

Correlation of Frailty, Functional Lower Extremity Strength and Mobility in Community Dwelling Older Adults

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DOI: <https://doi.org/10.52403/ijhsr.20220329>

ABSTRACT

Background: The frailty syndrome is explained by loss of muscle mass (sarcopenia), decreased muscle strength (dynapenia), changes in balance, loss of functional mobility and reduced levels of physical activity. Physical frailty and sarcopenia are related to weakness, slowness, and decrease muscle mass, yet with conserved ability to move independently. The reduced in muscle strength resulting from sarcopenia causes significant functional loss with regard to performing activities of daily living.

Aims & Objective: To find out correlation of Frailty, Functional lower extremity strength and mobility in community dwelling older adults.

Methodology: The study design was a cross-sectional study. 50 frail elderly people were included in the study; Frailty assessed by FRAIL questionnaire [$r=0.87$]; functional Lower Extremity was assessed by 5 times Sit-to-Stand [$r=0.91$]; Mobility is assessed by Timed up and go test [TUG; $r=0.93$]. In which male and female participants both were included. The response was recorded and analysed.

Results: Spearman's rho correlation was used to analyse data. Significant and moderate correlation was found between frailty and 5 times sit to stand ($r = 0.61$; $p < 0.05$). Significant and weak correlation found between frailty and TUG ($r = 0.35$; $p < 0.05$).

Conclusion: Moderate correlation was found between frailty and functional lower extremity strength weak correlation was found between frailty and mobility in community dwelling older adults. So, the study concluded that frailty was correlated with functional lower extremity strength and mobility in community dwelling older adults.

Keywords: Frailty, Community dwelling older adults, lower extremity muscle strength

INTRODUCTION

Elderly population around the world is rapidly increasing, now a days the increase in ageing population in developing countries is observed in more numbers, while it was observed before in developed countries (UN-2013) ⁽¹⁾. India is recognized as “an ageing country” with 7.7% of its population is more than 60 years old and elderly population in India is extremely

increasing ⁽²⁾. Aging can be defined as the decline and deterioration of functional properties at the cellular, tissue and organ level ⁽³⁾. Human ageing has been showed as a progressive decline in both physical and psychological functioning that leads to increasing health care burden on the society.

Frailty is measured as highly widely accepted with increasing age and it leads to high risk for adverse health outcomes that

includes mortality rate, falls, institutionalization and increased rate of hospitalization⁽⁴⁾. Frailty is a multidimensional geriatric syndrome that increasing with the age.

Frailty is defined as a state of increased vulnerability resulting from aging-associated decline in reserve and function across multiple physiologic systems such that the ability to cope up with every day or acute stressors (e.g., extreme heat and cold, minor injury, even changes in medication) is comprised⁽⁵⁾. Frailty leads to changes in the health status of community dwelling older adults by mobile to immobile, independent to dependent and increased risk of falls, lucid to delirium.

Frailty syndrome is explained by sarcopenia (loss of muscle mass), dynapenia (decrease in muscle strength), Changes in balance, loss of functional mobility and reduced level of physical activity. According to Fried and colleagues they described frailty phenotype and is objectively identified as five components which includes weakness, slowness (slow walking speed), shrinking (unintentional weight loss), exhaustion (self-reported), and low physical activity⁽⁴⁾. Physical frailty characterized by sarcopenia, osteoporosis, muscle weakness, slowness that leads to preserved ability to move independently.

Sarcopenia is characterized by loss of skeletal muscle mass, reduced muscle strength and power that key component of frailty⁽⁶⁾. The underlying mechanism of sarcopenia is including oxidative stress, muscle apoptosis, dysregulation of inflammatory cytokines and hormones, malnutrition, physical inactivity these all are the contributing factors of frailty⁽⁷⁾. It is also responsible for the reduction in the metabolic rate and physical activity that leads to altered regulation of the energy produced and its consumption that resulting into malnutrition⁽⁸⁾.

The European working group on Sarcopenia in older people recognized that muscle strength and muscle mass are components of it⁽⁹⁾. Sarcopenia leads to

changes in muscle fiber by reducing the satellite cell reduction, inflammatory factors, hormonal factors, protein oxidative and developmental factors. The pathological changes in sarcopenia includes reduction in muscle mass and quantity due to replacement of muscle fibers with the fat, oxidative stress, hormonal imbalance, increase in fibrosis and degeneration of neuromuscular junction⁽¹⁰⁾.

