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Sarcopenia, frailty, pre- frailty, lean body mass (LBM), left hand grip strength (LHGS), right hand grip strength (RHGS)

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Prevalence of Physical Frailty and Sarcopenia among Geriatric Population of Rural Field Practice Area of Medical College, Jaipur

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Abstract
Frailty and sarcopenia are the most important health conditions manifesting as a decreased ability to carry out daily activities, disabling the old to age gracefully and adjust to living independently. Therefore, this study was conducted with the objectives of estimating the prevalence of sarcopenia, frailty and the factors associated with sarcopenia and obesity among the elderly population residing in the catchment areas of RHTC of a medical college in Jaipur. A cross sectional study was carried out among population aged 60 years and above. Study population comprised of 152 participants chosen through simple random sampling. Data was collected using pretested, semi-structured questionnaire and measurements in situ. For data analysis Jamovi software version 2.4.1 was used. The prevalence of sarcopenia and frailty was estimated to be 4.6% and 21.1% respectively. Sarcopenic obesity was higher in males as compared to females. Majority of old had no comorbid conditions subjecting them to frailty. Highly significant association was observed between socioeconomic status, type of family with left-hand grip strength among sarcopenics. Prevalence of sarcopenia in our study population was low but frailty and pre-frailty cases were many. Sarcopenia was linked to obesity. Males were more sarcopenic than females. However, there was no association of frailty status according to gender. These conditions need to be addressed as an important vagrancy of old age.

INTRODUCTION

With the success of existing public health and medical system, communicable disease burden has decreased. This has impacted the demographic characteristics like age. We will not only have children and women of reproductive age groups as vulnerable population, old debilitated people (triple burden) will consume maximum attention of health care facilities in the near future.

We need our health-cadre to be sensitized with the primary care needs attributed to the well-being of elderly. Frailty and sarcopenia are the most important health conditions manifesting as a decreased ability to carry out daily activities, disabling the old to age gracefully and adjust to living independently.

Both physical frailty and sarcopenia are disabling conditions. Physical frailty includes poor muscle strength, inability to walk without falling, difficulty in carrying out daily activities like lifting, holding, eating, cooking, toilet and bathing activity and more. Sarcopenia is the loss of skeletal muscle mass. It can become a factor in frailty and hence there is a need to establish the burden of these two conditions among the elderly population and then apply control measures so that the poor, isolated, disabled old people can live a life of dignity with care.

Objectives:

- To estimate the prevalence of sarcopenia among the elderly population of RHTC catchment area.
- To estimate the prevalence of frailty among the elderly population of RHTC catchment area.
- To determine the factors associated with sarcopenia and obesity among elderly population of RHTC catchment area.

MATERIALS AND METHODS

Ethics: An informed consent in Hindi was administered to each elderly participant duly signed by them or their thumb impression was taken. Approval of Institutional Ethical Committee was also granted. The registration number of our research is JNUIMSRC/IEC/2023/93.

Study Design: Selection and description of participants- For our cross-sectional study design, the elderly population aged above 60 years and residing in the Rural Health Training Centre (RHTC) catchment area of medical college was selected. The catchment area includes villages Saankh, Sindoli, Bala ki Nangal and Ralawata.Simple Random Sampling from a list of elderly prepared by the panchayat (Sindoli) for unorganized sector pensioners was used to select the desired sample size which was calculated from a total 273 pensioners enlisted in the panchayat data. 152 people aged 60 years and above were chosen as participants. The estimation of sample size was as follows:The formula for calculation of sample size from a finite population is,

n'= n/ 1+ {z2 X p(1-p)/d2 X N} where.,

n'= study sample

n= sample size for infinite population

p=known prevalence of sarcopenia among CKD patients in India, here 17.5%[1]

d= absolute precision of 4%

z= At 95% confidence limits, z statistic is 1.96

N= Study Population, here 273

Calculated sample size is 150.69, we took 152 samples.All randomly selected elderly agreed to participate after signing an informed consent.

