



Impact Of High-Speed Power Training On Cognitive Function And Activities Of Daily Living

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Abstract

This study explores the cognitive function and activities of daily living which could shed light on various aspects of functioning such as memory, thinking, problem solving and activities of daily living.

Background: The average level of cognitive function in the overall population rises normally during childhood, peaks in maturity, and then declines as people age. These population- average trajectories have different general shapes depending on ability

Study design: Randomized control study

Aim: To assess the impact of high speed power training on cognitive function and activities of daily living among senior citizen.

Objective: To evaluate the impact of high speed power training on cognitive function and activities of daily living among senior citizen.

Participants: The participants were recruited on the basis of exclusion and inclusion criteria. The participants were divided in two group control group and experimental group 20 participants in each group total 40 participants were included in the study.

Method: This is randomized controlled study; a total 40 participant recruited between 60-75 years of age. Participants were randomly assigned in one of 2 groups: control group with usual occupational therapy program and experimental group with power training program. Exercise intervention was conducted in 5 sessions per week, 45 min for 12 weeks. The outcomes of the intervention were assessed using MOCA and KATZ outcome measure.

Result: In Montreal Cognitive Study (MOCA) pre and post in resulted that the pre mean of MOCA (14.5) accompanied by standard error (0.4947) and subsequently post mean value of MOCA increased (16.6) standard error (0.4723) and standard deviation (2.1126) which indicate progress of post mean value (16.6) indicating an improvement to a level of cognitive function. In KATZ pre and post related that the pre mean of KATZ (3.15) accompanied by standard error (0.1666) and subsequently post mean value decrease (4.5) standard deviation (0.8271) which indicate progress of post mean value (4.5) signifying a reduction in dependency and progress toward independence.

Conclusion: This research discovered that the effect of high speed power training is more significant than only conventional occupational therapy program for cognitive and ADL abilities of senior citizen. This training helps

CC License CC-BY-NC-SA 4.0	senior citizen to improve cognition and decrease ADL dependency. <i>Keywords: MOCA, KATZ, Cognition, Activities of daily living</i>
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INTRODUCTION:

The ageing process is a global phenomenon. People can today expect to live well into their 60s and beyond wherever in the world. India is home to the second-largest elderly population in the world, behind China (17.9%), with a projected growth in the proportion of senior persons (60 years of age and beyond) from 13.4% in 2020 to 21.3% by 2050. This accounts for 8.6% of the world's old population¹. Over the past twenty years, India's social structure has rapidly changed, accompanied by a sharp decline in mortality rates that hasn't been matched by a comparable drop in birth rates. As a result, the base of the population pyramid has been quickly declining and the proportion of older people in India is growing. Because of improved health, education, nutrition, and financial security, people are living longer. People are living longer than ever thanks to the effective control of infectious diseases and vaccination campaigns against them².

One of the most notable demographic developments of the modern era is population ageing, which is the process by which older people become a proportionately bigger fraction of the total population. Global recognition has been accorded to two noteworthy characteristics of the ageing process: the feminization of ageing and the rising demographic ageing of the older population. Ageing of the population has been an extraordinary demographic change of the twentieth century and the beginning of the current one. The population has been rapidly ageing this century, especially among women. The current rate of demographic change cannot be stopped. While there isn't a set definition for an elderly person, it's generally considered that a person is becoming older when they reach the age of sixty. The world is getting older, which presents social and economic issues that the family and society as a whole must raise to².

In India, the population over 60 is growing at a faster rate each year than the country as a whole. The percentage of the population that is 60 years of age or older is expected to increase from its current 8.1% share to 19.1% in 2051. Between 2011 and 2051, there would be a rise in absolute numbers from 86.5 to 298.2 million. India had 98 million senior persons in 2011; by 2021, that number is predicted to rise to 143 million, with 51% of those seniors being women. In rural areas, there were 985 women for every 1000 men, but in urban areas, there were 1046 women for every 1000 men³.

The phrase "cognitive function" is broad and includes a wide range of specific cognitive talents. These skills include the following: learning from experience, accurately reciting and applying cultural information (crystallized knowledge), mentally rotating and manipulating objects (spatial ability), quickly performing mental operations (processing speed), retaining information in consciousness while simultaneously updating or manipulating information (working memory), encoding and retrieving information (episodic memory), solving abstract problems accurately and efficiently (fluid reasoning), and performing learned procedures and operations (procedural knowledge). The ability to maximize performance, such as in terms of speed, efficiency, and/or accuracy, is what unites all cognitive talents. It's important to note that assessments of cognitive function are remarkably predictive of outcomes in the real world, despite the fact that most people's everyday demands do not push them to the limits of their abilities and that many tests of cognitive function are abstract and do not closely reflect real-world demands⁴.