Loss of muscle strength is also related to reduction in loss of skeletal muscle mass, changes in the muscle fiber type-1 muscle fibers are increase in area and number but not in size, the type-2 muscle fibers appeared smaller and flatter. The changes in muscle fiber indicates that there is reduction in neural activation or reduction in intrinsic force generated by the skeletal muscle mass^(11,12).

Dynapenia is the progression of sarcopenia. The contribution of dynapenia divided into two factors 1) Neurological 2) skeletal muscle mass properties, because it is outputs from these sources' controls muscle force production; Dynapenic individuals could have fewer functioning motor units, reduction in the ability to optimally produce force, decrease in the intrinsic force generating capacity of muscle caused by potential changes in the excitation-contraction coupling process. which would affect the muscle strength^(13,14).

Although sarcopenia and dynapenia is the systemic process, identification of individual muscle groups may contribute to early recognition of older adults as they are prone to develop the frailty syndrome. Lower limb strength is related to achieve various routine tasks, such as rising from a chair, going down a flight of stairs and walking at optimal speed which has corresponds to perform basic activities associated with Functional independence level^(15,16).

These are the changes related to sarcopenia has effect on functional loss with difficulty performing activities of daily living activity, reduced gait speed, walking,

falls and fractures, reduced balance that leads to reduced mobility of older adults.

METHODOLOGY

A cross-sectional study was accomplished in Ahmedabad city. Data of 50 community dwelling older adults were taken. The older adults were explained about the procedure and purpose of the study in their vernacular language. After that obtaining verbal and written permission from different societies of Ahmedabad were recruited for study.

Community dwelling older adults between age 65-85 years; Both male and female; older adults who were willing to participate and who were able to perform the test were included in the study. Older adults who have recent history of any upper limb or lower limb fracture, recent history of abdominal or spinal surgery or any recent condition of any neurological disorder like stroke were excluded from the study. Convenient samples of 50 community dwelling older adults were included and frailty by simple frail questionnaire; functional lower extremity strength by 5 times sit to stand and mobility by timed up and go test were assessed.

Measures:

Frailty measurement:

Frailty was assessed by The Simple Frail Scale which includes 5 components: Fatigue, Resistance, Ambulation, Illness, Loss of weight. Frail scale score ranges from 0-5 (i.e., 1 point for each component; 0= Best to 5= Worst) and represents Frail (3-5); Pre- Frail (1-2), and robust (0). This scale is reliable to assess frailty in older autistic scale was valid and reliable ($r=0.87$) to evaluate in older adults⁽¹⁷⁾.

Functional lower extremity strength:

Functional lower extremity strength was assessed by 5times sit to stand test. The equipment is used were stopwatch and standard height chair. Ask the participants to sit on the chair with arm folded across their chest; Then instructs the individuals to

“Stand up and sit down as quickly as possible 5 times, without stopping in between with arms folded across the chest. The test performance was based on its duration; the shorter time taken by individuals the better the functional lower extremity functional strength. The 5 times sit to stand test has a reliable and valid for measuring the functional lower extremity strength with intra-rater reliability (ICC= 0.914-0.933)⁽¹⁸⁾.

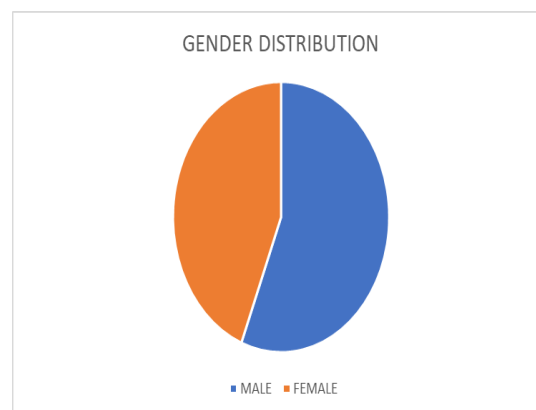
Mobility:

Mobility was assessed by Timed up and go test (TUG). In the test subjects were asked to rise from a standard chair, walk to a marker 3m away, turn, walk back and sit down again; Then duration was recorded to complete the test by an individual. TUG performance for community dwelling older adults between 65-85 years duration was 12 second or less. This is a reliable and valid tool to measure mobility in older adults with intratester and intertester reliability (ICC= 0.92)⁽¹⁹⁾.