Inclusion Criteria: All elderly males and females who consented to participate in this study.

Exclusion Criteria: Those elderly who did not give consent to participate.

Time Period: 1st February 2024-31st March 2024

Technical Information: Our Public Health Nurse and health workers (MSW, HE) were first trained to collect information from the elderly person who was randomly selected and identified with the help of the MSW on the field using the list provided by the panchayat (Sindoli). A pretested, semi-structured questionnaire was translated in local language-Hindi for collecting information about socio-demographic profile, co-morbidities, frailty profile, alcohol and smoking practice and for noting all measurements. They were trained to use a digital body composition weighing scale to note lean body mass and weight in kgs using their mobile phone Bluetooth. Right-and left-hand grip strength was measured using a digital dynamometer in kgs. The data collection team was taught to measure height using a measuring tape which was also carried to the field. Defining data variables-The 2014 Asia Working group, for Sarcopenia[2] (AWGS) recognized the condition as a geriatric syndrome characterized by age related decline in skeletal muscle plus low muscle strength and physical performance. These guidelines were restated in 2019 with the same definition. In this research, a <70% by weight[3] of Lean Body Mass (%LBM) as a proxy for skeletal muscle mass[4] and poor hand grip strength were considered as sarcopenia. But it should be noted that the lean body mass was the necessary indicator and hand grip strength was additional. If lean body mass was not low, hand grip strength alone was not considered as a sarcopenic indicator. This was decided because in our study physical performance

was not low, inhibiting us to consider hand grip strength alone as a measure of sarcopenia. Recent consensus[5] about the correct measurement of sarcopenia in the elderly in a field-based study without a gold standard testing has not been established. DEXA as gold standard has also been poorly discussed for its accuracy. Hand-grip strength has been considered more for frailty diagnosis than sarcopenia.

According to AWGS, obesity[6] was defined as BMI equal to and above 25 Kg/m^2. We measured BMI to consequently, define categories related to sarcopenia as sarcopenic obese, sarcopenic non obese, non-sarcopenic obese and non-sarcopenic non-obese among the randomly selected elderly.

An adapted version of the frailty phenotype described by Fried[7] and colleagues was used to determine the frailty status. The criteria according to the version is:

- History of significant weight loss (visible, experienced or measured >5%) in the past 12 months.
- Exhaustion-Extreme tiredness after physical activity. We considered score less than 3 for walking as an activity of daily living.
- Low physical activity average score was regarded as less than 3 (marked as 1-5 for each of the 9 activities). We have put 0 score for activities not performed due to family culture like cooking by an elderly male. We excluded the 0 marked activity from the denominator to calculate average scores of activities of daily living.
- Score 5-Activities performed fully independently without difficulty
- Score 4-Fully independently but with some difficulty
- Score 3-Fully independently but with great difficulty
- Score 2-Cannot perform but with help
- Score 1-Complete help
- Activities included were Cycling, walking, farm work, cleaning utensils, independently going to toilet, Bathing, Eating, Cooking, cleaning/mopping
- Slowness was measured by 4 meters walking test twice forward and backwards. Speed[8] less than 0.8 m/s was considered as criteria of poor performance.
- Weakness was measured by hand grip strength. For the age group 60-88 years (Camry's dynamometer chart), Right Hand Grip Strength (RHGS) minimum cut-off was 33.3 Kg for males and 19.9 Kg for females. Left Hand Grip Strength (LHGS) minimum cut-off for the same age group was 34.66 Kg for Males and 21.71 Kg for females. If 1 or 2 criteria were met, we considered it as pre-frailty[9], 3 or more criteria if positive were considered frailty.

Modified B.G Prasad Scale 2024[10] was utilized to classify the socio-economic status of the elderly. Factors such as adequate day time sleep were considered for not <1 hour and not >2 hours. Adequate sleep during night time was considered between 7-9 hours.

