# "ASSESSMENT OF PHYSICAL DISABILITY AND NUTRITIONAL STATUS AMONG ELDERLY IN A RURAL POPULATION IN SOUTH INDIA"

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**CHENNAI, FOR THE DEGREE OF**

**MD BRANCH-XV (COMMUNITY MEDICINE)**

**EXAMINATION TO BE HELD IN APRIL, 2013.**

# CERTIFICATE

**This is to certify that "ASSESSMENT OF PHYSICAL DISABILITY AND NUTRITIONAL STATUS AMONG ELDERLY IN A RURAL POPULATION IN SOUTH INDIA" is a bona fide work of**

**Dr. Sherin Susan Paul N. in partial fulfillment of the**

**requirements for the**

**M. D Community Medicine examination (Branch-XV) of the Tamilnadu Dr. M.G.R. Medical University, Chennai, to be held in April, 2013**

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4. **DEGREE AND SUBJECT** : MD Community Medicine
5. **NAME OF THE GUIDE** : Dr Vinod Joseph Abraham
6. **OBJECTIVES**:
    - To determine the prevalence of physical disability among elderly in a rural population.
    - To identify the common type of disability among elderly in the above mentioned population.
    - To determine the nutritional status of elderly in the same population.
    - To identify the factors associated with physical disability and poor nutrition
7. **METHODS:**

    A cross sectional study was conducted among elderly of age 60 years and above was conducted in Kaniyambadi block of Vellore district which was the service of Christian medical college Vellore, community medicine department. A sample size of 340 was calculated assuming a prevalence of mild disability as 27 percent, based on a study conducted in south India, with an absolute precision of 7, design effect of 2 and anticipated non responsiveness of 5 percent. Using cluster sampling method 17 clusters of size 20 were selected based on probability proportional to size (PPS). Within each cluster elderly were chosen using simple random sampling. A semi structured self administered questionnaire was used which included basic demographic

details, Mini nutritional assessment (MNA) scale and Barthel index. Blood samples were collected for testing hemoglobin and serum albumin levels. Data was entered using the software epi info and was analyzed using spss version 17.

8. **RESULTS:**

The prevalence of physical disability was 20.6 percent (95% CI 16.2- 25.0). According to the MNA scale nobody is malnourished. Disability is more in the age group 75 years and above (OR= 2.266 (1.276- 4.024), (p= 0.005) and among women (OR 2.814 (1.311- 6.041) (p= 0.004). There is no malnutrition among the elderly according the MNA scale. The prevalence of those who are at risk of malnutrition is 10.9 percent (95% CI 7.52- 14.28). Using BMI classification (revised by Ministry of health, India, WHO classification for Asia) the percentage of those who are malnourished is 62.1 percent of which 18.3 percent are under nourished, 16.8 percent are overweight and 27.1 percent are obese. The undernutrition according to the BMI has statistically significant association between gender (OR= 1.805 (1.021- 3.189) (p= 0.042) and ses (OR= 2.378 (1.251- 4.521) (p= 0.008). The total prevalence of anemia among the study population was very high, 38.2 percent (95% CI 33.0- 43.4) thus coming under the WHO classification of moderate to severe public health significance. Anemia among women is 38.7 percent and among men is 37.7 percent. Anemia is more in the age group 75 years and above as compared to 60 to 69 year age group (OR= 2.399 (1.177- 4.889) (p=0.016).

# 1. Introduction

The world population is graying and the longevity which has been looked upon as the result of technological advancement is now being looked as a bane by many societies. As a result of the decrease in mortality and fertility rates at varying levels across the world, there was an increase in life expectancy, which resulted in more people living to enter the old age.(1) According to World Health Organization (WHO) the population of elderly across the world was steadily rising from 200 million in 1950 to 350 million in 1975 and is expected to be 1100 million by 2025, which will be 15 percent of the total world population.(2,3) This great achievement by the improvement in global health care brings with it a greater responsibility, to the government by putting pressure on finances and social support system and to the individuals as there will be an increase in the number of elderly dependent on the working age group (old age dependency ratio), which is expected to double between 2010 and 2050 in Asian countries.(4) In India, the government has adopted a 'National policy on older persons' in January 1999 which defined senior citizen or elderly as a person aged 60 years and above.(5) The current life expectancy at birth is 62 years and the old age dependency ratio is 13.8 and 12.5 for women and men respectively.(5) Elderly who accounted for 6.7 percent of our population in 1991 is expected to rise to 10 percent by 2021.(5) The elderly women were more dependent on children than elderly men because the life expectancy of women were higher and traditionally they were married to older men thus were widowed at a younger age making them more vulnerable to physical and verbal abuse. With the surge of globalization and industrialization, there was migration of youth to the urban areas which led to the disintegration of

age old joint family system, thereby forcing the elderly to continue to work for their daily living. They are affected by situations of social exclusion, lack of opportunities to participate in development activities, extremely limited access to health care, non-existence or minimal development of pension systems, scarcity in the social service networks etc. Old age is not a disease in itself, but our elderly faces a spectrum of medical problems, both communicable and non communicable, mainly because of the age related decline in immunity and this poses an additional burden on the health care sector. Knowledge about the prevalence of disability among elderly is important as it decreases the quality of life, increases the pressure on health care, demands long term care and cost and policy development. A study done in rural South India showed that the prevalence of mild disability among elderly was 27 percent and that there was an increase in disability and restriction of participation in activities with an advancement of age.(6) There are different methods to measure disability, among which the Barthel index which has scores between 0 and 100 is an important tool for measuring functional independence and mobility. Studies have shown moderate to high inter rater reliability and alpha Cronbach value of 0.9.(7) Nutrition is another neglected aspect among elderly. Malnutrition is associated with impaired muscle function and decreased bone mass leading to increased falls, impaired immune function, anemia, prolonged hospitalization, delayed post-operative recovery, poor quality of life and increased morbidity and thus increased cost of care. One study which looked into the prevalence of malnutrition, reported that 12 percent of the independently living elderly are malnourished.(8) Another unpublished study done in rural South India revealed that the prevalence of malnutrition among elderly ranges from 8 to 30 percent.

Different tools like Mini Nutritional Assessment (MNA), biochemical markers like hemoglobin and serum albumin and anthropometric measurements like Body Mass Index (BMI) are used to measure malnutrition. MNA scale is developed specifically in use among elderly patients in hospital, nursing homes and the community. Significant correlations were found between full MNA scores and age ($r = -0.14$), body mass index ($r = 0.59$), serum albumin ($r = 0.60$) and mid arm circumference ($r = 0.50$).(9) Malnutrition among elderly should be considered as a serious public health problem. It can cause a heavy economic burden to the society. Many studies regarding nutritional status and functional disability among older population have been conducted in developed countries. However, very little data regarding the above aspects are available from developing countries. In this study we will be looking at the prevalence of physical disability, types of disabilities and nutritional status among the elderly in a rural community. We will also be looking at the various factors which cause malnutrition and disability and the association between physical disability and nutritional status.

# 2. Objectives

1. To determine the prevalence of physical disability among elderly in a rural population.

2. To identify the common types of disabilities among elderly in the above mentioned population.

3. To determine the nutritional status of elderly in the same population.

4. To identify the factors associated with physical disability and poor nutrition.

# 3. Review of Literature

## 3.1 The world scenario:

The world population is graying and the longevity which has been hailed as the success of social and technological advancements is now being looked upon as a bane by many societies. Demographic transition is a process by which the mortality and subsequently, the fertility have both decreased. As a result of this, there is a relative shift of population from younger to older age groups.(1)

Over the last half a century, the fertility rate across the world has declined by almost half, from 5 to 2.7 children per woman.(1) It is expected to reach the replacement level of 2.1 children per woman over the next decade.(1) In most of the industrialized countries the fertility rate is already well below the replacement level. In developing countries, a wide range of disparity in fertility levels persist, ranging from 5.5 in the African region to 2.5 over the South central Asia, South America and Caribbean region.(1) This regional disparity is expected to decline as the fertility rate is decreasing in developing countries and a marginal increase is anticipated in developed countries. As the fertility rate decreases, the increase in life expectancy is determined by a decrease in mortality rate. Life expectancy at birth has increased globally from 46.5 years to 66 years over the past 5 decades.(1) The gain in life expectancy is about 23 years in less developed countries and 9 years in developed countries. The average increase in life expectancy in least developed countries is 16 years over the past decade. These figures show a decrease in mortality rate that is marked by a stark regional disparity. By 2045-2050 the life expectancy at birth is expected to be 82 years in developed countries and 75 years in developing and least developed

countries.(1) This means more people will survive to an older age. Under the existing mortality conditions, 3 of every 4 newborns will survive to an age of 60 years and 1 of every 4 newborns will survive to an age of 80 years. Thus, the combined effect of reduction in fertility and mortality rates worldwide has resulted in more people living to enter advanced stages of life. According to a United Nations estimate, 200 million people belonged to the age group 60 and above in 1950. By 1975 their number had increased to 350 million. The WHO projection for the year 2025 is 1100 million, that is a 224 percent increase since 1975.(2) The proportion of elderly in world population is expected to increase from 10% in 2000 to 15% in 2025 and 21.1% in 2050.(3) This rise is unprecedented in world history, and most probably irreversible. Not only the world is graying but also the older population is living longer. The population of older people worldwide is growing at a rate double of the total annual population growth. (4) The number of retired people is set to become more than that of number of young employable people in the labor market. According to Organization for Economic Corporation and Development (OECD) the ratio of older people per working population will be double by 2050. While the rise in older population represents a major global success story in terms of better health care and increased accessibility, it brings greater responsibilities to the country, family and individual, putting a greater pressure on government social support and public finances. The old age dependency ratio is expected to double in Asian countries between 2010 and 2050, while in developed countries like United States it is expected to rise from 22 in 2010 to 35 in 2030.(4) Likewise, the inverse of dependency ratio, the support ratio is expected to drop over half by 2050, worldwide. It is projected to decline to 3.9 by 2050.(4) To maintain the current standard of living and improve

the prospects of elderly in developing countries, the society should assign an active and productive role for elderly. To improve the condition of elderly, we need to look at them less as a problem and more as a resource.(4)

## 3.2 The Indian Scenario:

The Government of India adopted the 'National policy on older persons' in January 1999 which defined senior citizen or elderly as a person aged 60 years and above.(5) In India since majority of its population is aged less than 30, the focus was always on children and the youth, and fulfillment of their basic necessities to attain full physical and social development. In addition to this, the breakdown of the age old joint family system has been detrimental to the social and economic security of elderly. But only few studies have been attempted to study and document their plight. But recently, with rapid changes in the economic and social scenario, the problems of elderly started getting more attention from policy makers, administrators, voluntary organizations and civil society. Like the international trend, the ageing of Indian population is also due to the fall in fertility and mortality rates. It is observed that the percentage of population above 60 is rapidly growing; even the above 80 sub-segment is growing fast. Simultaneously the ratio of people in the working age group to the elderly is shrinking. North India will be younger compared to South by 2026.(5)

The elderly population which accounted for 6.7 percent of the total population of India in 1991 is projected to be 10 percent by 2021. The size of elderly population was 77 million according to the 2001 census. It is expected to become 140 million by 2021.(5) There is relatively a higher ratio of female to male among elderly. During the period of 1975-1976, the average length of life was only 48 years and

59 years in rural and urban areas respectively. During the period 2002-2006 the life expectancy at birth was found to be 64.2 for females and 62.6 for males.(5) Also, life expectancy in urban areas and rural areas were 68.8 years and 62.1 years respectively. Life expectancy at 60 was found to be 18 and at 70 was 12 years.(5) There is a sharp rise in age specific death rate with advancing age, from 20 per thousand for the age group 60 to 64 years to 80 per thousand among those aged 75 to 79 years and 200 per thousand for ages more than 85 years. The rates for males are invariably higher than females. The old age dependency ratio was 10.9 percent in 1961. According to 2001 census, it is 13.8 for women and 12.5 for men. Sixty five percent of the elderly depend on others for their day to day maintenance. In rural areas, 66 percent elderly men and 23 percent elderly women still participate in economic activities.(5) In the age group beyond 60, percentage of women with a living spouse is less than the percentage of men with living spouses. More than 75 percent of elderly males and 45 percent of elderly females live with their spouses. About 20 percent of the aged men and more than half of elderly women live with their children.(5)

## 3.3 Implications of ageing:

Elderly constitute an 'invisible' group for the government and institutions especially in developing countries. They are affected by situations of social exclusion, lack of opportunities to participate in development activities, extremely limited access to health care, non-existence or minimal development of pension systems, scarcity in the social service networks etc.(10) India has an elderly population of 80 million.(11) Advances in medicine, education and family planning have contributed to this demographic change. The main problem

associated with changing demographics is people are having fewer numbers of children, retiring earlier and living longer. The burden on the working class is therefore increasing. The smaller number of tax payers will not be able to handle a tax burden high enough to support the ageing population.(12) The additional pressure on the health care sector, social security schemes and government will be high. That does not mean that our elderly should lose out on their rights. Over the last two decades India reaped huge benefits from globalization, industrialization and rapid economic growth. As a result, there was migration of people from rural areas to the urban areas. This led to a major change in the social structure in India. The age old joint family system disintegrated and with it collapsed the safety net for the elderly. The experts opine that growth in elderly population make their condition pitiable because this causes heavy dependence on the limited resources of the family. With rising cost of parent care per child and the precarious financial situation in the country, most children will not have enough resources to take care of their parents. Where resources are not scarce, psychological barriers against caring for elderly have emerged. Youth migrate to different places in search of employment and social security. This creates a situation wherein there will be tremendous pressure on elderly to look after themselves.

The elderly require special care. Ten to fifteen percent of hospital beds are occupied by elderly.(13) According to the principles of health economics, elderly requiring long term treatment should be managed at home for better resource utilization. However with increasing percentage of working women, the provision for care of elderly, at home, has come down over time. Housing shortages and reduction in space have eroded into the rights of elderly. Recent studies show

that about 35 percent of elderly in the urban areas and 32 percent in rural areas are living alone.(13) Since there is nobody to look after them, lack of security and financial constraints has to be taken care of by themselves. As a result, more and more elderly are looking for job opportunities, most of them settling into jobs at a lesser salary with insecure and unhealthy working conditions.

There is a difference between urban and rural elderly. The rural elderly constitute a much older population when compared to urban elderly, but the accessibility of health care is abysmally low. Even the female elderly population is more in rural than in urban areas. A large section of working rural elderly population is in the informal sector - 70 percent compared to 48 percent in urban areas.(13)

Elderly women suffer more since they live longer than their spouses. Widows constitute a large proportion of the elderly, particularly in India because of the cultural pattern in which women generally get married to men who are older to them by 10 to 15 years. This tends to make things worse as they don't have anyone to take care of them after their husbands' death. Most of them will be abused physically, verbally and psychologically.

Living longer is both an achievement in itself and at the same time, a big public health challenge. Investing in health and promoting a healthy way of life throughout the society, is the only way to ensure that more people will reach old age in good health and with capability of contributing to the society.