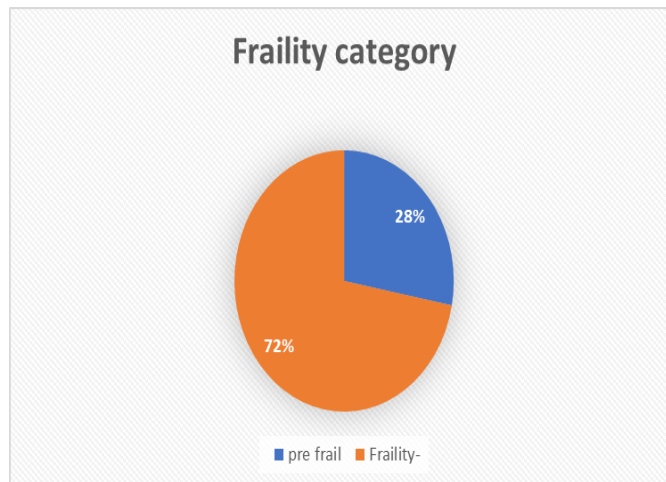
Statistical Analysis:

The study was conducted on 50 community dwelling older adults. Statistical analysis was done by using SPSS version 20.0. Data was not normally distributed So Spearman's rho correlation was used to analyse the data. Microsoft excel was used to generate graphs of age and frailty category.

RESULTS

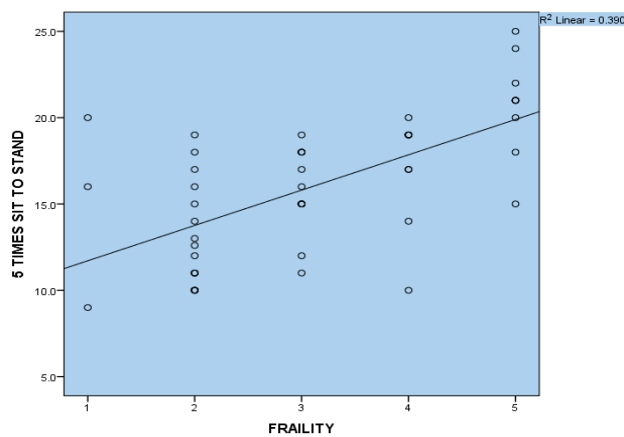


Graph-1: Gender distribution among 50 Community dwelling older adults (Male=28; Female=22)



Graph-2: Distribution of frailty category (pre-frail-14; frail- 36)

❖ **Correlation between Frailty and functional lower extremity strength (5 times sit to stand)**



Graph-3: Correlation between frailty and Functional lower extremity strength(5TSST)

Interpretation: There was a moderate positive and significant correlation found between frailty and functional lower extremity strength ($r = 0.63$; $p < 0.05$)

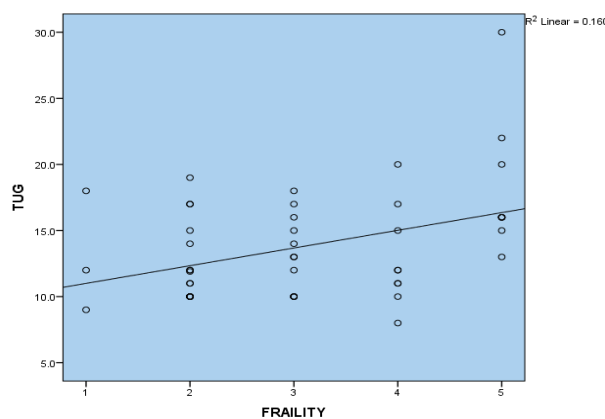
Table:1-Correlation between frailty and 5TSST

Test	r value	p value
Spearmen's rho correlation	0.63	$p < 0.05$

❖ **Correlation between Frailty and mobility (TUG)**

Table:2 -Correlation between frailty and TUG

Test	r value	p value
Spearmen's rho correlation	0.35	$p < 0.05$



Graph-4: Correlation between frailty and mobility (TUG)

Interpretation: There was a weak positive and significant correlation found between frailty and mobility ($r = 0.35$; $p < 0.05$)

DISCUSSION

This study was evaluated correlation of frailty, functional lower extremity strength and mobility in 50 community dwelling older adults between age of 65-85 years. Frailty is the common geriatric syndrome that include the risk of unfortunate decline in health and functions among older adults.