The Study was Self-funded. Logistics Bought were as Follows:

- Eagle 200 Kg Fully Automatic Smart Body Composition Monitor Digital Weighing Scale, EEP-1002A-New
- Camry Digital Dynamometer (200 Lbs/90 Kgs)

Statistics: Data was entered in Jamovisoftware. Descriptive statistics were used to calculate frequency or sample prevalence of frailty, sarcopenia and its categories. Chi-square test was used to analyse Goodness of Fit for independent frequencies of socio-demographic profile associated with frailty. Probable influent factors for these conditions were determined using ESCI model of difference between proportions. Risk difference or attributable risk was deciphered along with Confidence Intervals.

RESULTS AND DISCUSSIONS

Prevalence: 29.6% (45) elderly females and 70.4% (107) elderly males participated in this study.

The sample prevalence of sarcopenia was found to be 4.6% in this research. Out of the 7 sarcopenia cases, sarcopenic non-obese were found to be 0.7% (1) and sarcopenic obese were 3.9% (6). The prevalence of non-sarcopenic obese elderly was 34.9% (53) and non-sarcopenic non-obese were 60.5% (92). The study also determined the prevalence of sarcopenic frailty to be 0.7% corresponding to 1 case. There were 5 (3.3%) cases of pre-frail sarcopenic obese and 1 case (0.7%) of pre-frail sarcopenic non-obese.

Overall sample prevalence of frailty was 21.1% (32/152), pre-frailty 75% (114/152) and no frailty was 3.9% (6/152).

Only one female was sarcopenic obese whereas one male was sarcopenic non obese. There were 5 (3.3%) sarcopenic obese males.

25 (16.4%) cases of frail elderly had no comorbidity, 2 (1.3%) had HTN, 1 (0.7%) had COPD, 2 (1.3%) had both T2DM and HTN, 1 (0.7%) had impaired glucose tolerance discovered by RBS testing during data collection. 80 (52.6%) cases of pre-frail elderly had no comorbidity. Out of the pre-frailty cases, 3 (2%) had joint pain, 7 (4.6%) had HTN, 1 (0.7%) had chronic

Table 1. Distribution showing sarcopenia status according to socio-demographic profile

Sociodemographic-Profile	Sarcopenic LBM* (%)	Chi-square (p-value)	RHGS# below cut-off (%)	Chi-square (p-value)	LHGS$ below cut-off (%)	Chi-square (p-value)
Age in years						
60-70	06 (3.9)	0.83 (0.66)	100 (65.8)	0.22 (0.89)	104 (68.4)	0.338 (0.84)
70-80	01 (0.7)		27 (17.8)		28 (18.4)	
80 and above	00 (0)		06 (3.9)		06 (3.9)	
Gender						
Female	01 (3.9)	0.826 (0.36)	35 (23.0)	5.52 (0.019)	39 (25.7)	1.3 (0.25)
Male	06 (0.7)		98 (64.5)		99 (65.1)	
Socio-economic status						
Upper class	00 (0)	2.23 (0.69)	03 (2.0)	7.88 (0.09)	03 (2.0)	13.5 (0.009)
Upper middle class	00 (0)		11 (7.2)		11 (7.2)	
Middle class	02 (1.3)		20 ((13.2)		20 (13.2)	
Lower middle class	04 (2.6)		56 (36.8)		60 (39.5)	
Lower class	01 (0.7)		43 (28.3)		44 (28.9)	
Type of family						
Nuclear	03 (2.0)	5.30 (0.07)	30 (19.7)	5.66 (0.06)	31 (20.4)	9.97 (0.007)
Joint	02 (1.3)		91 (59.9)		95 (62.5)	
Three generation	02 (1.3)		12 (7.9)		12 (7.9)	

*Lean Body Mass, #Right Hand Grip Strength, $Left Hand Grip Strength

Table 2. Distribution depicting Adaptable Fried's Phenotype Frailty Criteria (Physical frailty) according to gender and age