## 3.4 Ageing: The health issues

Health status has an important effect on the quality of life of elderly. The major part of health status is perceived health, especially psychological well being and functional status. Perceived health declines with age.(14) A proper knowledge

about the morbidity profile of elderly is required to provide a proper health care delivery system for elderly. Old age is not a disease in itself. Elderly are vulnerable to long term diseases of insidious onset such as diabetes, hypertension, cardiovascular and cerebrovascular diseases, malignancies, musculoskeletal disorders etc.(15) They have multiple symptoms due to decline in various body functions. In India, elderly faces the spectrum of dual medical problems; both communicable and non communicable diseases. Decline in immunity and age related physiological changes make elderly vulnerable to communicable diseases. Chronic conditions like tuberculosis are more common among the elderly.(16) Literature shows that among the age group 60 years and above, 10% suffer from physical disabilities and 10% of them are hospitalized at any given time, both proportions increasing with age. In the population above 70 years of age around 50% suffer from more than one chronic condition.(17) It was found that most prevalent morbidity among elderly is anemia followed by dental problems, hypertension, chronic obstructive pulmonary disease (COPD), cataract, and osteoarthritis. The morbidities were more common in rural areas except for hypertension, osteoarthritis, diabetes, obesity and psychosis which were more common in urban area.(14) According to government of India statistics, cardiovascular disorders account for one third of elderly mortality followed by respiratory disorders which account for 10% while infections including tuberculosis account for another 10%. Neoplasm account for 6% and accidents, poisoning, and violence constitute less than 4% of elderly mortality with more or less similar rates for nutritional, metabolic, gastrointestinal, and genito-urinary infections.(16) An Indian Council of Medical Research (ICMR) study on chronic

morbidity profile on elderly shows that hearing impairment is the most common morbidity followed by visual impairment.(18)

## 3.5 Disability

Knowledge about disabilities is important in providing care for elderly because, they can have multiple diseases at the same time with varied impact on the day to day life. The importance of restricted activity was recognized more than 20 years ago in the U.S. Surgeon General's original Healthy People Report, which identified reduction of restricted activity as one of its two major goals for older persons.(19) The same report stressed on the gargantuan adverse effects of disability on individual well-being, the need for informal help, provision for healthcare, as well as long-term needs and costs.(19) Long-term disabilities causing restricted mobility are common among older persons. Multiple risk factors, together with subsequent precipitants, greatly increase the likelihood of long-term mobility disability.(20) After having a physical disability for a long time, the probability of attaining functional independence will be low and the need for both formal and informal care will be high. The knowledge about the prevalence of physical disability is necessary for the policy development regarding elderly care. In contrast to the developed countries, most of the developing countries lack reliable data regarding the functional status of elderly which is necessary for public health policy formulation. Older people's ability to function independently is important, as physical disability and functional limitation have profound public health implications with increased utilization of health care and a need for supportive services and long-term care. A community based study among elderly in the sub-urban regions of Bangalore, using the International Classification of

functioning, disability and health (ICF), showed that 27 percent of the respondents have mild disability.(6) Disablement levels showed significant increase with age. Restriction of participation in activities of daily living was more influenced by increasing age and cognitive function than the current health status.(6)

Disability is considered as the restriction or lack of ability to perform an activity in the manner or range which is considered normal for a human being.(21) The United Nations Disability Statistics Compendium (DISTAT) noted that in India, percentage of population with disability is 2.1.(21) In contrast, a study conducted by the National Sample Survey Organization (NSSO), the percentage of people living with disability is 1.8 percent. According to the study conducted by United Nations Economic and Social Commission (UNESC) for Asia and Pacific in 2002 the prevalence of disability in India is 1.8 percent.(21) Age is considered as a risk factor associated with disability worldwide. But no studies are done to show the contribution of old age to the overall burden of disability. The study done by National Sample Survey Organization in 2002 shows that among loco-motor disability, visual disability and hearing impairment, the elderly constitutes 3.3, 23.4 and 25.5 percent respectively, of the total people living with such disabilities.(21) Prevalence of disability increases with age. It is more common in age group more than 75 as compared to 60 years. Similarly, it is more common among female gender as life expectancy of women is longer than that of men. Disability lowers the quality of life and demands resources for care and rehabilitation. Helping to combat disability in elderly improves the quality of life. Prevention of disability in the elderly is a matter of humanitarian and economic concern. Disability prevention will lead to promotion of health and emergence of

an economically and intellectually active older age group. Unfortunately, internationally comparable data on disability is most often not available. Such data is important for planning, implementation, monitoring and evaluation of an inclusive healthcare delivery system.

## 3.6 Measurement of disability:

Differential approaches in the study of disability, have resulted in contrasting disability rates being reported, even within the same geographical territory. Developing countries generally tend to report lower rates of disability. Some factors lead to higher rate of disability in developed countries. The different factors include high survival rate, increased life expectancy and increased awareness among the people regarding different treatment modalities available. Sample surveys tend to report a higher rate, compared to census data. This is mainly because of the type of questions asked. For international comparison, census based data is needed, because in poorer countries the periodical census is the only way of collecting information.(22)

Different tools are available to measure disability. Some of the commonly used tools include Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL) and Barthel Index. In the activities of daily living scale, the ability to do the basic activities independently, like bathing, dressing, toileting, transferring and continence are assessed. In Instrumental activities of Daily living, the ability to do instrumental activities like handling of money, doing household work, etc is also assessed.

Barthel index is an instrument used worldwide to assess the functional independence and mobility. Its predecessor was called Maryland disability Index,

developed in Baltimore mainly to assess the progress of patients with chronic disease. Later on Dr Florence I Mahoney and Dorothea W Barthel modified this index to its present form. This instrument was first used in 1955 and was well established by the time it was published in 1965. It belongs to the daily life activity (DLAs) assessment field and measures the functional independence in the fields of personal care, mobility, locomotion and excretion. Activities assessed and scores assigned for each activity is mentioned in table 3.1.(23) The different activities included feeding, bathing, grooming, dressing, bowel control, bladder control, transfer from one place to another, mobility from one place to another and ability to climb stairs. The maximum scores attained is 100 and the minimum score attained is 0.

The Barthel index was developed as a tool to assess disability in patients with neuromuscular and musculoskeletal conditions. In a study published in *Age and Ageing*, regarding the reliability of Barthel Index in elderly population, the inter rater reliability is reported as fair to moderate agreement for individual Barthel items and a high percentage agreement for total Barthel index score.(24) Another study was done in Brazil to validate the Barthel index for the elderly attending the outpatient clinic through analysis of reliability and validity. The reliability calculated through alpha of Cronbach presented the value of 0.9 for the total scale. The validity analysis of convergent criterion, using the Functional Independence Measure, identified a satisfactory Correlation for most areas. In the factor analysis, which retained only one domain and the 10 items of the original scale, the variance explained was 63.8%. The results recommended its use to measure functional ability.(7)

**Table 3.1 Barthel index**

| Serial number | Activity | Score |
|---|---|---|
| a | **Feeding** | |
| | Unable | **0** |
| | Needs help cutting, spreading butter etc. or requires modified diet | **5** |
| | Independent | **10** |
| b | **Bathing** | |
| | Dependent | **0** |
| | Independent | **5** |
| c | **Grooming** | |
| | Needs to help with personnel care | **0** |
| | Independent face/ hair/teeth/shaving (implements provided) | **5** |
| d | **Dressing** | |
| | Dependent | **0** |
| | Needs help but can do about half unaided | **5** |
| | Independent (including buttons, zips, laces, etc.) | **10** |
| e | **Bowels** | |
| | Incontinent (or needs to be given enemas | **0** |
| | Occasional accident | **5** |
| | Continent | **10** |

**Table 3.1 Barthel index (continued)**

| Sl no | Activity | Score |
|---|---|---|
| f | **Bladder** | |
| | Incontinent, or catheterized and unable to manage alone | **0** |
| | Occasional accident | **5** |
| | Continent | **10** |
| g | **Toilet use** | |
| | Dependent | **0** |
| | Needs some help, but can do something alone | **5** |
| | Independent (on and off, dressing, wiping) | **10** |
| h | **Transfers ( bed to chair and back)** | |
| | Unable, no sitting balance | **0** |
| | Major help (one or two people, physical), can sit | **5** |
| | Minor help (verbal or physical) | **10** |
| | Independent | **15** |
| i | **Mobility (on level surfaces)** | |
| | Immobile or < 50 yards | **0** |
| | Wheel chair independent, including corners, >50 yards | **5** |
| | Walks with help of one person (verbal or physical) > 50 yards | **10** |
| | Independent ( but may use any aid) > 50 yards | **15** |
| j | **Stairs** | |
| | Unable | **0** |
| | Needs help (verbal, physical, carrying aid) | **5** |
| | Independent | **10** |

## 3.7 Nutritional status of elderly:

Elderly people are nutritionally vulnerable. There is no universally accepted definition for malnutrition in elderly. Malnutrition is a broad term to define nutritional imbalance, ranging from over nutrition as seen more in developed countries, to under nutrition as seen more in developing countries. According to World Health Organization, malnutrition is cellular imbalance between the supply of nutrients and energy and the demand of body for adequate growth, maintenance and functions.(25) When a person is not getting enough quantity of nutrients or the right type of nutrients, malnutrition is an imminent malaise. Malnutrition is the commonest cause for disease according to the United Nations Standing Committee on Nutrition. Under nutrition among the elderly population is a continuing cause of concern. Eliminating malnutrition involves sustaining the quality and quantity of food a person consumes, as well as adequate health care and a healthy environment.

It is a well documented fact that worldwide, the elderly population is increasing and, there is a similar increase in incidence of malnutrition among elderly. Malnutrition in the elderly is associated with impaired muscle function and decreased bone mass leading to increased falls, impaired immune function, anemia, prolonged hospitalization, delayed post-operative recovery and increased morbidity. It also causes significant increase in mortality and morbidity in independently living older people, as well as in nursing home residents and hospitalized patients. A nutritional screening week was conducted in United Kingdom in 2007. According to its report, prevalence of malnutrition increases as the age advances. The prevalence is around 35 percent in adults over 80 years of age, 25 to 35 percent in the age group 60 to 80 years and 25 percent in

persons less than 60 years of age.(26) Many changes associated with ageing cause malnutrition, but malnutrition as such is not a symbol of ageing. Older patients are at a greater risk of not being able to recover from diseases, due to the presence of malnutrition.(27) Risk factors for malnutrition in elderly can be classified as medical factors, life style, social factors and psychological factors. The medical factors include poor appetite, poor dentition, loss of taste and smell, respiratory disorders like emphysema, gastro intestinal disorders like mal absorption, endocrine disorders like diabetes, thyrotoxicosis, neurological like cerebrovascular accident, Parkinson's disease, infections like urinary tract infections, chest infections, physical disability, drug interactions like metformin and other conditions like cancer. Lack of knowledge about food and nutrition, isolation/loneliness, poor social support in terms of procuring and cooking, are the common life style and social factors for malnutrition. Psychological factors like depression, dementia, confusion, bereavement and anxiety also contribute to malnutrition in elderly.(28)

Older people are not a homogenous group and therefore factors will manifest differently from one person to the other. A study done in Iran in 2008 reported that 12 percent of the independently living elderly are malnourished.(8) Another European study reported that the prevalence of malnutrition among community dwelling ambulatory elderly was 15 percent where as 5 to 44 percent of home bound patients were malnourished.(29) Some unpublished studies from rural south India shows prevalence between 14 to 30 percent among free living elderly population. The prevalence of malnutrition in the hospital setting is even higher, between 20 to 50 percent.(30) In 2005, Professor Claude Pilchard of European Nutrition for Health Alliance(ENHA), presented data suggesting that the

prevalence of malnutrition among hospitalized patients is 46 percent.(25) In older patients these percentages are even higher. It ranges from 50 to 77 percent.(31) Even though the malnutrition is high among hospital setting, it is not necessarily because of poor availability of food, rather It is because of the failure of providing appetizing food for the patient at the right time.(25) A remarkable fact about the malnutrition among elderly is the low awareness of the problem among the general public and the health and social care professionals. A survey was conducted among family doctors in United Kingdom regarding their awareness of malnutrition and use of nutritional support services. The survey report showed that 88 percent of the respondents were not aware of any nutritional screening tools. Only 13 percent used to refer at-risk patients to National Health Service.(25)

Malnutrition is a complex problem affecting several organ systems in elderly. Health related quality of life is significantly reduced in elderly men and women at risk of malnutrition. This is more pronounced in men than in women.(32) The relationship between Health Related Quality of Life and malnutrition is dome shaped with highest quality of life seen in moderately over weight individuals (BMI- 25- 27.5kg/$m^2$).(32) Malnutrition can go undetected and if left undermanaged, can cause severe health consequences such as delayed wound healing, increased risk of infection, etc. The most vulnerable group for developing malnutrition include those with chronic diseases, the elderly, those recently discharged from the hospital, and those who are poor and socially isolated.(33) According to another study done in China, the significant risk factors of malnutrition is total dependence in activities of daily living, those living in a home for elderly, and being chair or bed bound.(34) Under and malnutrition are

independent risk and cost factor with a significant influence on mortality, morbidity, length of hospital stay and quality of life. We must recognize the huge economical and social cost of malnutrition. Malnutrition causes loss of independence and results in disability with a huge cost of care for elderly. If they are recognized early by targeted assessment and then treated appropriately, there will be good treatment outcomes with reduced cost of care.(35) In a report from United Kingdom it has been the shown that malnutrition cost the National Health Service 7.3 billion each year. This is mainly because the person who is malnourished needs frequent consultations with the doctor, needs frequent and prolonged hospital stay, has higher rates of complications and mortality compared to a well-nourished person.(36) This is a heavy burden and the cost is paid not just by the individual, but the society as a whole. A community based service is needed to prevent malnutrition among elderly. Economic opportunities should be provided for all the stake holders providing malnutrition interventions.

Different tools are available to treat and prevent malnutrition. Targeted clinical interventions are very effective. When the treatment is effective, clinical results can be dramatic. There is rapid increase in body weight, less number of infections and decrease in the number of days of hospital stay.(25)

Identifying malnutrition or the risk of malnutrition is essential for preventing it. It is therefore not surprising that many tools are available for clinician's use, which will help in accurate identification, referral and treatment of patients who are malnourished or at risk of malnutrition. We need to use a combination of different methods like validated questionnaire, anthropometric measurements and biochemical values for the identification of malnutrition.

