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RESEARCH ARTICLE

FALL RISK AND PHYSICAL FITNESS IN HEALTHY OLDER POPULATION

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ABSTRACT

Back ground and objectives: Falls are the major problem associated with old age. Many studies have explored the relationship between falls and physical performance but those studies were focused mainly on the frail elderly having several health problems. Hence it is important to clarify and evaluate the relation between falls and physical fitness in healthy elderly. The aim of this study was to analyze the correlation between the falling risk and physical fitness in healthy elderly and determining the top parameters affecting the fall risk.

Methodology: this study was cross sectional design which includes 60 elderly subjects whose mean age was 73.17±5.81 years. All the elderly subjects were selected on the basis of their cognitive function (MMSE.24) and fulfilled the physical fitness criteria as determined by SFT. All healthy subjects then underwent fall risk and balance assessment to evaluate the correlation between fitness, balance and fall risk.

Results: A strong positive correlation of BBT and SLST with chair stand, arm curl and 2 min step test was found, but the correlation of BBT and SLST with" 8 foot up-and go test " were negative. However, no significant correlations of BBT and SLST with chair sit and reach test, back scratch test (p.0.001) was found. The results of regression analysis showed that chair test was the top most parameter of SFT which affects fall risk and balance.

Conclusion: Falling risk increases with declining of upper and lower extremity muscle strength, aerobic endurance, agility and dynamic balance performance. Lower extremity strength was most relevant with fall risk and balance. it was concluded that the older persons falling risk, balance and physical fitness level should be evaluated in some intervals .according to their falling risk, balance and physical fitness level, the rehabilitation programmes should be planned.

INTRODUCTION

Ageing is the accumulation of changes in a person over time (Bowen *et al*., 2000). Ageing in humans refers to a multidimensional process of physical, psychological and social change. Some dimensions of ageing grow and expand over time, while others decline. Research shows that even late in life, potential exists for physical, mental and social growth and development. Roughly 100,000 people worldwide die each day of age-related causes (Aubre *et al*., 2007).

Successful ageing consists of three components: (Rowe 1997)

- Low probability of disease or disability.
- High cognitive and physical function capacity;
- Active engagement with life.

A Greater number of people self-report successful ageing than those that strictly meet these criteria. (Strawbridge *et al*., 2002) The terms "healthy ageing" and "optimal ageing" have been proposed as alternatives to successful ageing.

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Six suggested dimensions for successful ageing includes: (Diane *et al*., 2003).

- No physical disability over the age of 75 as rated by the physician.
- Good subjective health assessment
- Length of un-disabled life.
- Good mental health
- Objective social support
- Self-Rated life satisfaction in eight domains, namely marriage, income-related work, children, friendship and social contacts, hobbies, community service activities, religion and recreation/sports.

Developments in medicine and technology lead to the increased life expectancies and improved life standards and hence to a higher elderly population. With the increase of the elderly population, there came the problems related with the old-aged people, falls (Yesilbalkan and Karadahovan 2005). Regardless of age, falling is ubiquitous event experienced by all throughout life. Especially children and young adults, are of minor consequence and have no impact on subsequent function. Falls in elderly, by contrast, are major cause of

morbidity and mortality in persons older than 65. (Theresa A Soriano *et al*., 2007). They are the leading cause of death from injury, rate that increases with advancing age. In persons older than 85, approximately two thirds of injury related deaths are due to falls (Commodre *et al*., 1995). The majority of falls in elderly, however, result in minor or no injury. Because most falls do not result in injury requiring medical attention, it is likely that many falls go unreported and that fall rates are grossly underestimated. As one ages, fall risk shifts fromspread out over many diverse activities, situations and environments to being focused on basic movements required for routine daily activities.Some individuals see fall a normal consequence of becoming old. Along with this belief, the por knowledge about preventive measures causes increase incidence of falls (Yesilbalkan and Karadahovan 2005).

The changes related with the age and the diseases which affect the functions we need to maintain the balance, as well as medications, are among the intrinsic factors (Beers and Berkow 2000). Most of the literature studies seem to have explored the relation between the sex, chronic diseases, drug use, balance function and the muscle strength of lower extremity and the fall risk (Steven *et al*., 2005; Debbie *et al*., 2003; Kojima *et al*., 2011; Cheryl Hawk *et al*., 2006; Moreland *et al*., 2003). Various researchers reported that old aged people living in communal care centers, who had a history of fall had a significant decline in their lower extremity strength compared to those who did not have any fall history (Hill *et al*., 1994). Advancing age causes disorder in overall balance and reduction in muscle strength and decline in ability to exert force in lower extremity it thought to be contributor to balance disorder, which is an intrinsic element of a fall (Doubney *et al*., 1999). Physical Fitness is considered a measure of the body's ability to function efficiently and effectively in work and leisure activities, to be healthy, to resist hypokinetic diseases, and to meet emergency situations (Archived from the original on2012 Aug). It comprises two related concepts: general fitness (a state of health and well- being), and specific fitness (a task-oriented definition based on the ability to perform specific aspects of sports or occupations).

