NUTRITIONAL PROFILE OF THE ELDERLY IN THE SAT (SEMI ARID TROPICS) VILLAGES OF MAHABOOBNAGAR DISTRICT, TELANGANA STATE, INDIA

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B. Sc. (Home Science)

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(FOODS AND NUTRITION)

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BY

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B. Sc. (Home Science)

THESIS SUBMITTED TO THE PROFESSOR JAYASHANKAR TELANGANA STATE AGRICULTURAL UNIVERSITY IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF

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DECLARATION

I, **CH. JYOTHI,** hereby declare that the thesis entitled **"NUTRITIONAL PROFILE OF THE ELDERLY IN THE SAT (SEMI ARID TROPICS) VILLAGES OF MAHABOOB NAGAR DISTRICT, TELANGANA STATE, INDIA."** submitted to the **Professor Jayashankar Telangana State Agricultural University** for the degree of **Master of Science in Home Science** is the result of original research work done by me. I also declare that no material contained in the thesis has been published earlier in any manner.

Place : Hyderabad

(CH. JYOTHI)
I. D. No. HHM/2012-02

Date : 28/12/2015

CERTIFICATE

Ms. CH. JYOTHI has satisfactorily prosecuted the course of research and that thesis entitled "**NUTRITIONAL PROFILE OF THE ELDERLY IN THE SAT (SEMI ARID TROPICS) VILLAGES OF MAHABOOBNAGAR DISTRICT, TELANGANA STATE, INDIA."** submitted is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that neither the thesis nor its part thereof has been previously submitted by her for a degree of any university.

Place: Hyderabad

Date: 28/12/2015

Dr. (Mrs.) K**. UMA DEVI**

Chairperson

CERTIFICATE

This is to certify that the thesis entitled **"NUTRITIONAL PROFILE OF THE ELDERLY IN THE SAT (SEMI ARID TROPICS) VILLAGES OF MAHABOOB NAGAR DISTRICT, TELANGANA STATE, INDIA."** submitted in partial fulfillment of the requirements for the degree of **'Master of Science in Home Science**' of the **Professor Jayashankar Telangana State Agricultural University,** Hyderabad is a record of the bonafide original research work carried out by **Ms. CH. JYOTHI** under our guidance and supervision.

No part of the thesis has been submitted by the student for any other degree or diploma. The published part and all assistance received during the course of investigations have been duly acknowledged by the author of the thesis.

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LIST OF SYMBOLS AND ABBREVATIONS

ANOVA	: Analysis of Variance
ADS	: Aging & Disability Services
ADL	: Activities of Daily Living
BMI	: Body Mass Index
BMD	: Bone Mineral Density
BCM	: Body Cell Mass
BMR	: Basal Metabolic Rate
CVD	: Cardio Vascular Disease
CU	: Consumption Unit
CC	: Calf Circumference
CI	: Class Intervals
CED	: Chronic Energy Deficiency
DRI	: Dietary Recommended Intakes
CD4	: Cluster of Differentiation 4
CD 8	: Cluster of Differentiation 8
et al.	: And others
e.g.	: For example, for instance
etc.	: And so on; and other people/things
ENP	: Elderly Nutrition Programme
EMR	: Electronic Medical Records
EMS	: Elderly Mobility Scale
FFM	: Fat Free Mass
Fig	: Figure
FFQ	: Food Frequency Questionnaire
FV	: Fruits and Vegetables
g	: Gram
GLV	: Green Leafy Vegetables
GIT	: Gastro Intestinal Tract
GERD	: Gastro Esophageal Reflux Disease
GOI	: Government of India
hr	: Hour
HIG	: High Income Group
HTN	: Hypertension
HDD	: High Dietary Diversity
i.e	: Means
ICMR	: Indian Council of Medical Research