Nutritional screening is a process used to quickly identify those who are at risk, so that appropriate nutritional interventions can be provided. Different nutritional screening tools are available. Malnutrition Universal Screening Tool (MUST) is a screening tool used to identify the adults who are malnourished, at risk of malnutrition or obese. It can be used in hospital, community and other care settings. It is the easiest and quickest tool; an assessment using the same can be completed in 3 to 4 minutes.(37) The sensitivity and specificity of MUST is 61 percent and 76 percent respectively.(38) Another commonly used nutritional screening tool is 'Seniors in the Community: risk evaluation for eating and nutrition' (SCREEN 1 and SCREEN 2). The test- retest reliability on SCREEN 1 AND SCREEN 2 are 0.68 and 0.83 respectively. Intra class correlation for SCREEN 2 is 0.75 which is considered adequate but not good for confirmatory purposes. The sensitivity and specificity for SCREEN 1 is found to be 0.81- 0.94 and 0.32- 0.55 where as for SCREEN 2 it is given as 0.84 and 0.62.(39)

Mini nutritional assessment (MNA) is developed specifically in use among elderly patients in hospital, nursing homes and community and is thus limited to persons with specific demographic correlates. It is a screening and assessment tool with a reliable scale and clearly defined thresholds. The development of MNA started at the 1989 International Association of Geriatrics and Gerontology (IAG) Conference in Acapulco. The idea was to develop a tool similar to Mini Mental State Examination which is used for cognitive assessment. This is because despite the high prevalence of malnutrition among elderly, nutritional assessment was not being performed in clinical practice because of the practical difficulty in evaluating nutritional intake.(40) The MNA was first published in 1994. In 2001 a short form of the MNA was introduced. It is combined with MNA and can be used

as a two step process. MNA considers anthropometrical, medical, psychological and dietary factors in an 18 item assessment using point based scoring system to identify whether the patient is at risk of or suffering from malnutrition.(30) It has two parts: screening and assessment. The questions for screening are given in table 3.2.

**Table 3.2 MNA - Screening questions**

| **Screening:** | |
|---|---|
| **a** | **Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?**<br>0 = severe decrease in food intake<br>1= moderate decrease in food intake<br>2= no decrease in food intake |
| **b** | **Weight loss during the last 3 months**<br>0= weight loss greater than 3 kilogram<br>1= does not know<br>2= weight loss between 1 and 3 kilogram, 3= no weight loss |
| **c** | **Mobility**<br>0= bed or chair bound<br>1= able to get out of bed/ chair but does not go out<br>2= goes out |
| **d** | **Has suffered psychological stress or acute disease in the past 3 months?**<br>0= yes 2= no |
| **e** | **Neuropsychological problems**<br>0= severe dementia or depression, 1= mild dementia<br>2= no psychological problems |
| **f** | **Body mass index (BMI) (weight in kg)/ (height in $m^2$)**<br>0= BMI less than 19<br>1= BMI 19 to less than 21, 2= BMI 21 to less than 23<br>3= BMI 23 or greater |

Each question carries an individual score. At the end of screening total score is calculated by adding the individual scores. If the total score is 11 or less, continue with the assessment part of MNA to calculate the malnutrition indicator score.

Maximum attainable score after screening is 14; score of 11 or less point towards malnutrition. The classification is given in Table 3.3.

**Table 3.3 Screening scores**

| **Screening score: (subtotal maximum 14 points)** |
|---|
| 12 to 14 points: normal nutritional status |
| 8 to 11 points: at risk of malnutrition |
| 0 to 7 points: malnourished |

In assessment, the initial few questions deal with drug intake, independent life and pressure sore. Next few questions are about food intake. There are questions regarding number of meals per day, type of food, adequate water intake etc. These questions are incorporated, mainly to identify the adequate intake of protein. It also includes questions which assess mode of feeding and self perception of nutritional status. Further details are given in table 3.4.

Maximum attainable score for assessment is 16. The malnutrition indicator score is calculated by adding the screening and the assessment scores. The highest score that can be attained from MNA scale is 30. Malnutrition indicator score classification is given in box 3.5.

**Table 3.4 Assessment**

| **Assessment:** | |
|---|---|
| **g** | **Lives independently ( not in nursing home or hospital)**<br>1= yes 0= no |
| **h** | **takes more than 3 prescription drugs per day**<br>0= yes 1= no |
| **i** | **Pressure sores or skin ulcers**<br>0= yes 1= no |
| **j** | **How many full meals does the patient eat daily?**<br>0= 1 meal, 1= 2 meals, 2= 3 meals |
| **k** | **Selected consumption markers for protein intake**<br>• Atleast one serving of dairy products (milk, cheese, yoghurt) per day<br>• Two or more servings of legumes or eggs per week<br>• Meat, fish or poultry every day<br>0.0 if 0 or 1 yes, 0.5 if 2 yes, 1.0 if 3 yes |
| **l** | **Consumes 2 or more servings of fruits or vegetables per day?**<br>0= no 1=yes |
| **m** | **How much fluid (water, juice, coffee, tea, milk…) is consumed per day?**<br>0.0= less than 3 cups,<br>0.5= 3 to 5 cups<br>1.0=more than 5 cups |

**Table 3.4 Assessment continued**

| | |
|---|---|
| **n** | **Mode of feeding**<br>0= unable to feed without assistance<br>1= self fed with some difficulty<br>2= self fed without any problem |
| **o** | **Self view of nutritional status**<br>0= views self as being malnourished<br>1= is uncertain of nutritional state<br>2= views self as having no nutritional problem |
| **p** | **in comparison with other people of the same age, how does the patient consider his/ her health status?**<br>0.0= not as good<br>0.5= does not know<br>1.0= as good<br>2.0= better |
| **q** | **Mid- arm circumference (MAC) in cm**<br>0.0= MAC less than 21<br>0.5= MAC 21 to 22<br>1.0= MAC 22 or greater |
| **r** | **Calf circumference (cc) in cm**<br>0= cc less than 31<br>1= cc 31 or greater |

If the score is 23.5 and above, the person is considered to have normal nutritional status and no further action is needed. Dietary advice should be given to others.(41) MNA score of less than 17 indicate protein energy malnutrition.(40)

**Table 3.5 Malnutrition indicator score classification**

| **Malnutrition indicator score** |
|---|
| 24 to 30 points – normal nutritional status |
| 17 to 23.5 points – at risk of malnutrition |
| Less than 17 points- malnourished |

At this stage it is important to identify the severity of malnutrition by using bio chemical parameters, evaluating a three day record of food intake and measuring anthropometric features like body mass index.(40) It is quick to use and can be completed in 5 minutes. No previous training is needed for using MNA. MNA short form (MNA-SF) is now available that contains only the first half of MNA scale which makes screening easier in a clinical setting. In a hospital setting, low MNA score is associated with prolonged hospital stay and increased mortality. MNA can also be used as follow up assessment tool. It detects risk of malnutrition before change in weight and decrease in serum protein.(42) It closely correlates with biochemical markers, (albumin, prealbumin, transferrin levels, and lymphocyte numbers) a fact verified by a number of clinical studies on a wide set of geriatric patients.(9) Significant correlations were found between full MNA scores and age ($r = -0.14$), body mass index ($r = 0.59$), serum albumin ($r = 0.60$) and mid arm circumference ($r = 0.50$)(9) The MNA has been validated in many research studies among older adults, throughout the world in hospital, nursing

home and ambulatory care patients and also in community screening. Internal consistency, inter-observer reliability and validity were shown to be acceptable.(43) Reliability can be measured using kappa statistics and inter class correlation. Kappa value of 0.51 is reported for hospitalized elderly and 0.78 for institutionalized elderly, which suggest moderate and substantial agreement respectively. Intra class correlation is found to be 0.89 which suggest excellent reliability.(42) Internal consistency measured by using alpha co efficient is found to be 0.83.(39) Receiver operator characteristics (ROC) curve is a combined measure of sensitivity and specificity. ROC curve is necessary to understand the overall efficacy of a tool, and the area under the curve (AUC) can be used to determine whether it has use in clinical practise where a definite diagnosis of a condition is available. The AUC value for MNA is 96 percent. High sensitivity is required for a screening test and high specificity is required for the assessment or confirmation of disease.(42) Sensitivity and specificity of MNA is 98 percent and 94 percent respectively. With an AUC value of 96 percent, sensitivity of 98 percent and specificity of 94 percent MNA has the highest construct and predictive validity. Cross validation, the ability of a tool to identify nutrition risk in a population different from which it is developed, is assessed. MNA showed high sensitivity and specificity; 97.9 percent and 100 percent respectively, on cross validation. Based on the values of validity, reliability, sensitivity and specificity MNA is the most appropriate tool for nutritional risk assessment in community dwelling older population. The validity of the tool has been verified in different populations across different countries. But currently no data is available regarding inter rater and test- retest reliability in the community dwelling older adults.(39)

The use of anthropometry in elderly is relatively recent and the index of choice is Body mass index (BMI). The body mass index is calculated from person's weight and height. It is inexpensive, easy to perform tool to calculate the weight categories of people. It is also an indicator of direct measures of body fat. There are different and more complex methods to calculate the body fat level. Some of the measurements include under water weighing or hydrodensitometry, skin fold thickness and bio electrical impedance. Under water weighing is complex and difficult to use in daily practise. Bioelectric impedance measure total body weight, the percent and amount of fat, muscle mass, water mass and bone mass. But again, it is difficult to apply this technique in daily clinical practise. Skin fold thickness is a simple tool. But special training is required for its proper application. Studies have shown that BMI is a measure of body fat percentage (BF %).(44) BMI is age and sex dependant when used for calculating body fat.(45) Older people tend to have more body fat than younger ones. Similarly women are more obese than men. This can be easily corrected using age and gender specific prediction formulas. The prediction of BF% using BMI is less dependent on intra and inter observer variation than skin fold thickness.(44)

BMI can also be used to calculate under weight and overweight. It was first introduced by Quetlet in order to avoid the confounding effect of height on weight. Researchers have suggested that BMI can be used to assess chronic adult protein energy malnutrition. Studies have shown that 70 percent Indian men and 61 percent Indian women have their BMI less than 18.5 $kg/m^2$.(46) Height declines with age at a rate of 1 to 2 cm a decade and more rapidly in older age group.(47) Weight also declines with age, but the pattern is different from height and varies with gender. One of the reasons for reduction in body weight is the

reduction in body water content. As a result of this, there is a reduction in muscle mass and cell mass. This reduction is more pronounced in man than in woman. BMI increases by middle and later on plateaus by old age. It tends to decrease by 70 to 75 years of age. (47)This does not mean that BMI declines with age. It can be even have a value which is higher than the value at the middle age, considering the changes in weight and height. There are different studies which compared the BMI among different populations across the world. In most populations, women have greater BMI than men. Among elderly men, Central and South Americans and Chinese have lower BMI than others. Among women, those from China and Guatemala belonged to the lowest category, while Australians of Greek origin belonged to the highest category. All others belonged to the mid category.(47) The significance of high BMI among elderly is unclear. Low BMI is associated with diseases like tuberculosis, chronic obstructive lung diseases, malignancies of lung and stomach etc. Similarly, cerebro- vascular accidents, cardio vascular diseases, diabetes etc are common in high BMI group. Anthropometry is helpful to identify the population at risk of under nutrition and to assess the response of nutritional intervention. The current cut off points for BMI recommended by World Health Organisation (WHO) is given in table 3.6(48) Less than 18.5kg/$m^2$ is considered as underweight. According to WHO classification obesity is defined as a BMI of 30kg/$m^2$ and above. WHO recommends this classification for international comparison.

For Asian population additional cut off points were suggested by World Health Organisation for public health action. Under weight cut off points remain the same. The suggested changes in cut off points are applicable to the overweight category.

**Table 3.6 WHO BMI Classification**

| BMI | Category |
|---|---|
| <16kg/$m^2$ | Severe under weight |
| 16-16.9kg/$m^2$ | Moderate under weight |
| 17- 18.4kg/$m^2$ | Mild under weight |
| 18.5-24.9kg/$m^2$ | Normal |
| 25- 29.9kg/$m^2$ | Pre obese |
| 30- 34.9kg/$m^2$ | Obese class 1 |
| 35- 39.9kg/$m^2$ | Obese class 2 |

According to the WHO BMI classification for Asian population obesity is defined as a BMI of 27.5kg/$m^2$ and above. The classification is given in table 3.7

**Table 3.7 WHO BMI classification for Asian population**

| BMI | Category |
|---|---|
| <16kg/$m^2$ | Severe under weight |
| 16-16.9kg/$m^2$ | Moderate under weight |
| 17- 18.4kg/$m^2$ | Mild under weight |
| 18.5-22.9 kg/$m^2$ | Normal |
| 23- 27.4 kg/$m^2$ | Pre obese |
| 27.5- 32.4 kg/$m^2$ | Obese class 1 |
| 32.5- 37.4 kg/$m^2$ | Obese class 2 |
| 37.5 and above | Obese class 3 |

For Asian population BMI of 23 and above were considered as high risk for adverse health effects and 27.5 and above were considered higher risk for adverse health effects.(48) In 2008 government of India revised the BMI guidelines for the country. According to this classification, obesity is defined as a BMI of 25kg/$m^2$ and above.(49)

**Table 3.8 Revised Government of India classification for BMI**

| BMI | Category |
|---|---|
| <18.5 kg/$m^2$ | Under weight |
| 18.5- 22.9kg/$m^2$ | Normal |
| 23- 24.9kg/$m^2$ | Over weight |
| >=25kg/$m^2$ | obese |

It is a good indicator of nutritional status and morbidity and mortality among elderly.(50) Studies have shown that BMI is higher among women than in men. It is lower in older persons than in younger persons, in both genders.(51) BMI alone is not a good indicator of malnutrition. It has to be combined with other methods of nutritional assessment.

Biochemical markers also form an important tool in the assessment of nutritional status. Formation of serum proteins in the liver is associated with the nutritional state of the individual. In malnutrition, proteosynthetic liver function is usually decreased. Based on the half-life of individual plasma proteins, the duration of malnutrition can be determined. Albumin has relatively long half life of 20 to 21 days. It continues to be a suitable marker for the screening of malnutrition.(41)

Decrease in serum albumin is an independent indicator of severity of clinical state(41) and a good prognostic indicator of hospital survival in elderly patients. A recent study found hypo albuminemia to be associated with several socio demographic, lifestyle, and disease related factors in community-dwelling older persons. Functional impairment and disability have also been associated with low serum albumin in the elderly. Hypoalbuminemia (less than 35g/l) has been shown to be a reliable predictor of Protein Energy Malnutrition in elderly people. A more recent study evaluating predictors of early re-hospitalization among elderly non-elective hospitalized patients, found low albumin levels along with any amount of weight loss, to be the most predictive of re-admissions.(52) Low serum albumin in elderly men is associated with a higher risk of premature death.(53)(54) Serum albumin level decreases with age.(55) The other factors that cause reduction in serum albumin level among elderly, include vomiting more than 3 days, surgery for gastro intestinal tumors, having a condition that interferes with eating, heart failure, recurrent coughing attack, poor dentition, feeling tired or worn out, little or no exercise, low salt diet and smoking.(56) Community dwelling elderly with a risk of malnutrition and serum albumin level less than 3.5g/dl have more problems in daily living, decreased physical fitness, physical function and oral function.(55) Studies have shown that undergoing regular health examinations may prevent a fall in serum albumin levels. This leads to the conclusion that participation in routine health examination as a part of health behavior may prevent malnutrition among elderly. Annual health examination among elderly can provide better health and will reduce mortality among elderly.(55)

Anemia is the commonest hematological condition among the elderly. As per World Health Organization, anemia defined as a hemoglobin level of 12g/l for women and 13g/l for men. This is further explained in table 3.9.(57)

**Table 3.9 Hemoglobin cut off points to define anemia**

| Age or gender | Hemoglobin threshold |
|---|---|
| Children (0.50- 4.99 yrs) | 11 g/dl |
| Children (5.00- 11.99yrs) | 11.5 g/dl |
| Children (12- 14.99 yrs) | 12 g/dl |
| Non pregnant women (>=15yrs) | 12 g/dl |
| Pregnant women | 11 g/dl |
| Men (>= 15 yrs) | 13g/dl |

Anemia is further classified into mild, moderate and severe group. The limit for the above classification is different for men and women. For women, severe anemia is defined as hemoglobin of 7g/dl or less. Similarly, for men, severe anemia is defined as hemoglobin 9 g/dl or less. Further details about the classification is given in table 3.10 and 3.11.(58) The reason for difference in cut off points is beyond the scope of this dissertation.