However, it has been observed that the number of studies has been very limited with respect to the fields, including the muscle strength of upper extremity, flexibility, aerobic endurance, agility and dynamic balance and body mass index (BMI) all related with the falls. Also, most of the literature studies suggest that those individuals having a past history of falls are likely to experience a fall later in their lives (Jane Flaming *et al*., 2008). Those studies have often dealt with the primary risk factors of falls in those individuals who are healthy but carry a slouched posture and hence are exposed to an increased fall risk. Unfortunately, the risk factors contributing to the falls in physically fit or healthy individuals have only been dealt with by a very limited number of studies. (G.M.M.E *et al*., 2010; Orr *et al*., 2010; Ozcan *et al*., 2005). Therefore, the studies aiming at determining the risk factors which contribute to the fall risk and they will serve as a guide for the rehabilitation programs which aim to remove risk factors. The aim of this study is to explore the relation between the fall risk and physical fitness in the people aged 65 and over. For whom falls are a serious problem, and to determine the physical fitness parameters, which are the main contributors to fall risk.

Objective of the study

Primary objective

To analyse correlation between falling risk and physical fitness in healthy older population.

Secondary objective

To determine top parameters affecting fall risks in healthy older population.

MATERIALS AND METHODS

The data reported here is a part of research project in which 60 subjects underwent cognitive, physical fitness, fall risk and balance evaluation.

Source of Data: Little Sisters Home for Aged and Holy Family Home for aged in Mangalore, Karnataka during the period between january 2013 to april 2013.
Subjects: The study population considered of 60 subjects with the mean age 73.17±5.81 years. Of the total 60 subjects, 17 were men and 43 were womwn.

Inclusion criteria

- Gender:both male and female.
- Elderly 65 years and above.
- Subjects who are willing to participate in the study.
- Subjects who can follow verbal commands.

Exclusion criteria

- Any Neurological disorders that prevent subjects from participation
- People using walking aids
- People having history of fall last one year.
- People having unfit health condition
- MMSE score <24
- People identified at risk in senior fitness test.

Duration of study: 04 months

Procedure

Subjects were selected for the study on the basis of inclusion criteria and exclusion criteria. For fulfilment of this they also underwent MMSE and SFT as follows:

Mini Mental State Examination (MMSE)

The MMSE test was used to investigate the cognitive functions.

Senior Fitness Test (SFT)

The SFT protocol was applied to assess the physical fitness. Before applying the test isolation of the study area was set and each individual were instructed to do a 5-8minutes warm up

exercise including free exercises of upper limb, trunk and lower limb. This test has 6 phases and is completed in 30-40 min.

- Chair Stand Test
- Arm Curl Test
- 2minutes step Test
- Chair sit and Reach Test
- Back Scratch Test
- 8 foot-up-and-go test

All the 60 subjects selected were tested for fall risk and balance using BBT and SLST respectively on the next day of selection to minimize the risk of fatigue.

Variations of single leg stance test tested were:-

- RLSEP-right leg standing with eyes open
- LLSEO-left leg standing with eyes open
- RLSEC-right leg standing with eyes closed
- LLSEC-left leg standing with eyes closed