Criteria	Females (%)	Males (%)	Chi-square test (p-value)	Age 60-70 years (%)	Age 70-80 years (%)	Age above 80 years (%)	Chi-square test (p-value)
Weight loss in past 12 months	02 (1.3)	02 (1.3)	0.82 (0.37)	03 (0.2)	01 (1.3)	00 (0)	0.232 (0.89)
Exhaustion (subjective interpretation from walking)	08 (5.3)	25 (16.5)	0.582 (0.45)	91 (59.9)	24 (15.8)	04 (2.6)	2.01 (0.37)
Average ADL* score below 3	01 (0.7)	01 (0.7)	0.405 (0.52)	02 (1.3)	00 (0)	00 (0)	NA
Walking speed less than 0.8 m/sec	94 (61.8)	35 (23.0)	2.5 (0.11)	96 (63.2)	27 (17.8)	06 (3.9)	0.16 (0.92)
RHGS# below cut-off	35 (23.0)	98 (64.5)	5.52 (0.02)	100 (65.8)	27 (17.8)	06 (3.9)	0.03 (0.99)
LHGS$below cut-off	39 (25.7)	99 (65.1)	1.3 (0.25)	104 (68.4)	28 (18.4)	06 (3.9)	0.250 (0.88)
Prevalence of physical frailty	08 (5.3)	24 (15.8)	Total 32 (21.1)	22 (14.5)	07 (4.6)	03 (2.0)	0.211 (<0.001)
Prevalence of physical pre-frailty	33 (21.7)	81 (53.3)	Total 114 (75)	89 (58.6)	22 (14.5)	03 (2.0)	0.750 (<0.001)

#Right Hand Grip Strength, $Left Hand Grip Strength,*Activities of daily living

Table 3. Distribution showing sarcopenia status among elderly and probable factors

Factors associated with sarcopenia	Sarcopenic Frequency (%)	Non sarcopenic Frequency (%)	Risk Difference (C.I*)
Frailty status			
Not Frail or Pre-frail	6 (3.9)	114 (75)	0.018 (-0.11, 0.079)
Frail	1 (0.7)	31 (20.4)	
Co-morbid conditions			
None	3 (2.0)	105 (69.1)	0.063 (-0.012, 0.19)
Not none	4 (2.6)	40 (26.3)	
Diet pattern			
Mixed/ Eggetarians	2 (1.3)	11 (7.2)	0.118 (0.002, 0.39)
Vegetarian	5 (3.3)	134 (88.2)	
Known Alcoholics			
Drink	1 (0.7)	25 (16.4)	-0.009 (-0.07, 0.143)
Known Smokers			
Smoke	4 (2.6)	81 (53.3)	-0.002 (-0.08, 0.08)
Gender			
Male	6 (3.9)	101 (66.5)	-0.034 (-0.09, 0.06)
Female	1 (0.7)	44 (28.9)	
#BMI >/= 25 kg/m^2			
Obese	4 (2.6)	27 (17.8)	-0.104 (-0.27, -0.01)
Age in years (Chi-square test)			
60-70	6 (3.9)	107 (70.4)	0.648 (0.89)
70-80	1 (0.7)	30 (19.7)	
80 and above	0 (0)	7 (4.6)	
Socio-economic status (Chi-square test)			
Upper class	0 (0)	4 (2.6)	2.23 (0.69)
Upper middle class	0 (0)	12 (7.9)	
Middle class	2 (1.3)	25 (16.4)	
Lower middle class	4 (2.6)	60 (39.5)	
Lower class	1 (0.7)	44 (28.9)	

*Confidence Interval, #Body Mass Index

Table 4. Distribution depicting frailty status among elderly and associated factors