METHODOLOGY:

A total of 40 participants included in the study through randomization according to the convenient sampling divided into 2 groups experimental group and control group. In experimental group HSPT was given to the participants for duration of 12 weeks, 5 sessions per week for 45 min. In control group conventional O.T program was given to the participants for duration of 12 weeks, 5 sessions per week for 45 min. Participants were recruited from Sri Sai Satyam Nirog Sansthan, Ghaziabad.

As per inclusion criteria, age above 60 years, both male and female, Individual with walking ability of 10m without a walking aid and having irregular exercise throughout the week willing to participate in the study were included. As per Exclusion criteria, Individual with unstable neurological condition and musculoskeletal impairment are excluded. Participants were given a informed consent form outlining the goals, methods, possible hazards, and advantages of the study prior to its commencement. They were given sufficient time, as well as an explanation, to go over the document and ask any questions before giving their written agreement. Each participant underwent a pre-assessment to establish baseline measurements using

MOCA and KATZ ADL.

Outcome measures:

1. KATZ Activities of daily living scale:

The Katz Index of Independence in Activities of Daily Living, or Katz ADL, is the most appropriate tool for assessing functional status as a measure of the client's ability to do activities of daily living independently. Clinicians typically use this instrument to identify problems performing activities of daily living and to plan care accordingly. A person's ability to do each of the six tasks—eating, dressing, using the restroom, transferring, and maintaining continence—is ranked. Clients assess each of the six roles in terms of independence, with a yes or no response. An indication of full function is represented by a score of 6, a score of 4 indicates moderate impairment, and a score of 2 or less indicates severe impairment. The Katz ADL index has a strong reliability coefficient of 0.94 with excellent convergent validity.

2. Montreal Cognitive Assessment (MoCA)

The one-page, 30-point Montreal Cognitive Assessment (MoCA) is a cognitive screening instrument that takes around 10 minutes to administer. Twelve subtasks make up the MoCA test: memory (5 points for correctly recalling five nouns after two verbal presentations); visuospatial orientation (3 points for drawing a clock and 1 point for copying a cube); executive functioning (1 point for trail-making B task, 1 point for phonemic fluency, and 2 points for a two-item abstract thinking task); attention (1 point for tapping a target); working memory (3 points for a serial subtraction task, and 1 point for forward and backward digit span); language (3 points for naming animals of low familiarity), repetition of sentences (2 points), and the phonemic fluency challenge previously mentioned; orientation to time and location (6 points) (including year, month, date, and day of the week,). To differentiate between normal and unhealthy behaviour, the developers recommend using a cut-off score of

26. The inter-rater reliability (ICC) score for MoCA was 0.96 (95% CI: 0.91–0.98). Cronbach's alpha, a measure of internal consistency, was 0.79 for MoCA.

Treatment protocol:

1. Experimental group intervention- High Speed Power Training program

S.NO.	DOMAIN	REPETITION	EXERCISE
1.	High speed power training	12- 1\5 repetition	Grip strength exercises, isokinetic leg extensor, flexor exercises with use of elastic exercise band (green elastic band)

2. Control group intervention- Conventional Occupational therapy program

S.no.	Domain	Activity
1	Cognition	Occupational therapy Attention activities Education
2	Activities of daily living	Basic activities of daily living task training

DATA COLLECTION :

A total of 40 participants included in the study through randomization according to the convenient sampling divided into 2 groups, experimental group and control group. In experiment group, sixteen male and four female are included out of twenty participants and in control group, seventeen male and three female are included out of twenty participants in the study.

In experimental group power training was given to the participants for duration of 12 weeks, 5 sessions per week for 45min. In control group conventional occupational therapy program was given to the participants for duration of 12 weeks, 5 sessions per week for 45 min. Participants selected according to inclusion & exclusion criteria, data was conducted through two phases for Pre & Post assessment in which hard copy of outcomes measure distributed. Also collected consent form from all subjects of experimental and control group who are agree to participate in the study and participants were also explain about the purpose of the study. Demographic details were also collected through data collection form then administration of scale was given for pre assessment of experimental and control group. After duration of 12 weeks per week 5 sessions for 45 minutes, the re-administration of scale was given for post assessment of experimental and control group, and responses were recorded to calculate the pre and post data of experimental and control group.

Descriptive statistics was calculated and t-test was used for pre and post analysis.

