the lower limb strength test.¹⁸ In the present study, the value of 6-minute walk test showed negative moderate correlation with time up go test and step test whereas a positive correlation with arm curl test was seen in hypertensive adults.

While assessing the level of physical functioning and its relation with age, functional fitness showed decline with increasing years, and the decrease was more apparent in females. Males reduced flexibility with a small increase in upper limb strength (arm curl). Among females, a decrease in balance and muscle strength was observed. No changes in functional aerobic capacity variables were verified in both gender

by Tomás MT et al.¹⁹

The patients with higher scores in the six-minute walk test, which is associated with aerobic capacity, show less odds to have clinical diagnosis of hypertension. However, hypertension was not associated with poor physical and functional capacity by Coelho J. HJ et al.²⁰ Although, the current study done over hypertensive adults, showed inverse relations between cardiovascular fitness and functional capacities probably owed to the sedentary lifestyle of the individuals that were recruited in the study.

Weakness of the study:

Associative risk factors were not observed which could have led to the variability of results.

Strength of the study:

First of its kind study (as best of our knowledge) conducted in Pakistan which could help develop further programmes and interventions to manage hypertension and its effects on physical functioning and strength capacity.

Conclusion

According to the present study, it is concluded that there is no association of functional capacity with body mass index, time up go and step test. Moderate association of functional capacity with arm curl test and 30 second chair stand test exists.

Limitations of study:

- 1) There were barriers for data collection, only limited time was allowed from the hospital to study the target population.
- 2) Hypertensive patients were not screened according to their stages.

Recommendations of the study:

- 1) Population could be taken with cardiopulmonary risk factors, having sedentary

life style or involving geriatric population for further studies

2) Future researches are recommended to use these tests in the control environment.

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Ethical Considerations

Ethical considerations have been declared in the methods section

Ethical Approvals

Ethical approval letter was obtained from Research Ethical Committee, Riphah International University, Islamabad, Pakistan. (Ethical letter code: RIPHAH/RCRS/REC/Letter-00595)

Conflict of Interest

None

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