Factors associated with Frailty	Frailty Frequency (%)	Pre-frail/Not frail Frequency (%)	Risk Difference (C.I*)
$BMI above 25 kg/m^2	8 (5.3)	23 (15.1)	0.06 (-0.08, 0.25)
Co-morbid conditions			
None	25 (16.4)	83 (54.6)	0.07 (-0.08, 0.19)
Not none	7 (4.6)	37 (24.3)	
Adequate night sleep	23 (15.1)	79 (51.9)	0.05 (-0.001, 0.168)
Adequate day sleep	10 (6.6)	61 (40.1)	-0.131 (-0.25, -8.00e -5)
Diet pattern			
Vegetarian	29 (19.2)	110 (72.4)	-0.022 (-0.022, 0.15)
Eggetarians/Mixed	03 (2.0)	10 (6.6)	
Known Alcoholics	06 (3.9)	20 (13.2)	-0.02 (-0.22, 0.12)
Known Smokers	19 (12.5)	66 (43.4)	0.03 (-0.104, 0.155)
Gender			
Male	24 (15.8)	83 (54.6)	0.05 (-0.105, 0.169)
Female	8 (5.3)	37 (24.3)	
Age group	Frail	Pre-frail	Not frail	Chi-square (p-value)
60-70	22 (14.5)	88 (57.9)	3 (2.0)	6.11 (0.411)
70-80	7 (4.6)	22 (14.5)	2 (1.3)	
80 and above	3 (2.0)	3 (2.0)	1 (0.7)	
Socio-economic status				
Upper class	0 (0)	3 (2.0)	1 (0.7)	10.9 (0.21)
Upper middle class	4 (2.6)	7 (4.6)	1 (0.7)	
Middle class	6 (3.9)	19 (12.5)	2 (1.3)	
Lower middle class	11 (7.2)	51 (33.6)	2 (1.3)	
Lower class	11 (7.2)	34 (22.4)	0 (0)	

***Confidence Interval, $Body Mass Index**

infection, 7 (4.6%) had T2DM but adapted to drugs, 6 (3.9%) had COPD, 3 (2%) had both T2DM and HTN. CHD and HTN was found in 1 (0.7%) pre-frail cases, 1 (0.7%) had heart failure, (0.7%) had CHD, (0.7%) had arthritis and 3 (2%) had T2DM and joint pains. Out of the elderly with no frailty profile, 1 (0.7%) were suffering from COPD, 1 (0.7%) had seasonal allergy and 1 case (0.7%) had HTN.

Low socio-economic status viz., lower and lower middle-income families had higher frailty prevalence 11(7.2% each) among them. Similarly, pre-frail status was 34 (22.4%) and 51(33.6%) respectively, among the lower and lower-middle income strata according to modified B.G Prasad Scale[9] 2024.

Factors Affecting Sarcopenia and Frailty Profile: Table I shows a highly significant relationship with left hand grip strength and Socio-economic status, type of family among sarcopenics. Gender and age brackets as factors were not significantly associated. There existed almost no asymmetry between left-and right-hand weakness.

According to Table II, the association between frailty and pre-frailty status and gender is not statistically significant. The table depicts a highly significant relationship between frailty and pre-frailty status with elderly of different age groups. Age group of 60-70 years old has the maximum number of frail22, (14.5%) and pre-frail 89, (58.6%) elderly. None of the frailty criteria depicted age and gender wise significant relationship with each of the adapted version of Fried's physical frailty phenotype criteria.

Further, Table III depicts obesity as significantly influential factor for sarcopenia. Risk of sarcopenia was greater with a vegetarian diet and not mixed or eggetarian diet. In our study only 1 elderly gave the information about eggetarian diet. Table IV also does not show a significant association of frailty status with all factors chosen in this study. Neither BMI nor co-morbid conditions, age group and gender had high risk association with frailty. The risk difference for daytime sleep was negatively or inversely linked with adequately sleeping elderly during day time. Adequate night sleep was not associated with frailty. Factors like smoking and alcohol drinking were also not significantly associated.

In a study conducted by Wu CH *et al.,* in older Taiwanese rural community, it was observed that the prevalence of sarcopenia was 7.1% in comparison to our study where the prevalence was found to be 4.6% only[11].