BERG BALANCE TEST

RESULTS

The objective of the study was to determine correlation between fall risk and physical fitness in healthy older population. A total of 60 elderly people participated in the study. Pearson coefficient of correlation was calculated for all SFT phases, BBT and SLST scores. The t-test of correlation coefficient was performed to investigate whether the difference between the sample correlation co-efficient and zero is statistically. Then a regression analysis was done between SFT phases, BBT and SLST scores to find out the parameter which affects the fall risk and balance the most. The subjects had a mean age 73.17±5.81years and study population constituted of 28.3%male and 71.7%female of which 60% scored 25 and 40%scored 27 in MMSE indicating good cognitiveskills. Mean score in chair stand test, arm curl test, 2min.step test, chair sit and reach test, back scratch test, 8 foot up and go test were 13.20±3.61 reps, 15.75±3.55reps, 83.30±14.05 steps, 0.68±5.07 cms, 0.17±6.08cms, 6.88±1.35 secs respectively which indicates good performance in SFT (subjects were physically fit).Subjects had a mean BBT score of 48.63±3.21 and mean scores of SLST(RLSEO,RLSEC,LLSEO,LLSEC) were 9.75±2.78, 7.49±2.56, 6.81±2.61, 5.03±2.51 secs respectively indicating good performance in both the tests. Correlation coefficients (r) of chair stand test, arm curl test, 2min step test with BBT scores ranged between 0.859-0.917 and SLST scores "r" ranged between 0.672-0.706(RLSEO),0.513-0.573(LLSEO), 0.690-0.721(RLSEC), 0.492-0.543(LLSEC). The statistical analysis showed a strong positive correlation between chair stand, arm curl,2 min step test and BBT, SLST scores($p<0.001$). The scores indicate that more the strength and aerobic endurance lesser the fall risk and better will be the balance. A negative strong correlation was found between 8 foot up go test, BBT and SLST scores($r=0.821$, $p<0.001$; $r=0.399$-0.52, $p<0.001$ respectively). This indicates that time taken to complete 8 foot up and go test is directly proportional to fall risk but inversely proportional to balance. Trivial negative relations were found between chair sit and reach test ($r=-0\ 0299$, $p=0.823$), back scratch test ($r=0.057$,$p=0.660$) and BBT scores. While rivial negative relations were found between chair sit and reach test and RLSEO, LLSEO, LLSEC ($r=-0.198$ to -0.230) moderate negative relations was found with RLSEC ($r=-0.209$, $p=0.031$). There was trivial negative correlation between back scratch test and LLSEC, LLSEO, RLSEC ($r=-0.110$ to -0.251) while a moderate negative correlation with RLSEO was found ($r=-0.314$, $p=0.014$). This indicates that there is no significant influence of lower and upper extremity flexibility on both fall risk and balance. Regression analysis was performed o identify top most parameter affecting the fall risk and balance. Chair stand test was he variable which was affecting the BBT ($beta=0.785$, $p<0.001$) and SLST(EO $beta=0.757$,$p<0.053$;EC $beta=0.773$, $p<0.06$) the most. This indicates that lower extremity strength contributes to fall risk and balance the most.

DISCUSSION

The study aimed primarily to explore the relation between the fall risk in the old-aged people and their levels of physical fitness. The secondary objective was to identify the top physical fitness parameter that may cause the fall risk. In this study significant relation was found between the fall risk and balance with individuals strength, aerobic endurance, agility, dynamic balance whereas no significant relation of fall risk and balance was found with flexibility. It was concluded that individuals having better balance and lower fall risk also had better leg strength, aerobic endurance, agility and dynamic balance. Guimares and Farinatti found association between decreased flexibility (especially in hip and ankle muscle) and frequency of fall (Guimaraes *et al*., 2005). Because the lower extremity flexibility is basically related to the changes in walking pattern, it is a prominent element to be considered in identifying the fall risk. There are few studies which define flexibility as a variable that explains falls by old-aged people in epidemiological ways or regard it as risk factor in the occurrence of fall events (Guimaraes *et al*., 2005). Michael *et al.* found significant association between lower extremity flexibility and balance in elderly people (Michael *et al*., 2010). This study however, found no significant relation between the individual flexibility of shoulder and hamstring muscle group with fall risk and balance. The study by Hatch *et al.* found a strong relation between the timed stand-walk test and the BBT ($r=-0.81$) ($p<0.01$) (Hatch *et al*., 2003).Study by Bogle *et al.* the BBT was found to have correlation with both the Tinetti Mobility Index ($r=0.91$) and the stand-walk test ($r=-0.76$) (Bogle *et al*., 1996). Those individuals who got low scores in the BBT had achieved higher scores in the 8min stand-walk test with respect to test completion time. This data suggested that the less the individuals agility and dynamic balance, the more their fall risk. Brach and Van Swearingen conducted a study in which they examined 83 elderly male individuals aged between 65 and 97, who were living in old people's home, to explore the relation between the physical disorders and inabilities and daily chores (Brach *et al*., 2002). They found out that the walking speed, fall risk and muscle strength, independently of each other, contributed to the daily life activity levels of those male individuals. Besides, reduction in walking speed and mobility capabilities are one of the risk factors defined for fall events. Dynamic balance problems

should be regarded as a cause in fall experiences in the elderly. Because about 50% of fall events occur during various tasks which require proper static and dynamic balance such as come and go.

