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CORRELATION OF COGNITION, AEROBIC CAPACITY AND QUALITY OF LIFE IN OLDER ADULTS

Physiotherapy

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ABSTRACT

Background: The aim of the study was to correlate level of cognition, aerobic capacity and quality of life (QOL) in older adults.
Methodology: The correlational study included 40 individuals, both, males and females, 60 to 75 years, willing to participate and able to use stairs. Level of cognition was assessed with ACE III, aerobic capacity (VO2max) by self-paced step test, and Quality of life by QoL-AD.
Results: Spearman's correlation coefficient, between cognition and QoL for males was r=0.61, p<0.01, and for females r=0.04, p=0.88, between VO2max and QoL for males, r=0.085, p=0.6 and for females r=-0.05, p=0.85 and between VO2max and cognition, for males, r=0.32, p=0.1 and for females, r=0.03 and p=0.89.
Conclusion: There is strong to moderate correlation between level of cognition and QoL in males. There is no correlation between cognition and QoL in females, between aerobic capacity and QoL and between aerobic capacity and level of cognition.

KEYWORDS

Introduction:
Ageing brings anatomical, physiological, psychological and social changes. There is fear of future, loss of independence, grief and loss, memory and learning impairments, decrease in muscular strength, decrease in the sensations, etc.

Like other systems and organs in body, brain too goes for degenerative changes with ageing. Until recent past, it was believed that the age related changes in the brain are decreased weight, ventriculomegaly and histologically found neuronal loss, whereas, recent studies proved that cognitive decline occurs in the aging brain due to decreased synaptic and dendritic elements and also accompanying changes in the white matter.[1]

Cognition is defined as processes in mind that produce thought- and goal – directed action. [2] It is important to monitor cognitive changes in older adults as they involve changes in memory, attention, language, visuoconstructional abilities, orientation, calculative abilities, etc. Older adults consider optimum cognition as a vital part of successful aging. Cognitive decline is a matter of concern for both physical and mental health.[3,4]

With ageing, there are fewer changes in the upper respiratory tract, but the lower respiratory tract undergoes several changes in form of decreased capacity of elastic recoil of the lungs, decreased force producing capacity of the respiratory muscles and increased chest wall rigidity. These changes lead to increase in the functional residual capacity. Also, considering the cardio vascular system, the cardiac output decreases linearly as one ages, the cardiac index falls on the slower rate, there is decreased efficiency of the cardiac muscles and increase in both diastolic and systolic myocardial stiffness, the large arteries progressively become rigid, which eventually causes left ventricular hypertrophy and cerebrovascular events. Blood pressure lability is observed due to delayed baroreceptor response. These cardiopulmonary changes may lead to decreased physiological functional capacity and decreased VO2max.[5,6] Though, anatomical and physiological changes are normal age related changes, it brings some limitations to the life style of an elderly and affects their Quality of Life (QoL). Decreased cardiovascular fitness and cognitive abilities might affect the Quality of Life of an older adult. Quality of Life is one of the prime features of the successful ageing.

Older people contribute to the society by playing varied roles in the family and local community. However, the amount of contribution coming from older adults largely depends on one key characteristic: their health. Extra years spent in good health, contribute more to society. If these years are dominated by decline in physical and mental health, the implications will be more negative.[7]

There are several studies on association of pulmonary function with level of cognition in older adults. There are also studies which show the correlation of aerobic capacity and level of cognition in older adults. But these studies have been done in developed countries like Japan, Australia, and the United States of America[4,8,9] In a developing country like India, the studies to establish the correlation between aerobic capacity and cognitive functions are done in paediatric population.[10,11] Also the older population is increasing in number in India. So, there is a need to carry out this study in Indian older adults. Thus the aim of this study was to correlate level of Cognition, Aerobic capacity and Quality of life in older adults. This study is a part of the project where older adults will be trained for cognition and physical activity.

Methodology:
Ethics approval was obtained from Institutional ethics committee of Ahmedabad Institute of Medical Sciences, with ethical approval number AIMS/2016/75.