Present study showed that majority of participants with sarcopenic LBM belonged to the age group of 60-70 years. This can be attributed to the fact that majority of study participants belonged to this age group and it was higher in males as compared to females. A study conducted in Taiwan by Liu LK[12] using the data of ILAS (I-Lan Longitudinal Aging Study) showed that lean body mass declined with aging and LBM was comparatively higher in males than females with statistically significant results. This was in contrast to our study.

In our study, the RHGS and LHGS declined with increasing age but the results were not found to be statistically significant. The RHGS and LHGS were lower in females as compared to males but the difference was not statistically significant. Liu LK[12] espoused that hand grip strength was higher in males as compared to females and the results were statistically significant. Thus, increasing age was regarded as a risk factor for sarcopenia.

We observed that the overall prevalence of frailty and pre frailty was 21.1% and 75% respectively and it was higher in males as compared to females with higher prevalence of frailty in the age group of 60-70 years and the difference was statistically significant. In a cross-sectional study conducted by Liu W[13] in 20 nursing homes in Changsha, China, the overall prevalence of physical frailty was slightly higher (55.6%) than our study whereas the prevalence of pre-frailty was nearly half (38.5%) of that observed in our study with higher prevalence among the females and in older age groups.

In our study, ADL score below 3 was observed in equal number (0.7%) of participants belonging to both the sexes with no statistically significant results whereas a study conducted by Liu[13] reported 8% of physically frail subjects who had ADL disability. Out of them, 32.2% with had co-morbid conditions. Similarly, our study also showed 40% participants with co-morbidity, among whom, 2.6% of elderly had sarcopenia. These results were not in concordance with the study conducted by Liu LK[13] in which 12.7% of frail elderly subjects showed presence of comorbidity, much higher than our findings. The reason for low prevalence of co-morbid conditions could be a non-significant distribution among all elderly and that we did not perform a complete enumeration of all pensioners. We attribute this discrepancy to sampling error, or inherent healthy practices of elderly in rural Rajasthan.

It is clear that morbidity and mortality increases if the BMI is >or equal to 30 kg/m^2[14]. In our study we observed that obesity was significantly influential factor for sarcopenia. We also observed that the risk of sarcopenia was higher in subjects consuming vegetarian diet (also the pre-dominant diet of the inhabitants in the area), however., frailty showed no significant association with any of the study variables such as BMI, presence of comorbid conditions, age groups, gender, adequate night sleep, diet pattern, smoking and alcohol consumption.

A study published in American Journal of Preventive Medicine by Castiollo EM[15] among a cohort of elderly patients attending the Rancho Bernardo clinic to study the risk factors for sarcopenia showed that increasing age, current smoking and lack of physical activity were risk factors for sarcopenia. Results of meta-analysis of 19 studies, to find out the association between alcohol consumption and risk of sarcopenia showed that there was no significant association between alcohol consumption and risk of sarcopenia, similar to our study[16]. Van Assen *et. al* conducted a cross-sectional study among community dwelling older people and reported that higher alcohol consumption and less smoking were associated with less total, physical, psychological and social frailty[17]. These findings were similar to our study but we measured only physical frailty.

Also, diet pattern and frailty in a longitudinal study, based in Rotterdam found that following vegetarian or non-vegetarian diet had no association with frailty[18]. Our findings are similar.

We can conclude that prevalence of sarcopenia in our study population is low but frailty and pre-frailty cases are many. Sarcopenia was linked to obesity. Males were more sarcopenic than females. However, there was no association of frailty status according to gender. Attributing a lot of pre-frail elderly to the elicited factors, gives us a picture of a ubiquitously progressive age-related condition that requires immediate attention because the population of elderly in our country will soon match the developed world, increasing the burden of health systems for which the grass-root level needs preparation. Sarcopenia and frailty (pre-frailty) are conditions that need to be addressed as an important vagrancy of old age.