Global prevalence of anemia among elderly is 23.9 percent (95% confidence interval 18.3-29.4).(57) The prevalence of anemia increases with age. Of the total anemic elderly, one third is nutritional anemia.(59) It should never be considered as a part of normal ageing process.

**Table 3.10 Classification of Anemia- Women**

| Hemoglobin | | Category |
|---|---|---|
| Women | 12g/dl and above | Normal |
| | 10 to 11.9g/dl | Mild anemia |
| | 7 to 9.9g/dl | Moderate anemia |
| | less than 7g/dl | Severe anemia |

**Table 3.11 Classification of Anemia - Men**

| Hemoglobin | | Category |
|---|---|---|
| Men | 13g/dl and above | Normal |
| | 12 to 12.9g/dl | Mild anemia |
| | 9 to 11.9g/dl | Moderate anemia |
| | less than 9g/dl | Severe anemia |

The occurrence of anemia is frequently multifactorial.(60) The weighted mean prevalence of anemia was 17 percent overall and 12 percent in studies based in the community; 47 percent in nursing homes and 40 percent in hospital admissions.(60) Prevalence of anemia is more among women than in men till the age of 75. By the age 75 the male prevalence surpasses female prevalence by 5 percent. This disparity continues to the uppermost age bracket.(59)

Studies have shown that anemia decreases physical performance and strength in elderly. Mild anemia causes reduction in oxygen transport by the blood which will lead to fatigue and diminished physical activity. Fatigue and decrease in strength

may increase the risk of fall. When there is reduction in red blood cells the ability to absorb oxygen from lungs are affected. This impact of this will be worse if the person is suffering from severe anemia. Anemia can cause arrhythmia, heart failure and other secondary organ damage. Loss in physical function causes dependence among elderly and affects their quality of life. This has substantial social and economic impact.(61) Anemia in elderly may have an effect on cognitive function and can lead to worsening of disease conditions like dementia. Anemia also increases mortality among people with other co morbid conditions.(59) Depending on the prevalence, anemia is classified into various categories of public health significance. These categories include no public health problem, mild public health problem, moderate public health problem and severe public health problem. This is further explained in table 3.12.(57)

**Table 3.12 Anemia and public health significance**

| Prevalence of anemia (%) | Category of public health significance |
|---|---|
| <= 4.9 | No public health problem |
| 5.0-19.9 | Mild public health problem |
| 20.0-39.9 | Moderate public health problem |
| >=40.0 | Severe public health problem |

Malnutrition contributes to anemia in the elderly and is under diagnosed. Iron and vitamin b 12 are the two important micro nutrients that are essential for the proper functioning of the red blood cells, the absence of which will cause anemia. There are different causes for deficiency of iron and vitamin b 12. One of the important

cause is poor nutritional intake or the absence of right type of food in the diet. Meat, fish and iron fortified food products are the best source of iron. Vegetarian diet can also provide adequate iron if people are including large amounts of dark green leafy vegetables, beans, dried fruits etc, in their diet. Vitamin b 12 is a water soluble vitamin and it is naturally present in some food products. Methylcobalamine and 5 deoxyadenosylcobalamine are the active form of vitamin b 12 in human beings. Vitamin b 12 is a co factor for methionine synthase and L-methylmalonyl-CoAmutase. L- methylmalonyl- CoAmutase converts L-methylmalonyl- CoA to succinyl Co A. Succinyl Co A is essential for red cell formation. Thus vitamin B 12 is essential for proper blood cell formation. Vitamin B12 is naturally present in animal diet like fish, meat, egg, milk and milk products. It is usually not present in plant products. So the chance of having vitamin b 12 deficiency in pure vegetarians is very high. Elderly who are generally neglected on the nutritional aspect will easily develop anemia if their diet lack adequate amounts of right type of food.

Studies have shown that anemia is related significantly to the parameters associated with malnutrition (p=0.0001).(62) It remains to be determined whether this nutritional component of anaemia is amenable to intervention through better attention to nutritional status and whether this will ultimately benefit the patient.

Malnutrition among elderly should be considered as a serious public health problem. It can cause a heavy economic burden to the society. Many studies regarding nutritional status and functional disability among older population have been conducted in developed countries. But very little data regarding the above aspects are available from developing countries. In this study we will be looking at the prevalence of physical disability, types of disabilities and nutritional status

among the elderly in a rural community. We will also be looking at the various factors which cause malnutrition and disability and the association between physical disability and nutritional status.

# 4. Materials and methods

## 4.1 Study Setting

The study was done in Kaniyambadi block, which is an administrative block served by the Community Health and Development (CHAD) program of the Department of Community Health of the Christian Medical College (CMC) Vellore. The block belongs to the Vellore district of Tamilnadu. The total population of the block is around one lakh twenty thousand, which is distributed in 88 villages. This is predominantly a rural block with majority of its population involved in agricultural activities and manual labour. There are three primary health centers and one medical college, catering to the health needs of people in the block. Besides these, CHAD has been providing comprehensive integrated health services in the block for more than twenty years focusing mainly on the maternal and child health, nutrition, leprosy, tuberculosis, rheumatic heart disease, filariasis, non communicable diseases like diabetes and hypertension and various other socioeconomic development programmes using the principle of primary health care.

CHAD has recruited grass roots workers called Part Time Community Health Workers (PTCHW) whose job description is similar to Accredited Social and Health Activists (ASHA) in the government system. They also have health aides who cover a population of 5000. She gathers basic demographic data, vital statistics, immunisation, chronic disease data etc at the grass root level. She also visits newborns, identifies people who require medical care at the grass root level. CHAD totally has deployed 17 health aides for the above purpose. Next in

the team is a public health nurse, who covers a population of twenty five thousand, and an area doctor, who has a population of forty thousand under him or her. There are totally 5 public health nurses and 3 area doctors. The CHAD health information system works in a unique hierarchical way in which information passes from grass root PTCHW to health aides to public health nurses and finally to the doctor in charge of the areas.

Community health department runs a computer cell which maintains an electronic data base where all the information gathered at the grass root levels is stored. Data regarding the demography of the block, vital statistics, immunisation, chronic diseases etc are available at the computer cell. This well knitted system provides a good back up in identifying participants in the study.

## 4.2 Study design:

This study was designed and carried out as a cross sectional study, with the participants coming in contact with the interviewer only once during the study period. The field activities and data collection from the participants were under taken between September 2011 and April 2012.

## 4.3 Study population:

**Inclusion criteria**: All elderly of age 60 years and above were eligible to be included in the study. If the person was unable to give consent by himself or herself, consent was taken from the nearest relative.

**Exclusion criteria**: Those who refused to give consent to be a part of the study was excluded.

## 4.4 Sample size:

Based on a study in South India (17) reporting a prevalence of mild disability of 27% among the elderly, the sample size was estimated.

Prevalence (P) = 27%

Q = 100-27 = 73

Precision (margin of error) = 7

Design effect (cluster sampling) = $1 + \partial(n - 1)$ where $\partial$ is the intra class correlation and n is the average size of the cluster. There is a possibility that respondents in a cluster will somewhat be similar to one another in cluster sampling as compared to simple random sampling. As a result the sample size in cluster sampling will not be as varied as it would be in simple random sampling, thereby reducing the effectiveness of sample size. This loss of effectiveness is negated by multiplying a design effect. It is a ratio of variance of a statistic calculated using a complex sampling design to assumed variance of that statistic using simple random sampling design. It is dependent on intra class correlation, likelihood of two samples in a cluster having similar values for a given statistic as compared to two samples in a randomly selected population having similar value, and the cluster size. Design effect increases with the cluster size and the intra class correlation.

For this study an intra class correlation of 0.05 and a cluster size of 20 were used.

Therefore design effect = 1+ 0.05 (20 – 1) = 1.95 which was approximated to 2.

Sample size

$$n = \frac{4 \times p \times q}{d^2}$$

$$= \frac{4 \times 27 \times 73}{7^2}$$

= 160

Applying the design effect of 2, sample size was 320

Non-response or unavailability of 5% was anticipated. This value was also added to the calculated sample size. Thus, the final sample size for the study was 340.

## 4.5 Sampling method:

The sampling method followed was the Cluster Sampling method, with a cluster size of 20 and a total of 17 clusters. Each village was considered as a cluster, and clusters were selected based on Probability Proportional to Size (PPS). In probability proportional to size sampling larger villages had a higher probability of being selected multiple times and the people in the larger villages had a lesser probability of being selected.

The number of elderly in each cluster was obtained from the database maintained by the Community Health Department. Within the cluster the elderly were chosen using the simple random sampling.

## 4.6 Study tools:

An interviewer administered semi structured questionnaire was used for data collection. The questionnaire had three parts.

**Part 1:** This part dealt with the demographic and socio economic details, which included age, gender, Body Mass Index (BMI), type of family, current source of income, dependency on children, socio economic score (SES) and blood investigations (haemoglobin and serum albumin). (Annexure 1)

**Part 2:** The second part was the mini nutritional assessment (MNA) scale. (Annexure 2)

**Part 3:** The third part was Barthel index. (Annexure 3)

Nutritional status was assessed using BMI, haemoglobin, serum albumin and the MNA scale. Physical disability was assessed using the Barthel index.

## 4.7 Survey Methodology:

The villages were selected by cluster sampling method. Within a cluster, the names of all the elderly were collected from the CHAD data set. The names were initially arranged according to the ascending order of street numbers. Although the cluster size was 20, 40 names were picked from the list using simple random sampling accounting for non response or non availability of subjects. Double the number of people was selected, to accommodate for drop outs. On the day of survey, elderly were visited in the order of selection. If anybody was unavailable, the immediate next person in the list was selected for the study. When the expected number of 20 was obtained, the data collection was stopped for a particular cluster. A written informed consent was filled by all the study participants. Semi structured questionnaire, which had socio demographic details, MNA scale for nutritional assessment and Barthel index for physical disability, was administered on each participant. 5ml venous blood was collected

from each study sample for testing haemoglobin and serum albumin levels. Samples were sent to the laboratory on the same day for further analysis.

The blood for haemoglobin is collected in a bottle coated with EDTA to prevent clotting. One ml of blood is used for analysing haemoglobin level. Haemoglobin is analysed using an instrument called Sysmex KX- 21 which is an automatic multi-parameter blood cell counter. This instrument performs blood cell count by DC detection method.

The blood for serum albumin was collected in a clotted tube. 4 ml of blood was collected for the above purpose. The blood is later centrifuged to separate the serum for analysis.

## 4.8 Data entry and analysis:

Data was entered using the software epi info and was analysed using spss version 17.

## 4.8 Variables:

Rates and percentages were calculated for all the categorical variables. Univariate analysis was done to calculate the prevalence of physical disability, malnutrition and anaemia. Chi square test and odds ratio was done for bi - variate analysis. Multivariate analysis was done using binary logistic regression to identify the association between gender, age place of stay and socio economic status and physical disability, malnutrition and anaemia.

# 5. Results

A total of 340 elderly from 17 different villages were contacted and studied. The description of the study population is given in the tables below.

**Table 5.1. Age distribution of the study population**

| Age Category | Frequency | Percentage |
|---|---|---|
| 60-64 years | 140 | 41.2% |
| 65-69 years | 111 | 32.6% |
| 70-74 years | 54 | 15.9% |
| 75-79 years | 19 | 5.6% |
| ≥ 80 years | 16 | 4.7% |
| **Total** | **340** | **100%** |

Among the 340 elderly studied, the proportion in each 5 year category decreased with increasing age. Around seventy three percent of the total study population were in the 60-69 years age group. Only 4.7 percent were in the age group 80 and above.

**Table 5.2 Gender distribution of the study population**

| Gender | Frequency | Percentage |
|---|---|---|
| Male | 159 | 46.8% |
| Female | 181 | 53.2% |
| **Total** | **340** | **100 %** |

Of the study population, 46.8 percent were males and 53.2 percent were females.

**Table 5.3 Marital status of the study population**

| Marital status | Frequency | Percentage |
|---|---|---|
| Married | 237 | 69.7% |
| Unmarried | 2 | 0.6% |
| Widow | 84 | 24.7% |
| Widower | 17 | 5.0% |
| **Total** | **340** | **100%** |

69.7 percent were currently married. Almost one third (29.7 percent) of the study population were widow or widower. Majority were widows, 24.7 percent. 2 of the study participants were unmarried.

**Table 5.4 Place of stay for the study population**

| Place of stay | Frequency | Percentage |
|---|---|---|
| Living alone/spouse | 115 | 33.8% |
| Living with son | 197 | 57.9% |
| Living with daughter | 19 | 5.6% |
| Others | 9 | 2.6% |
| **Total** | **340** | **100%** |

More than half of the study population, 57.9 percent, was living with their sons. Nearly 33 percent were living alone. Living alone category included people who did not have any of their children living with them.

**Table 5.5 Type of family of the study population**

| Type of family | Frequency | Percentage |
|---|---|---|
| Nuclear | 158 | 46.5% |
| Extended | 167 | 49.1% |
| Joint | 15 | 4.4% |
| **Total** | **340** | **100%** |

Forty six per cent were in nuclear family, where as 49.1 percent were in extended family, the rest, 4.4 percent were in joint family. The nuclear family included people who had their unmarried children living with them.

**Table 5.6 Type of house of the study population**

| Type of house | Frequency | Percentage |
|---|---|---|
| Hut | 18 | 5.3% |
| Katcha | 32 | 9.4% |
| Mixed | 79 | 23.2% |
| Pucca | 186 | 54.7% |
| Mansion | 3 | 0.9% |
| Government houses | 22 | 6.5% |
| **Total** | **340** | **100%** |

Out of 340 participants 22 were living in government made houses. Only 5.3 percent and 9.4 percent of the study population were living in hut and katcha

houses respectively. More than half, 54.4 percent were living in pucca houses. There were 3 participants who were living in mansions.