Regression analysis done to determine the variable most affecting the fall risk indicated that lower extremity strength was a top most parameter affecting fall risk and balance followed by upper extremity strength, aerobic endurance, agility and dynamic balance. Reduction in lower extremity muscle strength is an intrinsic element of falls. Having difficulty in rising up from a seated position in a chair is associated with the increase in fall risk and poor balance.

REFERENCES

"President's Council on Physical Fitness and Sports Definitions for Health, Fitness and Physical Activity". *Archived from the original* on2012 Aug.

Aubrey D.N.J. *et al*. "Life Span Extension Research and Public Debate: Societal Considerations". Studies in Ethics, Law and Technology1.2007:1(5).

Beers M.H, Berkow R. The Merck Manual of Geriatrics, third ed. Merck Research Laboratories,USA.2000.

Bogle *et al*. Use of the Berg Balance Test to predict falls in elderly person. *Physical Therapy*. 1996; 76:576-585.

Bowen RL *et al*. "Living and dying for sex. A theory of ageing based on the modulation of cell cycle signalling by reproductive hormones". Gerontology. 2000; 50(5): 265-90.

Brach J.S. *et al*. Physical impairment and disability:relationship to performance of activities of daily living in community-dwelling older men. *Physical Therapy*. 2002; 82:752-761.

Cheryl Hawk *et al*. Assessment of balance and risk of falls in community dwelling aged65 and older. Chiropractic and osteopathy.2006.

Commodre DI. *et al*. Falls in elderly population; a look at incidences, risks, healthcare costs and preventive strategies. Rehabilitation Nurse.1995;20:84-9.

Debbie AL. *et al*. Association between falls in elderly women and chronic disease and drug use. British Medical Journal.2003;3:327-712.

Diane FG. *et al*. Health, illness and optimal aging: biological and psychological perspectives. Thousand Oaks: Sage Publications 2003.

Doubney M.E *et al*. Lower-extremity muscle force and balance performance in adults aged 65 years and older. *Physical Therapy*.1999; 79:1177-11.

G.M.M.E *et al*. Which types of activities are associated with risk of recurrent falling in older persons? *Journal of gerontology And Biological sciences and medical sciences*. 2010July; 65(7):743-50.

Guimaraes J.M.N. *et al*. Descriptive analysis of variables theoretically associated to the risk of falls in elder women. *Rev. Bras. Med. Esporte*.2005;11:280-286.

Hatch J *et al*. Determinants of balance confidence in community-dwelling elderly people. *Physical Therapy*. 2003; 83:1072-1079.

Hill K. D *et al*. A falls and balance clinic for the elderly. Physiotherapy Canada. 1994;45:20-27

Jane Flaming *et al*. Falls in advanced old age: recalled falls and prospective follow up of over 90 years old in Cambridge city. *Biomedical central journal geriatrics*. 2008; 8:6.

Kojima T. *et al*. Association of poly-pharmacy with fall among geriatric outpatients. Geriatrics and Gerontology International.2011Oct;11(4):438-444.

Michael C *et al*. The relationship between Range of movement, Flexibility and Balance in the Elderly. Topics in Geriatric Rehabilitation. 2010;26(2):148-155.

Moreland J *et al*. Evidence based guidelines for secondary prevention of falls in older adults. Gerontology. 2003;49:93-116.

Orr *et al*. Contribution of muscle weakness to postural instability in the elderly. European *Journal of Physical Rehabilitation and Medicine*. 2010Jan;46(2):183-220

Ozcan A *et al*. The relationship between risk factors of falling and quality of life in older adults. *Biomedical central journals of Public Health*. 2005Aug;5:444-478

Rowe JW *et al*. "Successful aging". Gerontologist. 1997; 37(4):433-40

Shumway-Cook AO *et al*. Predicting the probability for falls in community-dwelling older adults. *Physical Therapy*. 1997;77:812-81.

Steven JA. *et al*. Gender differences for non-fatal unintentional fall related injuries among older adults. Injury Prevention.2005;11:115-119

Strawbridge WJ. *et al*. "Successful aging and well-being: self-rated compared with Rowe and Kahn". Gerontologist. 2002; 42(6):727-33

Theresa A Soriano *et al*. Falls in community dwelling older adult:review for primary care settings. Clinical interventions in aging. 2007 Dec; 2(4):545-553.

Yesilbalkan, Karadahovan A. The frequency of falls in elderly individuals living in Narlidere rest home and evaluation of the affecting factors. Geriatri Dergisi.2005;8:72-77.

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