IDA	: Iron Deficiency Anemia
IDD	: Iodine Deficiency Disorder
LIG	: Low Income Group
LDD	: Low Dietary Diversity
<	: Less than sign
mg	: Milligram
ml	: Milliliter(s)
MUAC	: Mid Upper Arm Circumference
MNA	: Mini Nutritional Assessment
MAC	: Mid-Arm Circumference
MIG	: Middle Income Group
MDD	: Medium Dietary Diversity
>	: More than sign
No.	: Number
NS	: Non- Significant
NV	: Non-Vegetarian
NSAIDS	: Non Steroidal Anti inflammatory Drugs
PEM	: Protein Energy Malnutrition
%	: Per cent
±	: Plus or - Minus
PA	: Physical Activity
QOL	: Quality of Life
RNI	: Recommended Nutritional Intake
RDA	: Recommended Dietary Allowance
RDI	: Recommended Dietary Intake
SC	: Scheduled Caste
ST	: Scheduled Tribe
SAT	: Semi -Arid Tropics
SES	: Socio-Economic Status
TB	: Tuberculosis
TBK	: Tactically bred killers
µg	: Microgram
µl	: Micro liter
VAD	: Vitamin 'A' Deficiency
WHO	: World Health Organization

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ABSTRACT

Aging is a complex phenomena including physiological changes linked to social conditions; management of aged in modern society poses many problems due to emergence of nuclear families. Elderly also experience profound psychological and environmental changes such as isolation, loneliness, depression and inadequate finance. These affect dietary intake ultimately impacting nutritional status. Aging is also associated with decreased physical activity and progressive depletion of lean body mass

Aged or the elderly people need utmost care to lead a normal life. The inevitable degenerative changes that occur during the aging process result in their functional decline. The current study is addressing these problems and was taken up to assess the nutritional profile of elderly in SAT villages of Mahaboob Nagar district, Telangana State, India.

The mean age of elderly women of Aurepalle was the highest with 73.3yrs compared to women of Dokur village and men of both the villages. Literacy level was very poor in Dokur village with highest per cent of illiterates.

The mean height, weight, BMI, MAC and calf circumferences of elderly of Dokur village were higher compared to that of elderly of Aurepalle village.

The dietary diversity scores of nearly 83% and 96% of elderly men of Aurepalle and Dokur respectively were medium, while 16% and 5% of elderly in Aurepalle and Dokur had a high dietary diversity. Only 5 elderly were in the middle income group and 2 were in the high income group, and all had a medium dietary diversity, except one person in Dokur who exhibited high dietary diversity. Aurepalle had a high dietary diversity score. While majority of the dependants had a medium dietary diversity score, 5 dependents of Aurepalle had a high dietary diversity.

Poor intake of protective foods among elderly could be attributed to lack of purchasing power, lowered capacity to prepare food for themselves, inability to chew food, lack of knowledge and negligence of self care. The high incidence of bone pain complaints was due to inadequate calcium intake and anaemia due to poor intake of iron rich leafy vegetables and occasional meat consumption.

Malnutrition indication score envisages that 25% of elderly are in normal nutritional status, and nearly 66.7% of elderly had risk of malnutrition. Nearly 8.3% percent of elderly were identified as malnourished.

Observation of clinical signs and symptoms of elderly showed a very small percentage of elderly (8.3%) having good nutritional status, especially of protein. Nearly 20% of elderly showed signs of tiredness and had symptoms like pale conjunctiva, pallor of tongue, lips, face, and skin due to anemia. Fifteen percent had spoon shaped nails indicating severe iron deficiency anemia.

Comparison of present BMI with previous BMI (Body mass indices) status shows normal and same for the previous past five years. The weight of the elderly was significantly increased from the previous nutritional status to present nutritional status, and height of the elderly reduced from the previous status to present status, which is natural with aging.

The results of the present study will help the nutritionists and policy makers to plan effective programmes for the benefit of elderly.

INTRODUCTION

Chapter I

INTRODUCTION

Aging is not a disease, but a biological process (Henry, 2000). The increased proportion of aged population, due to higher life expectancy is not necessarily devoid of any problems and in fact invites a lot of socio-economic, psychological, physiological, health and nutritional problems. Improvement in health care technology has resulted in increased life expectancy. The number of persons in old age has increased. In India, the elderly constitute about 7 per cent of the total population and by 2016; the number is likely to increase to 10 per cent. The number of old age people is expected to cross 177 million by the year 2025 (WHO, 2007).