**Table 5.7 Land ownership by the study population**

| Land ownership | Frequency | Percentage |
|---|---|---|
| Own | 330 | 97.1% |
| Rental | 6 | 1.8% |
| Government | 2 | 0.6% |
| Others | 2 | 0.6% |
| **Total** | **340** | **100%** |

Houses were made in their own property by 97.1 percent, and 1.8 percent were staying in rented property. Two of the houses were in government property and two in neighbors' land on which they were living without paying any rent.

**Table 5.8 Current source of income for the study population**

| Current source of income | Frequency | Percentage |
|---|---|---|
| Currently working | 134 | 39.4% |
| Retirement pension | 47 | 13.8% |
| Dependant on children | 66 | 19.4% |
| Old age pension | 147 | 43.2% |
| Others | 39 | 11.5% |

More than one third of the study population (39.4%), were currently working. Nearly 43 percent were getting government old age pension and 13.8 percent were getting retirement pension. A small number of people (19.4%) were dependant on children. A few (11.5%) had other sources of income like spouse's pension, spouse's daily income, widow pension etc.

**Table 5.9 Age category of the currently working group**

| Age Category | Frequency | Percentage |
|---|---|---|
| 60-64 years | 73 | 54.5% |
| 65-69 years | 40 | 29.9% |
| 70-74 years | 13 | 9.7% |
| 75-79 years | 5 | 3.7% |
| ≥ 80 years | 3 | 2.2% |
| **Total** | **134** | **100%** |

Majority of the people who were working belonged to the age group 60 to 64 years (54.5%) followed by 65 to 69 years (29.9%). There were 9.7% in the 70 to 74 age category and 3.7% in 75- 79 age category. Only three belonged to the category 80 years and above.

**Table 5.10 Type of job involved by the currently working group**

| Type of job involved | Frequency | Percentage |
|---|---|---|
| MNREGS* | 43 | 32.1% |
| Manual laborer | 38 | 28.3% |
| Agricultural land owner | 25 | 18.7% |
| Petty business | 15 | 11.2% |
| Others | 13 | 9.7% |
| **Total** | **134** | **100%** |

***** MNREGS: Mahatma Gandhi national rural employment guarantee scheme

Majority of the elderly who were currently earning were employed under Mahatma Gandhi Rural Employment Guarantee scheme (32.1 percent). Manual laborers and agricultural land owners included 28.3 and 18.7 percent respectively. Other jobs included watchman, gardener etc.

**Table 5.11 Percentage of study population having a ration card**

| Ration card | Frequency | Percentage |
|---|---|---|
| Present | 333 | 97.9% |
| Absent | 7 | 2.1% |
| **Total** | **340** | **100%** |

Ration card was owned by 97.9 percent, there by getting the government benefits. Only 2.1 percent did not have a ration card.

**Table 5.12 Socio economic score of the study population**

| SES* category | Frequency | Percentage |
|---|---|---|
| Lower | 10 | 2.9% |
| Upper lower | 196 | 57.6% |
| Lower middle | 104 | 30.6% |
| Upper middle | 26 | 7.6% |
| Upper | 4 | 1.2% |
| **Total** | **340** | **100%** |

* SES: Socio economic score

Majority of the study population belonged to upper lower socio- economic group (57.6%) followed by lower middle (30.6%) and upper middle category (7.6%). There were 1.2 percent and 2.9 percent participants in upper and lower socio economic group respectively.

**Table 5.13 Co-morbidity present in the study population:**

| Co morbidity | Frequency | Percentage |
|---|---|---|
| Joint pain | 166 | 48.8% |
| Poor vision | 113 | 33.2% |
| Poor hearing | 33 | 9.7% |
| Diabetes | 48 | 14.1% |
| Hypertension | 81 | 23.8% |
| Asthma/ chronic obstructive pulmonary disease | 15 | 4.4% |
| Ischemic heart disease | 7 | 2.1% |
| Hemiparesis | 5 | 1.5% |
| Others | 18 | 5.3% |

Nearly 80 percent of the study population had one or more co morbidities. Majority of them suffered from joint pain (48.8%) followed by poor vision (33.2%) poor hearing (9.7%). About one fourth, 23.8 percent, had hypertension. Only 14.1 percent had diabetes. The other co morbidities were asthma/ chronic obstructive pulmonary disease (4.4%) ischemic heart disease (2.1%) and cerebro vascular accidents (1.5%).

**Anthropometry: (Body Mass Index)**

**Table 5.14 BMI categories according to WHO classification**

| BMI category | Frequency | Percentage |
|---|---|---|
| Severe under weight (<16kg/$m^2$) | 20 | 5.9% |
| Moderate under weight (16-16.9kg/$m^2$) | 7 | 2.1% |
| Mild under weight (17- 18.4kg/$m^2$) | 35 | 10.3% |
| Normal (18.5-24.9kg/$m^2$) | 186 | 54.7% |
| Pre obese (25- 29.9kg/$m^2$) | 72 | 21.2% |
| Obese class 1 (30- 34.9kg/$m^2$) | 17 | 5.0% |
| Obese class 2 (35- 39.9kg/$m^2$) | 3 | 0.9% |
| **Total** | **340** | **100%** |

Out of three forty study participants, one eight six had BMI between 18.5 and 24.9 kg/$m^2$. This constitute nearly one half (54.7%) of the total study participants. The prevalence of underweight among study participants were 18.3 percent (95%

CI 14.1- 25.5) of which 5.9 percent were severely under weight, 2.1 percent were moderate underweight and 10.3 percent were mild under weight. Rest of the population was overweight and obese. The percentage of participants who were overweight (pre obese) were 21.2. Five percent of the participants had BMI between 30 and 34.9 kg/$m^2$ (obese class 1). Only 3 had morbid obesity (BMI 35 – 39.9 kg/ $m^2$, obese class 2).

**Table 5.15 BMI categories according to WHO classification for Asia**

| BMI category | Frequency | Percentage |
|---|---|---|
| Severe under weight (<16kg/$m^2$) | 20 | 5.9% |
| Moderate under weight (16- 16.9kg/$m^2$) | 7 | 2.1% |
| Mild under weight (17- 18.4kg/$m^2$) | 35 | 10.3% |
| Normal (18.5- 22.9kg/$m^2$) | 129 | 37.9% |
| Pre obese (23- 27.4kg/$m^2$) | 107 | 31.5% |
| Obese class 1 (27.5- 32.4kg/$m^2$) | 32 | 9.4% |
| Obese class 2 (32.5- 37.4kg/$m^2$) | 10 | 2.9% |
| **Total** | **340** | **100%** |

According to WHO Asia classification only 37.9 percent had normal BMI. The prevalence of overweight and obesity were 31.5% and 12.3% respectively.

**Table 5.16 BMI categories according to Indian classification**

| BMI category (india) | Frequency | Percentage |
|---|---|---|
| Under weight (<18.5kg/$m^2$) | 62 | 18.2% |
| Normal (18.5- 22.9kg/$m^2$) | 129 | 37.9% |
| Over weight (23- 24.9kg/$m^2$) | 57 | 16.8% |
| Obese (25kg/$m^2$ and above) | 92 | 27.1% |
| **Total** | **340** | **100%** |

By the revised Indian BMI classification 27.1 percent were obese and 16.8 percent were overweight. Together 43.9 percent had BMI more than normal as compared to 18.2 percent who were under weight.

**Prevalence of anemia:**

The total prevalence of anemia among the study population was 38.2 percent (95% CI 33.0- 43.4).

**Table 5.17 Classification of Hemoglobin and anemia among women**

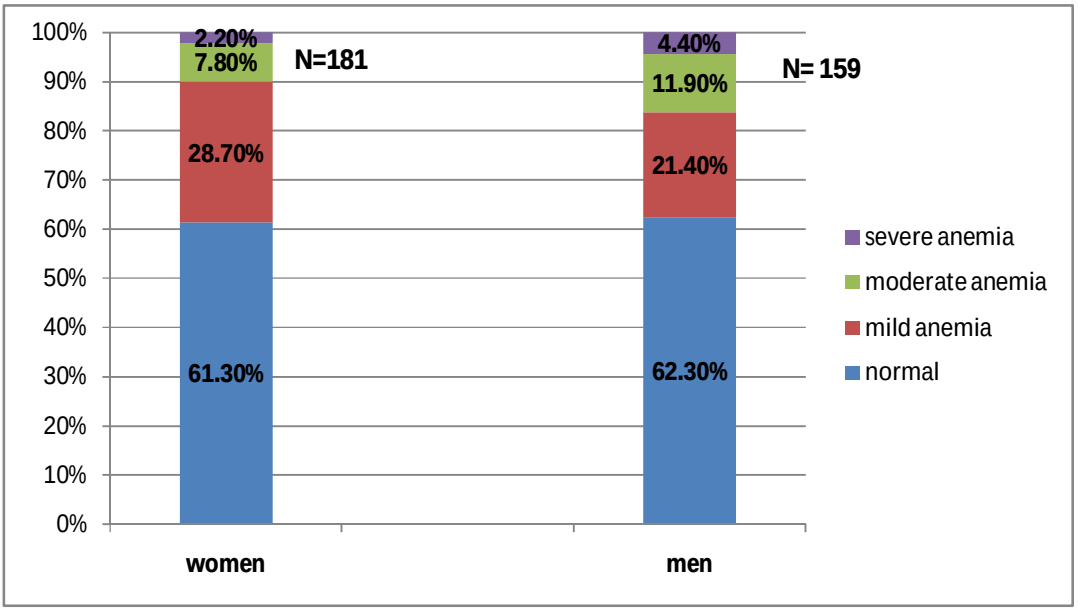
| Hemoglobin Category | Frequency | Percentage |
|---|---|---|
| Normal (12g/dl and above) | 111 | 61.3% |
| Mild anemia (10 to 11.9g/dl) | 52 | 28.7% |
| Moderate anemia (7 to 9.9g/dl) | 14 | 7.8% |
| Severe anemia (less than 7g/dl) | 4 | 2.2% |
| **Total** | **181** | **100%** |

In the study population, there were 181 women and 159 men. Among 181 women, 111 (61.3%) had a hemoglobin of 12g/dl and above (normal cut off for women). The percentage of women who were anemic was 38.7. Fifty two (28.7%) had mild anemia, fourteen (7.8%) had moderate and four (2.2%) had severe anemia.

**Table 5.18 Classification of Hemoglobin and anemia among men**

| Hemoglobin Category | Frequency | Percentage |
|---|---|---|
| Normal (13g/dl and above) | 99 | 62.3% |
| Mild anemia (12 to 12.9g/dl) | 34 | 21.4% |
| Moderate anemia (9 to 11.9g/dl) | 19 | 11.9% |
| Severe anemia (less than 9g/dl) | 7 | 4.4% |
| **Total** | **159** | **100%** |

**Figure 5.1 Anemia among women and men**



Similarly among 159 men, 62.3% had normal hemoglobin levels (13g/dl and above, normal cut off for men). The percentage of elderly men with anemia was 37.7 out of which 21.4% (34 men) had mild anemia, 11.9% (19 men) had moderate anemia and 4.4% (7 men) had severe anemia. There was no statistically significant association noticed between female gender and anemia. (p= 0.859)

The mean hemoglobin was 12.05 g/dl among women and 13.5 g/dl among men. The lowest and highest hemoglobin values for women were 5.4 g/dl and 15.2 g/dl respectively and for men 6.1 g/dl and 20.8 g/dl respectively.

**Table 5.19 Classification of serum albumin among study population**

| Serum albumin (g/dl) | Frequency | Percentage |
|---|---|---|
| <3.5 | 7 | 2.1% |
| 3.5 - 5.0 | 323 | 95.0% |
| >5.0 | 10 | 2.9% |
| **Total** | **340** | **100%** |

Majority, 95% had serum albumin within normal range. Only 7 had serum albumin less than 3.5g/dl. Out of the 7 who had low values, 6 had anemia. One among them had a Barthel score of 65. Nearly three percent had hyperalbuminemia (>5g/dl). The mean serum albumin for the study population was 4.4. The lowest and the highest values were 3.2 and 5.3 respectively.

**Prevalence of malnutrition:**

According to Mini Nutrition Assessment (MNA) scale there was zero prevalence of malnutrition among elderly in Kaniyambadi block.

**Table 5.20 Percentage of malnutrition in the study population - using MNA Screening**

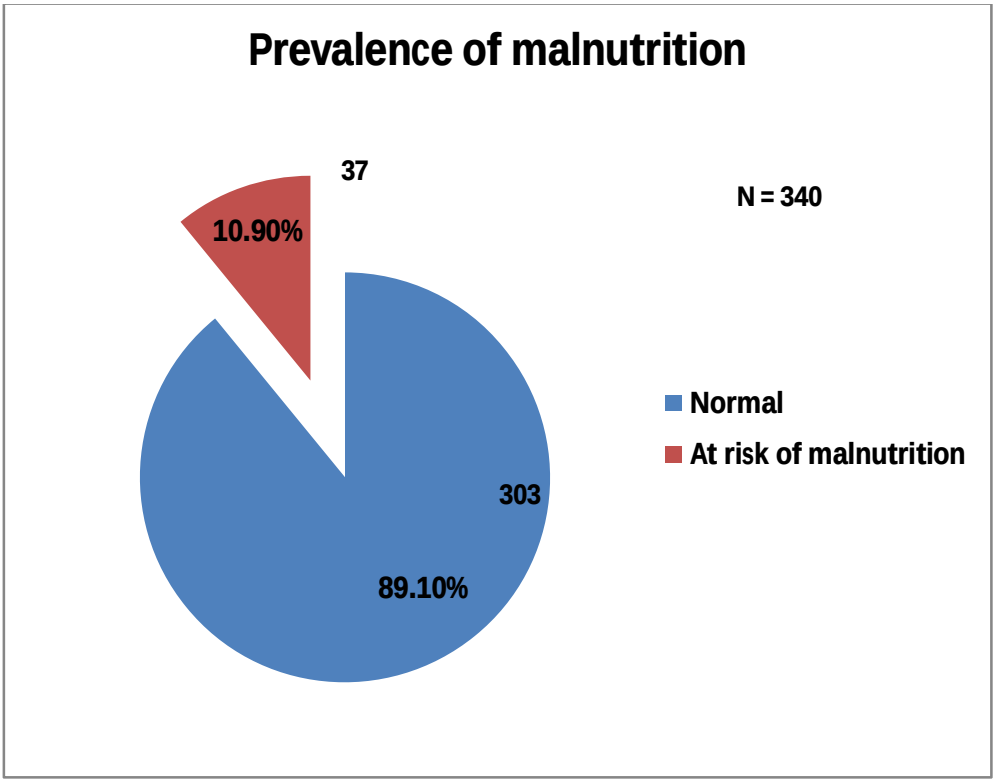
| MNA Screening | Frequency | Percentage |
|---|---|---|
| At risk | 83 | 24.4% |
| Normal | 257 | 75.6% |
| **Total** | **340** | **100%** |

At the end of screening using MNA 83 out of 340 (24.4%) were at risk of malnutrition. Rest 75.6% was normally nourished. Eight three were further analyzed using the assessment part of MNA scale to find out the actual prevalence of malnutrition. The prevalence thus calculated was given in table 5.21.