A correlational study was conducted among community dwelling older adults in Ahmedabad. The participants were informed about the study and consent was taken. 40 older adults were selected from the population by convenience sampling. Both males and females who were 60 to 75 years old, who were willing to participate, and those who could use stairs, and could read English and Gujarati were included in the study. Those who had any unstable medical condition, who had undergone recent surgeries in the lower limb, or any other surgery in last six months, whose vision could not be corrected to normal level using corrective glasses, those with impaired hearing, those with impaired speech, and smokers, were excluded from the study. The subjects were explained about the study and informed oral consent was obtained. They were asked to complete a questionnaire which included information regarding demographic data and the outcome measures. The outcome measures used in the study were self-paced step test to assess the aerobic capacity, ACE III to assess cognition and Quality of Life – AD to assess quality of life.

The aerobic capacity of an individual was measured using self-paced step test. The test consisted of stepping up and down two small steps (around 20 cm each). The individuals were instructed to fast at least two hours before the test. The resting heart rate of the individual was measured. The subjects were asked to step up and down ten times with

slow speed to get familiarized with the activity and the rhythm. Following this, five minutes of rest period was given. After the rest period, the subjects were asked to go for 20 steps up and down at a speed that they considered "normal". The time taken to complete the 20 steps was noted. Immediately at the end of completion of 20 steps up and down, the heart rate was also noted. Based on the formulas provided, the VO2max was calculated.[12]

The level of cognition was assessed by Adeenbrooke's Cognitive Examination - III (ACE – III) which includes total five cognitive domains: attention, memory, verbal fluency, language and visuospatial abilities. It has total score of 100 and more score indicates better cognition. Attention has a total score of 18, memory 26, fluency 14, language [26], and visuospatial ability [16.13]

Quality of life – AD has 13 different components and it assesses quality of life including physical health, energy, mood, memory, ability to do chores around the house, ability to do things for fun, self as a whole etc. The total score of Qol- AD is 52. Each item is rated as poor, fair, good or excellent with poor being 1 and excellent as 4. The older individuals were given instructions about filling up the QoL-AD questionnaire. [14]
The data obtained were analysed using Microsoft Excel 2010 and SPSS [16]. The level of significance was kept at 5%.

Results:
Total 65 subjects enrolled in the study. Sixteen subjects were excluded due to musculoskeletal complains before starting of the test and nine of them could not complete the step test. There was no adverse event during the performance of the step test. Table 1 indicates demographic characteristics and mean values. Table 2 indicates correlation of ACE III, VO_{2max} and QoL-AD in males using Spearman's correlation coefficient. Table 3 indicates correlation of ACE III, VO_{2max} and QoL-AD in females using Spearman's correlation coefficient.

Table 1: Demographic characteristics and mean values of outcomes

	Males	Females
Number	26	14
Age (years)	71±4.27	67±4.24
BMI (kg/m2)	23.93±2.66	24.95±3.60
HR rest (per min)	76.61±2.66	77.28±6.43
HR step (per min)	101.56±16.97	96.85±9.37
ST time (sec)	115.4±26.65	111.28±10.85
VO2max (ml/kg/min)	29.56±11.87	25.05±6.38
ACE III	76.04±17.09	75.07±17.44
QoL-AD	37.52±5.11	35.92±4.58

BMI - Body Mass Index, HR rest – resting hear rate, HR step – Hear rate after completing 20 step ups, ST time - time taken to complete 20 step ups, VO_{2max} – aerobic capacity, ACE III – Addenbrook's Cognitive Examination III, QoL-AD – Quality of Life – Alzheimer's disease.