Conflict of Interest: There is no conflict of interest in design, conduct and analysis of this research study

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REFERENCES

1. Dubey, A.K., J. Sahoo, B. Vairappan, S. Parameswaran and P. PS, 2021. Prevalence and determinants of sarcopenia in Indian patients with chronic kidney disease stage 3 & 4. Ost Sarc., 7: 153-158.
2. Chen, L.K., J. Woo, P. Assantachai, T.W. Auyeung and M.Y. Chou et al., 2020. Asian working group for sarcopenia: 2019 consensus update on sarcopenia diagnosis and treatment. J. Am. Med. Dire Assoc., 21: 300-3072.
3. Cheung, C.L., G.K.Y. Lee, P.C.M. Au, G.H.Y. Li and M. Chan et al., 2021. Systematic review and meta-analysis of lean mass and mortality: Rationale and study description. Osteo Sarc., 7: 3-12.
4. Misra, A., 2015. Ethnic-specific criteria for classification of body mass index: A perspective for asian Indians and American diabetes association position statement. Diab Tech amp Ther., 17: 667-671.
5. Varan, H.D., O. Deniz, S. CöteliS, R.T. DogrulR, M.C. Kizilarslanoglu and B. Göker, 2022. Validity and reliability of fried frailty phenotype in Turkish population. Turk. J. Med. Sci., 52: 323-328.
6. Setiati, S., P.W. Laksmi, I.G.P.S. Aryana, S. Sunarti and N. Widajanti et al., 2019. Frailty state among Indonesian elderly: Prevalence, associated factors, and frailty state transition. BMC Geri., Vol. 19, No. 1 .10.1186/s12877-019-1198-8.
7. Boyer, S., J. Trimouillas, N. Cardinaud, C. Gayot and C. Laubarie-Mouret et al., 2022. Frailty and functional dependence in older population: Lessons from the freedom limousin-nouvelle aquitaine cohort study. BMC Ger., Vol. 22, No. 128 .10.1186/s12877-022-02834-w.
8. Javalkar, S.R., S.H. , S.B. Davalagi and V.G. S, 2024. Socio economic status assessment in India: History and updates for 2024. Int. J. Of Com Med. And Pub Hea., 11: 1369-1377.
9. Wu, C., K. Chen, M. Hou, Y. Chang and C. Chang et al., 2014. Prevalence and associated factors of sarcopenia and severe sarcopenia in older TAiwanese living in rural community: The TIanliao OLd PEople study 04. Geri amp Gero. Int., 14: 69-75.
10. Liu, L., W. Lee, L. Chen, A. Hwang, M. Lin, L. Peng and L. Chen, 2014. Sarcopenia, and its association with cardiometabolic and functional characteristics in TAiwan: Results from I-LAn LOngitudinal AGing STudy. Geria amp Ger. Int., 14: 36-45.
11. Liu, W., M. Puts, F. Jiang, C. Zhou, S. Tang and S. Chen, 2020. Physical frailty and its associated factors among elderly nursing home residents in China. BMC Geriatrics, Vol. 20, No. 1 .10.1186/s12877-020-01695-5.
12. Mathus, V.E.M., 2012. 1. Obesity and the elderly. J. Clin Gas., 46: 533-544.
13. Castillo, E.M., D. Goodman-Gruen, D. Kritz-Silverstein, D.J. Morton, D.L. Wingard and E. Barrett-Connor, 2003. Sarcopenia in elderly men and women. Am. J. Pre Med., 25: 226-231.
14. Hong, S.H. and Y.J. Bae, 2022. Association between alcohol consumption and the risk of sarcopenia: A systematic review and meta-analysis. Nutrients, 14: 226-231.

15. van Assen, M.A.L.M., J.H.M. Helmink and R.J.J. Gobbens, 2022. Associations between lifestyle factors and multidimensional frailty: A cross-sectional study among community-dwelling older people. BMC Geriatrics, Vol. 22 .10.1186/s12877-021-02704-x.
16. De Haas, S.C.M., E.A.L. de Jonge, T. Voortman, J.S.D. Graaff and O.H. Franco et al., 2018. Dietary patterns and changes in frailty status: The rotterdam study. Eur. J. Nutr., 57: 2365-2375.