**Table 5.21 Prevalence of malnutrition using MNA**

| MNA classification | Frequency | Percentage |
|---|---|---|
| Malnourished | 0 | 0% |
| At risk | 37 | 10.9% |
| Normal | 303 | 89.1% |
| **Total** | **340** | **100%** |

**Figure 5.2 Prevalence of malnutrition using MNA**




Thus, after screening and assessment using MNA, the percentage of elderly who were malnourished was found to be zero. Therefore in Kaniyambadi block, the prevalence of malnutrition according to Mini Nutritional Assessment (MNA) scale was nil.

Thirty seven elderly were at risk of malnutrition. The prevalence of at risk of malnutrition were only 10.9 percent (95% CI 7.52- 14.28). Rest 89.1 percent of the study population were nutritionally well nourished according to this scale.

Out of thirty seven who were at risk of malnutrition seventeen (45.9%) were anemic. One had serum albumin level less than 3.5g/dl. Their mean BMI were 17.8kg/$m^2$.

**Table 5.22 Number of meals taken by study population**

| No of full meals | Frequency | Percentage |
|---|---|---|
| 1 meal | 2 | 0.6% |
| 2 meals | 83 | 24.4% |
| 3 meals | 255 | 75% |
| **Total** | **340** | **100%** |

Majority of the study population did not give any history of any weight loss, decrease in food intake or any psychological stress 3 months prior to the study. One third of the study population was having only 2 full meals and 2 were having only 1 full meal. Three fourth of the study population (75%) were having all three meals.

**Table 5.23 Protein consumption as per MNA scale among study population**

| Protein consumption markers * | Frequency | Percentage |
|---|---|---|
| Nil/1 yes | 256 | 75.3% |
| 2 yes | 76 | 22.4% |
| 3 yes | 8 | 2.4% |
| **Total** | **340** | **100%** |

*** 1. Atleast one serving of dairy products (milk, cheese, yoghurt) per day. 2. Two or more serving of legumes or eggs per week. 3. Meat, fish or poultry every day.**

Nearly three fourth of the study population (75.3%) answered either nil consumption or intake of only one of the products which were considered as markers for protein intake. Only 8 study participants were giving the history of intake of all three products which were considered as markers of protein consumption.

**Table 5.24 Vegetable consumption by study population as per MNA scale**

| 2 or more servings of vegetables | Frequency | Percentage |
|---|---|---|
| Yes | 323 | 95.0% |
| No | 17 | 5.0% |
| **Total** | **340** | **100%** |

Majority of the study population (95.0%) had 2 or more servings of vegetables in their diet. Rest 5% had less servings of vegetables.

**Table 5.25 Self view of nutritional status by study population as per MNA scale**

| Self view of nutritional status | Frequency | Percentage |
|---|---|---|
| View self as malnourished | 4 | 1.2% |
| Uncertain of nutritional status | 91 | 26.8% |
| View self as having no nutritional problem | 245 | 72.1% |
| **Total** | **340** | **100%** |

Majority (72.1%) never considered themselves having any nutritional problem. Only 1.2 percent had a self view of being malnourished. Nearly one fourth of the study population (26.8%) was very uncertain about their nutritional status.

**Table 5.26 Classification of mid arm circumference of the study population by MNA scale**

| Mid arm circumference | Frequency | Percentage |
|---|---|---|
| <21 cm | 5 | 1.5% |
| 21 to <22 cm | 10 | 2.9% |
| ≥22 cm | 325 | 95.6% |
| **Total** | **340** | **100%** |

Only five (1.5%) had mid arm circumference less than 21 cm. Another few (2.9%) had values between 21 and 22 cm. Rest (95.6%) had values more than 22 cm.

**Table 5.27 Classification of calf circumference of the study population by MNA scale**

| Calf circumference | Frequency | Percentage |
|---|---|---|
| <31 cm | 8 | 2.4% |
| >=31 cm | 332 | 97.6% |
| **Total** | **340** | **100%** |

Similarly 97.6 percent had calf circumference more than 31 cm. Only eight members in the study population (2.4%) had calf circumference less than 31 cm.

**Physical disability:**

The prevalence of disability among study population was 20.6 percent (95% CI 16.2- 25.0).

**Table 5.28 Classification of physical disability using Barthel Index**

| Barthel score | Frequency | Percentage |
|---|---|---|
| < 90 | 6 | 1.8% |
| 90-95 | 64 | 18.8% |
| 100 | 270 | 79.4% |
| **Total** | **340** | **100%** |

Seventy nine percent of the study population did not report any physical disability. Only one person, out of 340 study participants scored a Barthel value of 65. Next lowest value was 75 which were scored by 3 elderly participants. Out of the 6 who had scores less than 90, four belonged to the age category 65 to 69 years and the remaining two were more than 70 years of age.

**Table 5.29 Classification of Barthel score for climbing stairs**

| Climbing stairs | Frequency | Percentage |
|---|---|---|
| Unable | 2 | 0.6% |
| Needs help | 56 | 16.5% |
| Independent | 282 | 82.9% |
| **Total** | **340** | **100%** |

Among the different components in Barthel index, maximum dependency was seen in climbing stairs (17.1%). Two individuals (0.6%) were totally unable to climb stairs. Fifty six (16.5%) needed some help in climbing stairs. It was women who reported difficulty in climbing stairs more than men (68.9%). Rest 82.9% was independent.

**Table 5.30 Barthel score for feeding, bathing, grooming and dressing**

| Activities | Frequency | Percentage |
|---|---|---|
| **Feeding** | | |
| Needs help | 1 | 0.3% |
| Independent | 282 | 82.9% |
| **Bathing** | | |
| Dependant | 7 | 2.1% |
| Independent | 333 | 97.9% |
| **Grooming** | | |
| Needs help | 4 | 1.2% |
| Independent | 336 | 98.8% |
| **Dressing** | | |
| Dependant | 1 | 0.3% |
| Needs help | 5 | 1.5% |
| Independent | 334 | 98.2% |

One person needed help in feeding. Seven (2.1%) were dependant on others for taking a bath. Only four (1.2%) needed help for grooming. One was totally dependent on others for dressing. Rest five (1.5%) needed minor help from

others for dressing. Majority of the study population did not need any help in feeding, bathing, grooming and dressing.

**Table 5.31 Barthel score for bowel, bladder and toilet use**

| Activities | Frequency | Percentage |
|---|---|---|
| **Bowel** | | |
| Occasional accident | 1 | 0.3% |
| Continent | 339 | 99.7% |
| **Bladder** | | |
| Occasional accident | 6 | 1.8% |
| Continent | 334 | 98.2% |
| **Toilet use** | | |
| Need some help | 3 | 0.9% |
| Independent | 337 | 99.1% |

One had difficulty bowel control. Six (1.8%) had urinary incontinence. Nearly one percent needed some help with toilet use.

**Table 5.32 Barthel score for transfer and mobility**

| Activities | Frequency | Percentage |
|---|---|---|
| **Transfers** | | |
| Major help | 1 | 0.3% |
| Minor help | 3 | 0.9% |
| Independent | 336 | 98.8% |
| **Mobility** | | |
| Walks with help | 3 | 0.9% |
| Independent | 337 | 99.1% |

Nearly one percent needed some help in transferring. Rest of the 336 participants was independent and needed no help. Three participants needed help in walking. Majority (99.1%) were independent in terms of mobility.

**Table 5.33 Factors affecting anemia**

| Variable | | Anemia | | Unadjusted | | Adjusted | |
|---|---|---|---|---|---|---|---|
| | | **Present** | **Absent** | **P value** | **Odds Ratio (95% CI)** | **Odds Ratio (95% CI)** | **P value** |
| **Gender** | Female | 70 (38.7%) | 111 (61.3%) | 0.859 | 1.04 (0.67-.61) | 0.99 (0.63-1.55) | 0.976 |
| | Male | 60 (37.7%) | 99 (62.3%) | | | | |
| **Age category** | >= 75 years | 20 (57.1%) | 15 (42.9%) | **0.015** | **2.36 (1.16-4.8)** | **2.39 (1.17-4.88)** | **0.016** |
| | 60- 74 years | 46 (36.1%) | 88 (63.9%) | | | | |
| **Place of stay** | Living alone | 45 (39.1%) | 70 (60.9%) | 0.808 | 1.05 (0.66-.68) | 0.98 (0.59-1.61) | 0.944 |
| | Others | 85 (37.8%) | 140 (62.2%) | | | | |
| **SES** | Low ses | 84 (40.8%) | 122 (59.2%) | 0.232 | 1.31 (0.83-.07) | 1.34 (0.83-2.19) | 0.227 |
| | middle/ high | 46 (34.3%) | 88 (65.7%) | | | | |

Nearly 57% of the people in the group 75 and above were anemic as compared to 36.1 percent in the age group 60 to 74 years with an adjusted odds ratio of 2.399 (95% CI 1.177- 4.889) (p= 0.016). The percentage of people who were anemic in both the gender were almost equal (women 38.7%, men 37.7%). In low

ses 40.8% were anemic where as only 34.3% were anemic in middle and high ses combined. (p=0.227)

**Table 5.34 Factors affecting undernutrition**

| Variable | | Under Nutrition | | Unadjusted | | Adjusted | |
|---|---|---|---|---|---|---|---|
| | | **Yes** | **No** | **P value** | **Odds Ratio (95% CI)** | **Odds Ratio (95% CI)** | **P value** |
| **Gender** | Male | 35 (22.0%) | 124 (78.0%) | 0.091 | 1.61 (0.922.80) | **1.81 (1.02-3.19)** | **0.042** |
| | Female | 27 (14.9%) | 154 (85.1%) | | | | |
| **Age category** | >= 75 years | 10 (28.1%) | 25 (71.4%) | 0.095 | 1.95 (0.88-4.29) | 2.01 (0.90-4.52) | 0.091 |
| | 60- 74 years | 52 (17.0%) | 253 (83.0%) | | | | |
| **Place of stay** | Living alone | 19 (16.5%) | 96 (83.5%) | 0.559 | 0.84 (0.46-1.52) | 0.63 (0.33- 1.18) | 0.145 |
| | Others | 43 (19.1%) | 182 (80.9%) | | | | |
| **SES** | Low ses | 45 (21.8%) | 161 (78.2%) | **0.033** | **1.92 (1.05-3.53)** | **2.38 (1.25- 4.52)** | **0.008** |
| | Middle/ high | 17 (12.7%) | 117 (87.3%) | | | | |

Among elderly men, 22 percent were undernourished where as only 14.9 percent of the elderly women were undernourished. This difference was statistically significant. The odds of being malnourished were 1.805 times higher among elderly men as compared to elderly women. (p= 0.042). In bivariate analysis the difference was not statistically significant. [p= 0.091, OR= 1.61 (0.924- 1.824)]. But after multivariate analysis using logistic regression adjusting for the other variables the difference became statistically significant.

Similarly, 21.8 percent of those belonging to the low socio economic group were under nourished were as only 12.7 percent of those belonging to the middle and high socio economic group were under nourished. The odd of being malnourished was 2.378 times higher among those belonging to low socio economic group as compared to those belonging to middle and high socio economic group and this difference was statistically significant. (p= 0.008). Odds ratio after bivariate analysis was 1.924 (95% CI= 1.049- 3.528). The adjusted odds ratio calculated using logistic regression was 2.378 (95% CI= 1.251- 4.520).

In the study it was found that in the age category 75 years and above 28.1 percent was undernourished, where as in the category 60- 69 year group only 17 percent was under nourished. But this difference was not statistically significant (p= 0.091).

Among those who were living alone 16.5% were malnourished where as 19.1% were malnourished among those who were living with others. This difference was also found to be statistically not significant. (p=0.145)

**Table 5.35 Factors affecting physical disability**

| Variable | | disability | | unadjusted | | Adjusted | |
|---|---|---|---|---|---|---|---|
| | | some | Nil | P value | Odds ratio (95% CI) | Odds ratio (95% CI) | P value |
| **Gender** | Female | 48 (26.5%) | 133 (73.5%) | **0.004** | **2.25 (1.29-3.93)** | **2.81 (1.31-6.04)** | **0.008** |
| | Male | 22 (13.8%) | 137 (86.2%) | | | | |
| **Age category** | >= 75 years | 13 (37.1%) | 22 (62.9%) | **0.011** | **2.57 (1.22-5.41)** | **2.27 (1.28-4.02)** | **0.005** |
| | 60- 74 years | 57 (18.7%) | 248 (81.3%) | | | | |
| **Place of stay** | Living alone | 28 (24.3%) | 87 (75.7%) | 0.22 | 1.40 (0.82-2.41) | 1.34 (0.74- 2.43) | 0.337 |
| | Others | 42 (18.7%) | 183 (81.3%) | | | | |
| **SES** | Low ses | 50 (24.3%) | 156 (75.7%) | 0.037 | 1.83 (1.03-3.24) | 1.62 (0.87- 3.03) | 0.13 |
| | Middle/ high | 20 (14.9%) | 114 (85.1%) | | | | |

Among elderly women, 26.5 percent had some disability where as only 13.8 percent of the elderly men had some disability. This difference was statistically significant. The odds of having some disability were 2.814 times higher among elderly women as compared to elderly men. (p= 0.008).

In the study it was found that in the age category 75 years and above 37.1 percent had some disability, where as in the category 60- 74 year group only 18.7 percent had some disability. This difference was statistically significant (p= 0.005). The odds of having some disability were 2.266 times higher in age group 75 years and above as compared to 60 to 74 year age group.

In the low socio economic group 24.3 percent had some disability where as in the middle and high socio economic group 14.9% had some disability. But the difference was not statistically significant. (p= 0.13).