DATA ANALYSIS:

After completion of all (pre treatment and post treatment) evaluation, results were collected and data were put in the master chart and analyzed by using IBM SPSS.

The scoring of pre-treatment and post-treatment data of outcome measures MONTREAL COGNITIVE SCALE and KATZ SCALE were analysed using IBM SPSS for statistical significance result.

The Pre-test and Post-test for scoring of experimental and control group were analysed through parametric test, T-test was used to analyze the cognition and activities of daily living scores for analysis of outcome measure.

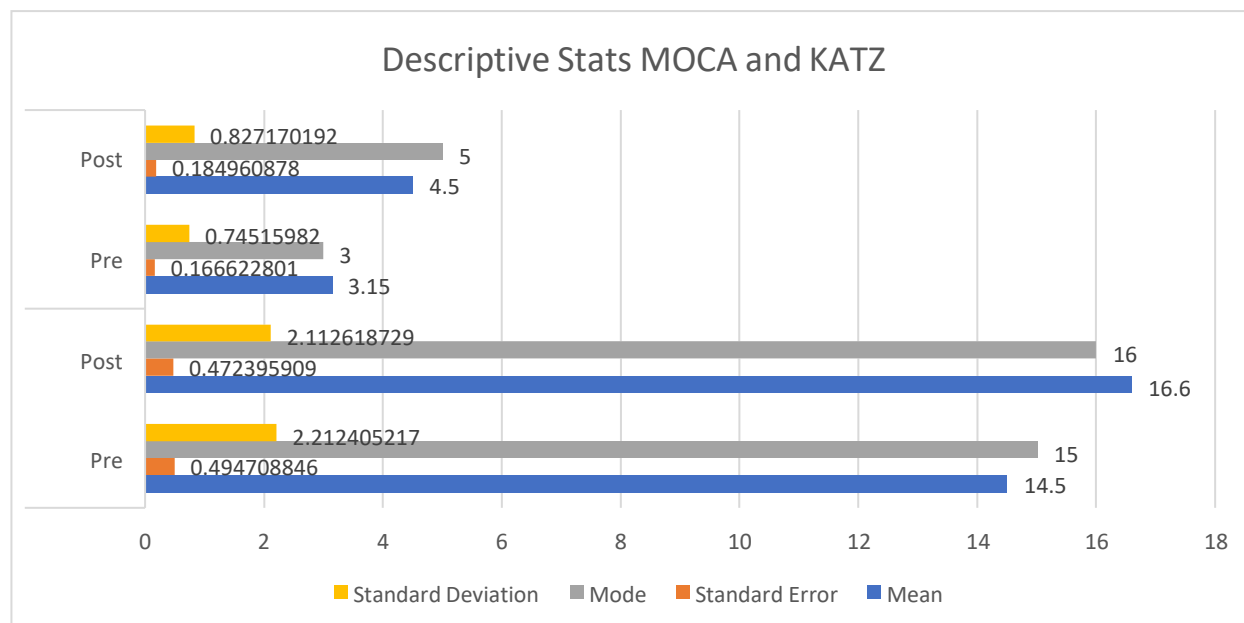
RESULT

The result presented in two phases: Pre test and Post test assessment and the significance of high speed power training was determined through MOCA and KATZ Outcome measures. In phase one: the pre test assessment of the MOCA and KATZ administered to the participants before providing intervention. In the second phase the post test assessment of the MOCA and KATZ was re-administered after a duration of 12 weeks, per week 5 sessions for 45 minutes was provided for the intervention interval of experimental and control group.