Table 2: Spearman correlation coefficient for Males

Outcomes	r value	p value
ACE III with QoL	0.61	<0.01
ACE III with VO_{2max}	0.32	0.1
VO_{2max} with QoL	0.085	0.6

Table 3: Spearman correlation coefficient for Females

Outcomes	r value	p value
ACE III with QoL	0.04	0.88
ACE III with VO_{2max}	0.03	0.89
VO_{2max} with QoL	-0.05	0.85

Discussion:
The study was undertaken to correlate the aerobic capacity, level of cognition and quality of life in older adults. In the present study, the mean value of the VO_{2max} for both males and females falls under normal expected values of their age. The mean value of ACE III indicates mild cognitive impairments. The mean value of QoL-AD indicates fair to good quality of life.

There are several tools available to measure the aerobic capacity of older adults by indirect method. These tools are bicycle ergometer, 12 minute running time, bench stepping etc. But these tools may not be appropriate for the older adults. Several walking tests are available which positively correlates with the cardio respiratory fitness and are also suitable for older adults. However, it has been argued that walking may not provide threshold stimulus to cardio respiratory system. Hence, in this study, self-paced step test was used to predict the aerobic capacity of older adults. The reliability is 0.88 and it is valid to predict the aerobic capacity for the older adults.[12]

There are several tools to assess cognition like Mini mental status examination (MMSE), Montreal Cognitive Assessment (MoCA), Addenbrook's Cognitive Examination – III (ACE-III) etc. In this study, Gujarati version of ACE – III was utilised to assess cognitive level. ACE – III is a free tool available in Gujarati Language. The ACE – III is highly sensitive, specific and with the reliability of 0.88 and it is validated for Gujarati population.[13]

Quality of Life – Alzheimer's disease (QoL-AD) is one tool to assess QoL in older adults. It clearly differentiates the demented individuals from normal age matched elderly. A recent study investigating the use of QoL-AD in older adults reported excellent reliability and validity. Reliability of QoL-AD for older adults ranges from 0.83 to 0.90.[14]

In this study, correlation of cognition and QOL in males indicates there is strong to moderate positive correlation between the two. On plotting the scatter diagram, it indicates it is a linear correlation. The findings of this study are similar to the findings of Lawton and Brody, where QoL-AD was correlated to Mini-Mental Status Examination (MMSE) scores. They concluded that there is weak to moderate correlation between the two. The MMSE scores were also correlated to Activities of daily living (ADL) score from Physical and Instrumental-Self maintenance scale. The results indicated that lower MMSE scores were associated with greater impairment in ability to do ADL. 15 Glisky EL has explained how cognitive functions may affect quality of life. She elaborated that many complex everyday tasks such as decision making, problem solving, and the planning of goal directed behaviours require attention, recall, integration and reorganisation of information. As the person ages, recall, attention, memory and reorganisation gets affected, leading to altered Quality of Life.[16]

Correlation of aerobic capacity with cognitive function QOL for males showed no correlation in this study. Marlgorzata Gajos et al. performed a similar study to establish the relationship between aerobic fitness and cognitive function, where older adults between the age group 50-85 were assessed for aerobic fitness and cognition. Aerobic fitness was assessed with six minute walk test and level of cognition was assessed with Mini Mental Status examination and Montreal Cognitive Assessment. 17 Contrary to present findings, Marlgorzata Gajos et al. had a weak but non- linear correlation between the aerobic capacity and level of cognition. This probably can be explained as their sample was more than two times numerous than the sample group of the present study.

Also Correlation of cognition, aerobic capacity and QOL in females showed no correlation. Possibly, this can be because the females are lesser in number (14) compared to males (26), in addition, greater samples might be required to establish a correlation between the two. Another limitation of this study was that the QoL-AD is as a self-reported questionnaire. Because of the same reason there may be a chance of subjective bias as seen with all self - reported questionnaires.

Conclusion:
The study concludes that there is strong to moderate correlation between level of cognition and QoL in males. There is no correlation between level of cognition and QoL in females. There is no correlation between aerobic capacity and QoL and no correlation between aerobic capacity and level of cognition in both males and females.

Further study with larger sample size can help establish the relationship between the level of cognition, aerobic capacity and quality of life in older adults.

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