The present study shows that there was a moderate and positive correlation ($r = 0.63$; $p < 0.05$) found between frailty (Simple frail questionnaire) and functional lower extremity strength (5 times sit to stand). Study indicates that as frailty score increases that increase in the duration while performing the 5 times sit to stand that shows as frailty score increases that leads to reduced muscle strength among community dwelling older adults That might be frailty are multifactorial and involving the dysregulation of many physiological system and from that sarcopenia leads to decrease in muscle mass and dynapenia leads to decrease in muscle strength.

Similar studies that support our findings the Baltimore Longitudinal studies on ageing shows that reported that men had greater rates of strength decline than women, and that increasing age was associated with greater loss of strength⁽²⁰⁾. Also, the studied by Bret H. et. al states that loss of skeletal muscle mass, strength and QOL among older adults and they find out that both men and women lost strength, with men losing almost twice as much strength as women leg strength reduced (3.4% in white men, 4.1% in black men, 2.6% in white women, and 3.0% in black women) were about three times more than the rates of loss of leg lean mass. The loss of muscle mass is associated with the reduce in strength in older adults, whereas this strength reduction is much more rapid than the concomitant loss of muscle mass, suggesting a decline in muscle quality⁽²¹⁾.

The present study shows that there was a weak and positive correlation ($r = 0.35$; $p < 0.05$) found between frailty (Simple frail questionnaire) and mobility (TUG). Study indicates that as frailty score increases that increase in the duration while performing the timed up and go test that shows frailty increases that leads to decrease mobility among community dwelling older adults.

Similar studies support our findings the study done by Gill et.al reported that mobility limitation in older adults is highly prevalent affecting about 35% of persons aged 70 and the majority of persons over 85 years and it is majorly due to negative health events such as hospitalization or falls or even high mortality risk⁽²²⁾. In a systemic review done by Zhang et. al review and meta-analysis of 10 studies with 10,073 participants, Zhang et al concluded that sarcopenia is a risk factor for falls among community-dwelling older people⁽²³⁾. Study done by Anna Mulasso et.al found that three frailty domains, physical ($p < 0.001$) and psychological ($P = 0.041$) domains were significant predictors of falls⁽²⁴⁾.

So, the present study findings shows that frailty is directly correlated with the functional lower extremity strength and mobility that indicates frailty among community dwelling older adults affects the strength and mobility might be due to multiple physiological changes with aging and loss of muscle mass, reduced the muscle quality, dysregulation of muscle contraction as well as chronic illness which affects the functional lower extremity strength and mobility in community dwelling older adults.

CONCLUSION

Moderate and positive correlation was found between frailty and functional lower extremity strength; weak correlation was found between frailty and mobility in community dwelling older adults. So, the study concluded that frailty was correlated with functional lower extremity strength and

mobility in community dwelling older adults.

Limitation of the present study was that there was no group of elderly people without frailty (non-frail individuals). The gender distribution is not equal. Occupations of the subject were not taken into consideration.

Future implication of the study:

Frailty screening should be done for geriatric rehabilitation.

Further studies can be done by frailty with cognitive function, Functional independence, mental health, balance and functional independence.

ACKNOWLEDGEMENT

We are grateful to all the participants for co-operating with us and being an integral part of the study.

Conflict of Interest: None

Source of Funding: None

Ethical Approval: Approved

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- How to cite this article: Shah HS, Thakrar G. Correlation of frailty, functional lower extremity strength and mobility in community dwelling older adults. *Int J Health Sci Res*. 2022; 12(3): 205-211. DOI: <https://doi.org/10.52403/ijhsr.20220329>