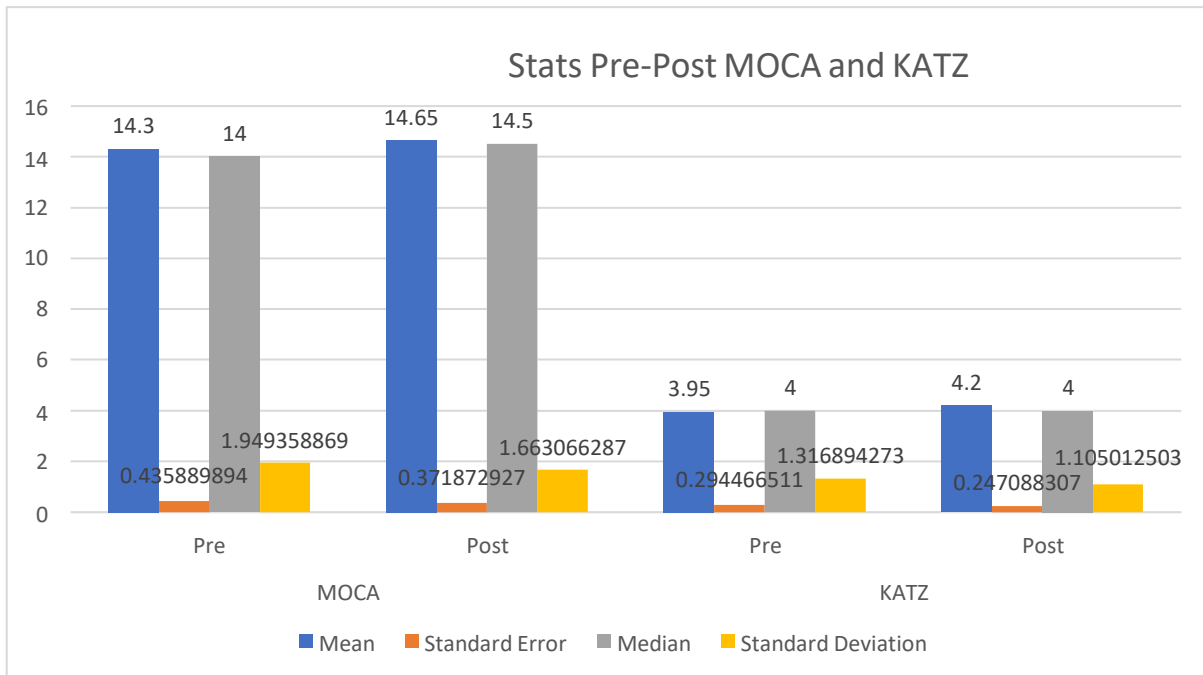
Table 1. Descriptive statistics of outcome measure

OUTCOME MEASURE	GROUP I EXPERIMENTAL GROUP				GROUP 2 CONTROL GROUP			
	Mean Test Score		Standard Deviation(SD)		Mean Test Score		Standard Deviation (SD)	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
MOCA	14.5	16.6	2.21224	2.112619	14.3	14.65	1.94935	1.663066
KATZ	3.15	4.5	0.74516	0.827170	3.95	4.2	1.316894	1.105

Table 1. Showing the Descriptive Statistics of MOCA & KATZ in Pre-test and Post-test of experimental and control group.



Graph 1. Graphical presentation of the Descriptive Statistics of outcome measure in Pre-test & Post-test in experimental group.



Graph 2. Graphical Presentation of the Descriptive Statistics of outcome measure for MOCA and KATZ of Pre-test & Post-test in control group.

Table 2. T-Test for Pre-test & Post-test of MOCA in experimental group

t-Test: Paired Two Sample for Means (MOCA)		
	PRE	POST
Mean	14.5	16.6
Variance	4.894736842	4.463158
P(T<=t) two-tail	8.25587E-12	
t Critical two-tail	2.093024054	

Table 2. Showing the p-value of 8.25587E-12 for pre-post MOCA, which falls below the conventional significance level of 0.05 (p < 0.05), that established statistical significance

Table 3. T-Test for Pre-Test & Post- test of KATZ in experimental group

t-Test: Paired Two Sample for Means (KATZ)		
	PRE	POST
Mean	3.15	4.5
Variance	0.555263158	0.684211
P(T<=t) two-tail	1.61997E-10	
t Critical two-tail	2.093024054	

Table 3. Showing the p-value for the pre- post KATZ comparison is 1.61997E-10, which falls below the significance threshold of 0.05 (p<0.05) that established statistical significance.

Table 4. T-Test for Pre-test & Post-test of MOCA in control group

t-Test: Paired Two Sample for Means (MOCA)		
	PRE	POST

Mean	14.3	14.65
Variance	3.8	2.765789
Observations	20	20
P(T<=t) two-tail	0.004729	
t Critical two-tail	2.093024	

Table 4. Showing the p-value for the pre-post MOCA comparison is 0.004729, which falls below the predetermined significance level of 0.05 ($p < 0.05$) that established statistical significance.

Table 5. T-Test for Pre-test & Post-test of KATZ in Control Group

t-Test: Paired Two Sample for Means (KATZ)		
	<i>PRE</i>	<i>POST</i>
Mean	3.95	4.2
Variance	1.734211	1.221052632
Observations	20	20
P(T<=t) two-tail	0.020992	
t Critical two-tail	2.093024	

Table 5. Showing the p-value for the pre- post KATZ comparison is computed as 0.02099, falling below the threshold of 0.05, established statistical significance.