Among those who were living alone 24.3% had some disability where as only 18.7% had some disability among those who were living with others. This difference was also found to be statistically not significant. (p=0.337)

# 6. Discussion

We discuss here the results of a cross sectional study done among elderly living in a rural area of Tamilnadu to assess their nutritional status, physical disability and the various associated factors. The study was done in Kaniyambadi block which was the service area of CHAD, with whom there was a well established rapport which provided a good community participation in the data collection. Those belonged to the age group 60 years and above were selected for the study. The total study population was 340 who were selected from 17 clusters in Kaniyambadi block. Each cluster was selected using population proportionate sampling method. Design effect of 2 and a non response of 5 percent were considered while calculating the sample size. An interviewer administered semi structured questionnaire, which had a general part which dealt with socio demographic characteristics, Mini Nutritional Assessment (MNA) scale and Barthel Index, was used for data collection. Blood samples were collected for assessing the levels of hemoglobin and serum albumin. Nutritional status was assessed using MNA scale, hemoglobin and serum albumin levels and body mass index (BMI). Barthel index measures functional dependence. It assessed ten different activities like feeding, bathing, grooming, dressing, bowels, bladder, toilet use, transfers( bed to chair or mat and back), mobility( on level surfaces) and stairs. Each activity is scored as 0,5 and 10.(23) The maximum score attainable was 100 and minimum was 0. Studies have shown that Barthel Index in elderly population showed high percentage agreement for inter rater reliability.(24) Mini nutritional assessment (MNA) scale, a screening and assessment tool, was developed specifically in use among elderly patients in

hospital, nursing homes and community and was thus limited to persons with specific demographic correlates. MNA considered anthropometrical, medical, psychological and dietary factors in an 18 item assessment using point based scoring system to identify whether the patient is at risk of or suffering from malnutrition. Maximum attainable point was 29 and minimum was 0. An MNA score of less than 17 indicate that a person had protein energy malnutrition.(40) Studies had shown that sensitivity and specificity of MNA was 98 percent and 94 percent respectively. On cross validation, MNA showed high sensitivity and specificity; 97.9 percent and 100 percent respectively.(39) Biochemical markers, haemoglobin and serum albumin were also used to measure the nutritional status. Decrease in serum albumin was an independent indicator of severity of clinical state(41) and a good prognostic indicator of hospital survival in elderly patients. Studies had shown that anemia was related significantly to the parameters associated with malnutrition (p=0.0001).(62)

90 percent of the elderly who participated in the study were in the age group 60 to 74 years, out of which 60 to 64 years constituted the maximum, 41.2 percent. Thus majority of the study population were in the younger period of old age. The life expectancy of women were more than men. In the study population 53.2 percent were females and 46.8 percent males. Women usually get married at a younger age to a person much older to her, making her a widow at a younger age. Almost 25 percent of our study population were widows. Due to globalization and industrialization more and more of younger generation were migrating to the towns and cities in search of greater job opportunities leaving their parents behind, thus leading to the disintegration of age old joint family system. Close to 33% percent of the study population were living alone. . Interestingly the

percentage of nuclear family was almost equalent to the percentage of extended/ joint family, showing a changing trend in the society. Studies had shown that about 20 percent of the aged men and more than half of elderly women live with their children.(5) In our study 63.5% were living with their children. Almost 97 percent were living in their own property not dependent on others. One third (35%) of the elderly were involved in some economic activity, mainly involved in Mahatma Gandhi National rural employment guarantee scheme and manual labour. Only 43 percent were getting the benefits of government's old age pension scheme. Old age pension was a centrally sponsored social security scheme implemented by state government with some modifications. In Tamilnadu the elderly of age group 60 years and above who did not have any subsistence from his/ her sources of income or any financial support from the family can avail the benefits of the scheme. 97 percent were having ration card, there by availing government benefits. Majority of the elderly were independent, having their own means of living. Only 20 percent were dependent on children.

Health had an important effect on the quality of life. Elderly were vulnerable to long term diseases of insidious onset like diabetes, hypertension etc. In our study population nearly 83 percent had some co morbidity. The most common one was joint pain followed by poor vision. Hypertension and diabetes constituted 24 percent and 14 percent respectively. The knowledge about the co morbidities was essential for developing a proper health care delivery system.

Disability was considered as the restriction or lack of ability to perform an activity in the manner or range which is considered normal for a human being. According to a study conducted by National Sample Survey Organization (NSSO) the prevalence of disability in India was 1.8 percent.(21) Among the loco motor,

visual and hearing disability the contribution by the elderly population was 3.3, 23.4 and 25.5 percent respectively.(21) In our study population 48.8 percent had joint pain, 33.2 percent had visual complaints and 9.7 percent had hearing problems. We used Barthel index to assess the physical disability among elderly. This index had a score ranging from 0 to 100. Anybody less than a score of 100 were taken as having some disability. The prevalence of physical disability among elderly was 20.6 percent (95% CI 16.2- 25.0) according to the Barthel index. The most common activity which needed help was climbing stairs. A multi logistic regression was done to identify factors which affect physical disability. It was found that there was a statistically significant association exists between disability, gender and age. Disability was more among women than in men. Being a woman increased the odds of having some disability by 2.814 (95% CI 1.311- 6.041) times as compared to man (p= 0.008). Disability appeared to increase with age. Older the age the odds of having some disability increased by 2.266 times (95% CI 1.27- 4.04) (p=0.005). No statistically significant association was found between gender, place of stay and ses.

Elderly were prone to malnutrition. In the above study malnutrition was assessed using MNA scale, BMI, serum albumin and hemoglobin. Studies done in United Kingdom had shown prevalence between 25 to 35 percent in age group 60 to 80 years.(26) Another unpublished study in rural South India showed prevalence between 14 to 30 percent among the free living elderly population. In the current study the prevalence of malnutrition was nil according to MNA scale. The prevalence of those at risk of malnutrition was 10.9 percent (95% CI 7.52- 14.28). Low Body Mass Index (BMI) and diseases were mutually complementary. Diseases like tuberculosis, chronic obstructive pulmonary disease, malignancies

etc were usually associated with low BMI. The prevalence of underweight among elderly in Kaniyambadi block is 18.3 percent (95% CI 14.1- 25.5). But the more interesting fact was the presence of obesity. Using the original WHO BMI classification (48) the prevalence of obesity in Kaniyambadi was only 5.9 percent (95 % CI 3.3- 8.5). For Asian population WHO suggested a lower cut off point for public health action.(48) According to that the prevalence of obesity was 12.3 percent (95% CI 8.7-15.9). Alarmed by the increase in the number of diabetes in India, Union Ministry of health revised the BMI classification in India in 2008.(49) The prevalence of obesity among elderly according to this classification was alarmingly high 27.1 percent (95% CI 22.3 – 31.9). This was much higher than the prevalence of underweight and needed to be addressed while making policies because diseases which are debilitating, requiring long term care and that affect the quality of life, like cardio vascular diseases, cerebro vascular accidents, and diabetes are known to be associated with obesity. A multi logistic regression was done to identify different factors which affects under nutrition. Under nutrition was found to be more in elderly men than in women. The odds of being under nourished increased by 1.8 (95% CI 1.02- 3.19) times in men as compared to women (p= 0.042). Similarly, under nutrition is more among low ses group than in high ses group. Being in low ses group increases the odds of being under nourished by 2.4 times (95% CI 1.25- 4.32) as compared to high ses group (p=0.008).

Serum albumin was another important bio chemical marker for assessing nutritional status. Decrease in serum albumin was an independent indicator of severity of clinical state(41) and good prognostic indicator of hospital survival in elderly patients. Functional impairment and disability had also been associated

with low serum albumin in the elderly. Interestingly, in our study population 95 percent had normal serum albumin levels. Only 2.1 percent had value less than 3.5 percent. These numbers were so low to look for any statistically significant associations. Out of the 7 who had value less than seven, 6 were anemic. The lowest value in the study population was 65.

Anemia was the commonest hematological condition among elderly. It should never be considered as a part of normal ageing. Global prevalence of anemia among elderly is 23.9 percent (95% confidence interval 18.3-29.4).(57) In Kaniyambadi the prevalence of anemia among elderly was 38.2 percent (95% CI 33.0- 43.4) which was significantly higher than the global prevalence. This would fall into WHO classification of moderate to severe public health significance which demands special attention towards the problem. One third of the cause of anemia among elderly was nutritional. 38.7 percent of the elderly women were anemic of which 7.8 percent were moderately anemic and 2.2 percent were severely anemic. Similarly, 37.7 percent of the men were anemic of which 11.9 had moderate anemia and 4.4 percent had severe anemia. No statistically significant difference was noticed between male and female. Anemia also showed an increase with age. 57.1 percent of the study population above the age of 75 was anemic. Being in age group 75 and above the odds of being anemic increased by 2.39 times (95% CI 1.17- 4.89) as compared to the age group 60 to 69 years (p= 0.016) . The main sources of iron and vitamin b 12, the absence of which in diet causes anemia, were meat, fish and fortified food. Being on vegetarian diet, as per culture probably may be the reason for high prevalence of anemia in the community. The other reasons for high prevalence among elderly in the community needed to be explored further.

# 7. Limitations

Most of the study population was belonging to the age group 60 to 70 years. The number of elderly belonging to the higher age group was less. It was difficult to locate the randomly chosen people as most of them would have gone for work before dawn. Administration of MNA scale had certain difficulties. Some of the questions in the MNA, for example those related to neuro psychological problems were difficult to administer since those diseases were less common and the people were very unfamiliar with those type of diseases. Most of the people in this block followed a vegetarian diet as per their culture. The question related to the consumption of protein intake in the MNA scale dealt only with milk and milk products, fish and meat which was not a part of normal diet of the people in this block. Muscle and skin tone decreased with age. The reliability of using mid arm circumference and calf circumference for assessing nutritional status was questionable. Barthel index was a study tool more suitable for hospitalized, bed ridden patients than for community dwelling elderly. Applying such a tool in a community setting might not given accurate information regarding the prevalence of disability in the community.

# 8. Summary and Conclusions

A cross sectional study was conducted between September 2011 and April 2012 among the rural population of Tamilnadu to assess the prevalence of physical disability and nutritional status among elderly and the factors contributing towards poor nutrition and disability. Sample size was 340 and the sampling method used was cluster sampling. Within a cluster the study population was selected using simple random sampling. Data was collected using a semi structured questionnaire which had 3 parts; first part general profoma which dealt with socio demographic details, second part Mini Nutritional Assessment (MNA) scale for assessing the nutritional status and third part was Barthel index for assessing physical disability.

Conclusions: The prevalence of physical disability was 20.6 percent (95% CI 16.2- 25.0). ). Nobody was malnourished as per MNA scale and those who were at risk of malnutrition was 10.9% (95% CI 7.52- 14.28). Using BMI classification (revised by Ministry of health, India, WHO classification for Asia) the percentage of those who were malnourished was 62.1 percent of which 18.3 percent were under nourished, 16.8 percent were overweight and 27.1 percent were obese. The total prevalence of anemia among the study population was very high, 38.2 percent (95% CI 33.0- 43.4) thus coming under the WHO classification of moderate to severe public health significance. Disability was more in the age group 75 years and above (OR= 2.266 (1.276- 4.024), (p= 0.005) and among women (OR 2.814 ( 1.311- 6.041) (p= 0.004). The undernutrition according to the BMI had a statistically significant association with female gender (OR= 1.805 (1.021- 3.189) (p= 0.042) and low ses (OR= 2.378 (1.251- 4.521) (p= 0.008).

Anemia among men and women were 37.7% and 38.7% respectively. Anemia was more in the age group 75 years and above as compared to 60 to 69 year age group (OR= 2.399 (1.177- 4.889) (p=0.016).

# 9. Recommendations

Further studies should be done to explore the reason for high prevalence of anemia among elderly. Elderly, especially women, those belonging to the low ses and who are obese should be regularly checked for physical disability. Special medical screening camps should be conducted for elderly for early diagnosis of various disabilities for early initiation of treatment/rehabilitation. They should be educated about the right type of diet. Special check list should be made for elderly care. They should be educated about the need for regular annual health check. The existing day care centers should be used to provide more information regarding elderly health. More programs should be organized for the elderly to make them feel wanted.

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# 11. Annexure

## Annexure.1 General profoma

1. Date:
2. Serial number:
3. Name:
4. Age:
5. Height:
6. Weight:
7. Sex: male/ female
8. Current marital status: a) married b) unmarried c) widow d) widower
9. Type of family: a) nuclear family b) extended family c) joint family
10. Place of stay: a) living alone b) living with son c) living with daughter d) others
11. Type of house:a) hut b)katcha c)mixed d)pucca e)mansion f)govt houses
12. Land ownership: a) own b) rental c) government d) others
13. Current source of income: a) earning by self b) retirement pension c) dependant on children d) old age pension e) others
14. If currently earning, what kind of work is he / she doing? ( open ended question, prompt beedi worker) ----------
15. Does he/ she has a ration card? a) yes b) no if no why?----------
16. SES score: a) upper( 26- 29) b) upper middle ( 16-25) c) lower middle (11-15) d) upper lower( 5-10) e) lower( < 5)
17. Education

| | |
|---|---|
| Professional degree | 7 |
| Graduate | 6 |
| Intermediate or past high school diploma | 5 |
| High school certificate | 4 |
| Middle school completion | 3 |
| Primary school or literate | 2 |
| Illiterate | 1 |

18. Occupation:

| | |
|---|---|
| Profession | 10 |
| Semi profession | 6 |
| Clerk, shop owner, farm owner | 5 |
| Skilled worker | 4 |
| Semi skilled worker | 3 |
| Unskilled | 2 |
| Unemployed | 1 |

19. Per capita income per month in Rs

| | |
|---|---|
| >=13500 | 12 |
| 6750 – 13499 | 10 |
| 5050 – 6749 | 6 |
| 3375 – 5049 | 4 |
| 2025 – 3374 | 3 |
| 676 – 2024 | 2 |
| <= 675 | 1 |

20. Other co morbidities associated: ( open ended question- prompt diabetes, joint pain)

**a. Investigations:**

21. Hemoglobulin level:

22. Serum albumin level:

## Annexure.2 Mini nutritional assessment scale:

**a) Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?**

0 = severe decrease in food intake

1 = moderate decrease in food intake

2 = no decrease in food intake

**b) Weight loss during the last 3 months**

0 = weight loss greater than 3kg (6.6lbs)

1 = does not know

2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)

3= no weight loss

**c) Mobility**

0 = bed or chair bound

1 = able to get out of bed / chair but does not go out

2 = goes out

**d) Has suffered psychological stress or acute disease in the past 3 months?**

0 = yes

2 = no

**e) Neuropsychological problems**

0 = severe dementia or depression

1 = mild dementia

2 = no psychological problems

**f) Body Mass Index (BMI) (weight in kg) / (height in $m^2$)**

0 = BMI less than 19

1 = BMI 19 to less than 21

2 = BMI 21 to less than 23

3 = BMI 23 or greater

**g) Lives independently (not in nursing home or hospital)**

1 = yes, 0 = no

**Takes more than 3 prescription drugs per day**

0 = yes, 1 = no

**h) Pressure sores or skin ulcers**

0 = yes, 1 = no

**i) How many full meals does the patient eat daily?**

0 = 1 meal

1 = 2 meals

2 = 3 meals

**j) Selected consumption markers for protein intake**

• At least one serving of dairy products (milk, cheese, yoghurt) per day yes/ no

• Two or more servings of legumes or eggs per week yes/ no

• Meat, fish or poultry every day yes/ no

0.0 = if 0 or 1 yes

0.5 = if 2 yes

1.0 = if 3 yes .

**k) Consumes two or more servings of fruit or vegetables per day?**

0 = no 1 = yes

**l) How much fluid (water, juice, coffee, tea, milk...) is consumed per day?**

0.0 = less than 3 cups

0.5 = 3 to 5 cups

1.0 = more than 5 cups.