The presence of resulting shows a significant improvement in cognitive impairment of the following intervention and training regimen. As per the statistical significance evaluation the tangible benefits enhanced by participation of patients in the program and also reinforcing the importance of proactive intervention strategies in managing cognitive decline.

DISCUSSION:

This study examined the impact of intervention on cognitive function and independence among elderly individuals through pre-post analyses of MOCA and KATZ assessments.

Dong Hyun Yoon, Dongheon Kang, Hee-jae Kim in 2016 conducted a study on Effect of elastic band-based high-speed power training on cognitive function, physical performance and muscle strength in older women with mild cognitive impairment. Their result suggests that increases in levels of cognitive function, physical function, and muscle strength³⁸.

As the current study explore the impact of intervention on cognitive function and independence among elderly individuals.

In the experimental group, the descriptive statistics for pre-post analysis of MOCA and KATZ are presented, the mean pre-MOCA score is 14.5, suggesting mild cognitive impairments among participants, while the mean post-MOCA score increases to 16.6, indicating an improvement to a moderate level of cognitive function. In experimental group, the mean pre-KATZ score is 3.15, implying a higher dependency on others for activities, whereas the mean post-KATZ score rises to 4.5, signifying a reduction in dependency and progress toward independence.

The standard errors for pre-MOCA and pre-KATZ are 0.4947 and 0.1666, respectively, while for post-MOCA and post-KATZ, they are 0.4732 and 0.1894, respectively. These values suggest a decrease in variability, indicating a more consistent improvement in cognitive function and independence among participants post-intervention.

Furthermore, the standard deviations for pre-MOCA and pre-KATZ are 2.2124 and 0.7451, respectively, compared to 2.1126 and 0.8271 for post-MOCA and post-KATZ. This reduction in deviation underscores a more concentrated distribution of scores post-intervention, reflecting enhanced cognitive abilities and independence levels among the elderly population.

The t-test analysis for pre-post MOCA is depicted. The variance for pre-MOCA is 4.89, whereas for post-MOCA, it stands at 4.4631. This evidence a decrease in post-MOCA variance compared to pre-MOCA

variance, indicating a moderation in cognitive impairment with subsequent improvement post-MOCA. Overall, these findings indicate a notable improvement in both cognitive function and independence activities following the intervention.

In the control group, the descriptive statistics revealed a nuanced picture of cognitive function and dependency levels before and after the intervention. Firstly, the mean scores for pre-MOCA assessments indicated minor cognitive impairments among the participants, with a mean score of 14.3, which improved slightly to 14.65 in post-MOCA assessments. This progression suggests a positive response to the intervention, although individuals still fell within the range of moderate cognitive impairments post-intervention.

Pre-KATZ assessments showed a mean score of 3.95, reflecting a relatively high dependency level among participants, which decreased to 4.2 post-intervention, indicating progresses towards independence in activities of daily living.

The standard errors associated with both pre and post-MOCA and KATZ assessments further supported these findings, with a decrease observed post-intervention. This reduction in standard errors indicates improved cognitive abilities and decreased dependency levels among the evaluated individuals.

Moreover, the reduction in standard deviations post-assessment underscores the decrease in variability, highlighting enhanced cognitive functioning and independence among the participants. This suggests a more consistent improvement across the sample, rather than sporadic changes observed initially.

The t-test conducted for pre-post MOCA assessments revealed a significant decrease in variance post-intervention, indicating a trend of improvement in cognitive function. The lower variance observed in post-MOCA scores suggests a more uniform response to the intervention among participants, further supporting the efficacy of the intervention in enhancing cognitive function.

The statistical analysis further solidifies these observations. The obtained p-value of $8.25587E-12$ for pre-post MOCA scores falls significantly below the conventional significance level of 0.05 ($p < 0.05$).

Consequently, the null hypothesis is rejected in favour of the alternative hypothesis, affirming the presence of a significant improvement in cognitive impairment following the intervention and training regimen. Such statistical significance underscores the tangible benefits accrued by patients participating in the program, reinforcing the importance of proactive intervention strategies in managing cognitive decline.

CONCLUSION:

This study concluded that the effect of high speed power training is more significant than only conventional occupational therapy program for cognitive and ADL abilities of senior citizen. The training helps senior citizen to improve cognition and decreases ADL dependency.

LIMITATION OF THE STUDY:

The study established with smaller sample size and was completed from a single place. This study limited to those Individual who have walking ability of 10m without using any assistive device and those who are having irregular exercise history throughout the week.

FUTURE RECOMMENDATION:

Future research could be done with a larger sample size and could be conducted from various places for data collection and can be done in relation to quality of life and life satisfaction among senior citizen.

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