**m) Mode of feeding**

0 = unable to eat without assistance

1 = self-fed with some difficulty

2 = self-fed without any problem

**n) Self view of nutritional status**

0 = views self as being malnourished

1 = is uncertain of nutritional state

2 = views self as having no nutritional problem

**o) In comparison with other people of the same age, how does the patient consider his / her health status?**

0.0 = not as good

0.5 = does not know

1.0 = as good

2.0 = better

**o) Mid-arm circumference (MAC) in cm**

0.0 = MAC less than 21

0.5 = MAC 21 to 22

1.0 = MAC 22 or greater

**p) Calf circumference (CC) in cm**

0 = CC less than 31 1 = CC 31 or greater

## Annexure.3 Barthel index

**a) FEEDING**

0 = unable

5 = needs help cutting, spreading butter, etc., or requires modified diet

10 = independent

**b) BATHING**

0 = dependent

5 = independent (or in shower)

**c) GROOMING**

0 = needs to help with personal care

5 = independent face/hair/teeth/shaving (implements provided)

**d) DRESSING**

0 = dependent

5 = needs help but can do about half unaided

10 = independent (including buttons, zips, laces, etc.)

**e) BOWELS**

0 = incontinent (or needs to be given enemas)

5 = occasional accident

10 = continent

**f) BLADDER**

0 = incontinent, or catheterized and unable to manage alone

5 = occasional accident

10 = continent

**g) TOILET USE**

0 = dependent

5 = needs some help, but can do something alone

10 = independent (on and off, dressing, wiping)

**h) TRANSFERS (BED TO CHAIR AND BACK)**

0 = unable, no sitting balance

5 = major help (one or two people, physical), can sit

10 = minor help (verbal or physical)

15= independent

**i) MOBILITY (ON LEVEL SURFACES)**

0 = immobile or < 50 yards

5 = wheelchair independent, including corners, > 50 yards

10 = walks with help of one person (verbal or physical) > 50 yards

15 = independent (but may use any aid; for example, stick) > 50 yards

**j) STAIRS**

0 = unable

5 = needs help (verbal, physical, carrying aid)

10 = independent

**TOTAL (0–100):**

## Annexure.4 Information sheet

**Informed consent document:**

This informed consent information sheet applies to adult consent (over 18 years old)

The following information is provided to inform you about the research project and your participation in it. Please read this form carefully and feel free to ask any questions you may have about this study and information given below. You will be given an opportunity to ask questions, and your questions will be answered. Also, you will be given a copy of this information sheet. Your participation in this research study is voluntary. You are also free to withdraw from this at any time.

**Purpose of the study:**

The purpose of this study is to determine the prevalence of physical disability, to identify the types of disability among elderly, to determine the nutritional status and also to identify the association between the physical disability and nutritional status among the elderly in Kaniyambadi block, Vellore.

**Procedures to be followed and approximate duration of study:**

September 2011 to April 2012.

The study involves collection of blood and answering a few questions.

The investigator will come and perform the following procedures:

1. Collect approximately 3 ml of blood by injecting a needle with a syringe into your vein under aseptic precautions.
2. The investigator will interview you regarding your socio demographic/ socio economic status medical history, nutritional habits, physical disability etc. The interview will take approximately 20minutes.

**Expected cost:** Nil

**Description of the discomforts, inconveniences, and / or risks that that can be reasonably expected as a result of participation in this study:**

There are no major risks associated with this procedure. The injection for collecting blood may be painful. Rarely some people may faint during the procedure. But there are no major proven risks associated with this procedure.

**Unforeseeable risk:** Nil

**Compensation in case of study-related injury:** Nil

**Anticipated benefits from this study:**

If you are participating in this study, you can know the hemoglobin and serum albumin level in your blood. If levels are lower than normal, you will be referred to CHAD hospital for further investigations and treatment.

The potential benifits to science and humankind that may result from this study are an increased understanding of the prevalence and factors associated with physical disability and malnutrition among elderly in a rural community.

**Alternative treatment available:** Not applicable.

**Compensation for participation:** Nil

**Circumstances under which the principal investigator may withdraw you from the study participation:** nil

**What happens if you choose to withdraw from study participation?**

Your questionnaire results will be destroyed and your data will not be included in any result.

**Contact information:**

If you have any questions about this research study or possibly, please feel free to contact:

Dr.Sherin Susan Paul N at 09629209219 or Dr Vinod Joseph Abraham at 04162284436. Also feel free to find more information about the Christian Medical College's Institutional Review Board at 0416-2284207.

**Confidentiality:**

All efforts, within reason, will be made to keep your personal information in your research record confidential.

**Privacy:**

Your information may be shared with, the Christian Medical College, or the government, Christian Medical College Institution Review Board, if we required to do so by law.

Signature of witness …….

date.....

Signature of the investigator .....

date.....

**Annexure.5 WRITTEN INFORMED CONSENT DOCUMENT**

**Study Title:** Assessment of physical disability and nutritional status among elderly in a rural population

Subject's initials:----------

Subject's name----------

Date of birth/Age----------

Before you agree, the investigator must tell you about (i) the purposes, procedures and duration of research; (ii) the procedures which are experimental; (iii) any foreseeable risks, discomforts and benefits of the research;(iv) how confidentiality will be maintained.

The investigator must also tell you about (i) any available compensation or medical treatment if injury occurs;(ii) the possibility of unforeseeable risks; (iii) circumstances when the investigator may halt your participation;(iv) any added costs to you; (v) what happens if you decide to stop participating.

If you agree to participate, you must be given a signed copy of this document and a written summary of the research.

Please initial the box:

(i) I confirm that I have read and understood the information sheet dated----------for the above study and have had the opportunity to ask questions ( ).

(ii) I understand that my participation in the study is voluntary and that I am free to withdraw at any time, without giving any reason without my medical care and legal rights being affected ( ).

(iii) I understand that Sponsor of the study, others working on the sponsor's behalf, the Ethics committee and regulatory authorities will not need my permission to look at my health records both in respect of the current study and

any further research that may be conducted in relation to it, even if I withdraw from the trial. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published ( ).

(iv) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s) ( ).

(v)I agree to participate in the above study ( ).

If you have any questions about this research study, please contact Dr.Sherin Susan Paul at 09629721146 or my advisor, Dr. Vinod Joseph Abraham at 04162284436.

Your study in this research is voluntary, and you will not be penalized or lose benefits if you refuse to participate or decide to stop.

Signing this document means that the research study, including the above information, has been described to you orally, and that you voluntary agree to participate.

Signature of the participant …….

Date…….

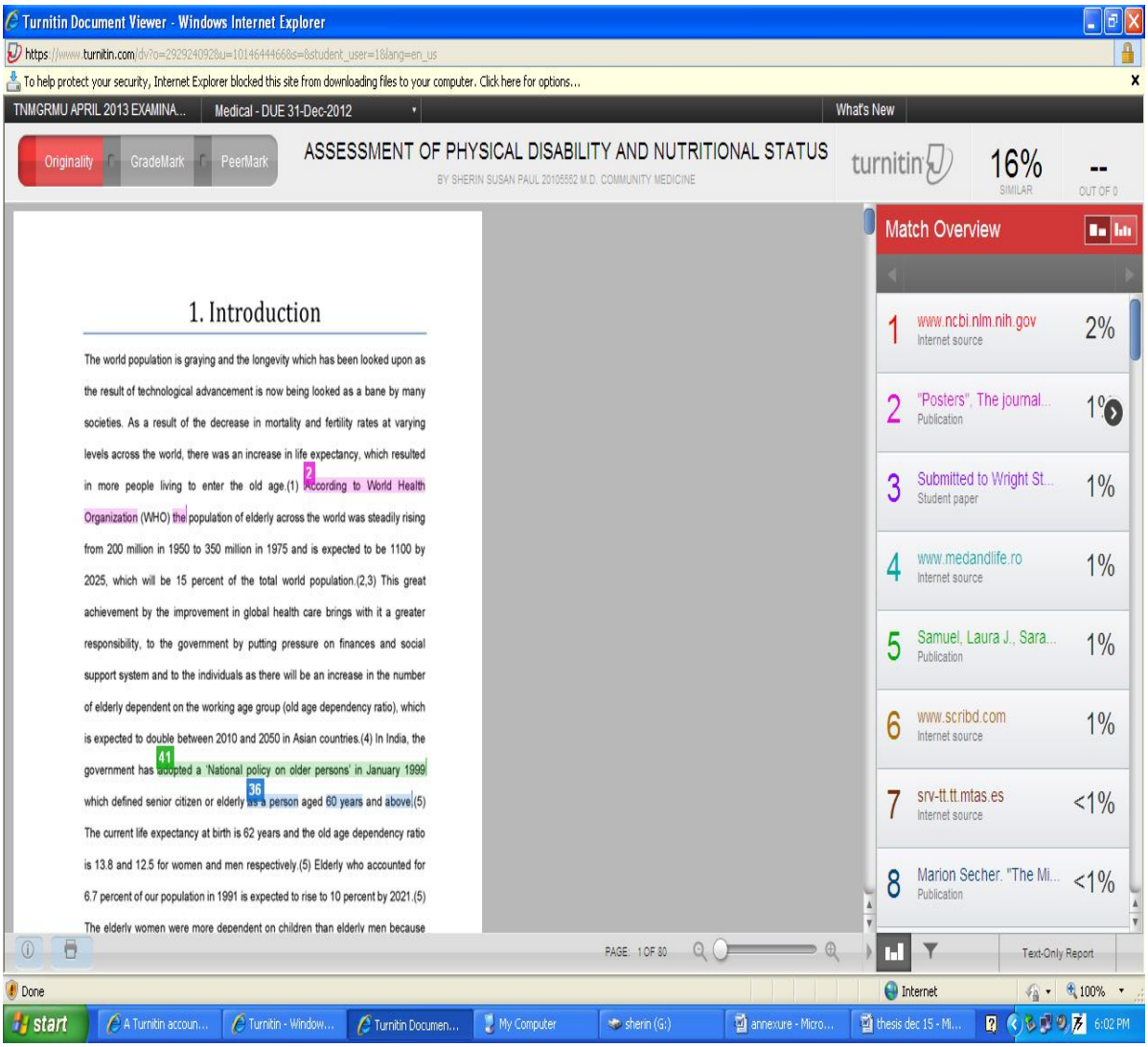
Signature of the Witness …….

Date…….

Signature of Investigator ……

Date……..

## Annexure 6 Antiplagarism



## Annexure 7 IRB Clearance


INSTITUTIONAL REVIEW BOARD (IRB)
CHRISTIAN MEDICAL COLLEGE
VELLORE 632 002, INDIA

Dr.B.J.Prashantham, M.A.,M.A.,Dr.Min(Clinical)
Director, Christian Counseling Centre
Editor, Indian Journal of Psychological Counseling
Chairperson, Ethics Committee, IRB

Dr.George Mathew, MS, MD, FCAMS
Chairperson, Research Committee &
Principal

Dr.Gagandeep Kang, MD, Ph.D, FRC Path
Secretary, Research Committee, IRB
Additional Vice Principal(Research)


June 15, 2011

Dr. Sherin Susan Paul N
PG Registrar
Department of Community Health
Christian Medical College
Vellore 632 004

Sub: **FLUID Research grant project NEW PROPOSAL:**
Assessment of physical disability and nutritional status among elderly in a rural population in South India
Dr. Sherin Susan Paul N, PG Registrar, Community Health, Dr. Vinod Joseph Abraham, Community Health, Dr. Prasad Mathews, Medicine.

Ref: IRB Min. No. 7395 dated 28.01.2011

Dear Dr. Paul,

The Institutional Review Board (Ethics Committee) of the Christian Medical College, Vellore, reviewed and discussed your project entitled "Assessment of physical disability and nutritional status among elderly in a rural population in South India" on January 28, 2011.

The Committees reviewed the following documents:

1. Format for application to IRB submission
2. Informed Consent Form and Information Sheet (English and Tamil)
3. Questionnaire
4. Cvs of Drs. Sherin Susan Paul, Prasad Mathews, Vinod Joseph
5. A CD containing document 1- 4

The following Ethics Committee members were present at the meeting held on January 28, 2011 at 2.00 pm in the CREST/SACN Conference Room, Christian Medical College, Bagayam, Vellore- 632002.

| Name | Qualification | Designation | Other Affiliations |
|---|---|---|---|
| Dr. B. J. Prashantham | M.A.(Counseling), M.A.(Theology), Dr.Min(Clinical) | Chairperson(IRB) & Director, Christian Counselling Centre | Non-CMC Staff |

# INSTITUTIONAL REVIEW BOARD (IRB)
# CHRISTIAN MEDICAL COLLEGE
## VELLORE 632 002, INDIA


**Dr B.J.Prashantham**, M.A.,M.A.,Dr Min(Clinical)
Director, Christian Counseling Centre
Editor, Indian Journal of Psychological Counseling
Chairperson, Ethics Committee, IRB

**Dr.George Mathew**, MS, MD, FCAMS
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Principal

**Dr.Gagandeep Kang, MD**, Ph.D, FRCPath
Secretary, Research Committee, IRB
Additional Vice Principal(Research)


| | | | |
|---|---|---|---|
| D. Jayaprakash Muliyil | BSC, MBBS, MD, MPH, DrPH(Epid), DMRC | Academic Officer, CMC | |
| Mr. Harikrishnan | BL. | Lawyer | Non-CMC Staff. |
| Mr. Samuel Abraham | MA, PGDBA, PGDPM, M.Phil, BL. | Legal Advisor, CMC. | |
| Mrs. S. Parrabiraman | BSc, DSSA | Social Worker, Vellore | Non-CMC-Staff |
| Mrs. Shirley David (on behalf of Mrs. Roseline Jayakaran) | M.Sc. (Nursing), RN, RM | Dean, College of Nursing, CMC. | |
| Dr. Sujith Chandy | MBBS, MD | Professor, Pharmacology Dept CMC. | |
| Dr. Srinivas Babu | MSc, Ph.D. | Sr. Scientist Neurological Sciences, CMC. | |
| Dr. Gagandeep Kang | MD, PhD, FRCPath. | Secretary IRB (EC)& Dy Chairperson (IRB). Professor of Microbiology & Addl. Vice Principal (Research), CMC | |

We approve the project to be conducted in its presented form

The Institutional Ethics Committee / Independent Ethics Committee expects to be informed about th progress of the project, any SAE occurring in the course of the project, any changes in the protoco and patient information/informed consent and asks to be provided a copy of the final report.

A sum of ₹ 80,000/- (Rupees Eighty thousand only) is sanctioned for 2 years out of which a maximum of ₹ 1,500/- can be spent for stationery, printing, Xeroxing and computer charges (if computers used are within the institution).

Yours sincerely,

George Mathew

Dr. George Mathew, MS, MD, FCAMS
Chairperson, Research Committee &
Principal, IRB