In recent years, there has been a sharp increase in the number of older persons worldwide and more old people are alive nowadays than at any time in history. The proportion of the population aged 60 and over, is also growing each year. By the year 2025, the world will host 1.2 billion people aged 60 and over and rising to 1.9 billion in 2050. The same trend is also predicted in the EMR while the proportion of the elderly population to total population was 5.8% in 2000, it is expected to reach 8.7% by year 2025 and 15.0% by 2050 (Ibrahim *et al.*, 2005).

Aging is accompanied by physiologic changes that can negatively impact nutritional status. Sensory impairment, such as decreased sense of taste and smell that occurs with aging may result in reduced appetite. Poor oral health and dental problems can lead to difficulty in chewing, inflammation, and a monotonous diet that is poor in quality, all of which increase the risk of malnutrition. Progressive loss of vision and hearing, as well as osteoarthritis, may limit mobility and affect the elderly people's ability to shop for food and prepare meals. Energy needs decrease with age; yet the need for most nutrients remains relatively unchanged resulting in an increased risk of malnutrition. Along with physiologic changes, the elderly may also experience profound psychosocial and environmental changes, such as isolation, loneliness, depression and inadequate finances. These affect dietary intake ultimately impacting nutritional status. Aging is also associated with decreased physical activity and progressive depletion of lean body mass. Older persons,

who are obese are also at risk for sarcopenia because fat often replaces muscle mass, resulting in decreased muscle strength and functionality.

Traditional perceptions of old age have been challenged during the past few years and it is important that elderly people are not taken as a burden on society, but rather as knowledge asset. Nutritional status can be affected by social factors. Education plays a key role in the positive levels of nutrient intake by older people.

Caloric intake becomes a key player, as this is the stage when nutrient dense foods become important. Dentition becomes a major cause for elderly nutrition problems. Often the elderly have a weakened perception of thirst that can lead to dehydration, dry skin, and constipation. Changes in the gastrointestinal tract happen as the movement of food slows down. Constipation can be related to low fiber and/or fluid intake, medications, and/or lack of exercise. Nausea, indigestion, heartburn, and a reduction of vitamin B_{12} absorption are all typical gastrointestinal problems stemming from the aging process. Lack of social support could also influence nutritional deficits. The elderly depend upon each other when it comes to sharing the social events involved in shopping, preparing, and sharing meals. This support or lack thereof could have a major impact on appetite and dietary intake. Food faddism is one among many influencing factors on elderly food choices. For older persons, some dietary restrictions may be due to cultural and some due to physiological states.

Nutrition is an important determinant of health in persons over the age of 60 and above. Over the past decade, the importance of nutritional status has been increasingly recognized in a variety of morbid conditions including cancer, heart disease, and dementia in persons over the age of 65 (Srilakhmi, 2009).

Although there is no uniformly accepted definition of malnutrition in the elderly, some common indicators include involuntary weight loss, abnormal body mass index (BMI), specific vitamin deficiencies and decreased dietary intake (Reuben 2004).

Malnutrition in older patients is regularly under diagnosed (Gariballa, 2000) and many physicians have expressed their need for more education regarding nutritional status in older patients (Mihalynuk *et al*., 2007).

According to World Population Prospects, UN revision 2006, Indian aged population is currently the second largest in the world. Worldwide, the average, life span is expected to be extended by another 10 years. According to Rajan (2003), dependency ratios for the old had risen from 10.5% in 1961 to 11.8% in 1991. It is projected to be 16.1% by

2021. Despite reduction in overall morbidity in elderly population, the illness and disability has been increasing with increasing age. Inter-relationship between physical and psychological problems gives rise to functional impairment. Apart from these, elderly also face frequent episodes of infections and acute illnesses, which result in many disturbances or imbalances. Existing knowledge about nutrition and ageing suggests that as age increases, food and energy intake decreases because of malabsorption, decline in senses of smell, taste and chewing problem (Srilakhmi, 2009). Elderly population has increased over the years; but, the quality deteriorated. Elderly are one of the most vulnerable groups and require proper care and attention.

NFHS-II (1998) data showed that 14.7% elderly were partially dependent and 16.2% were fully dependent on others whereas, only 20.2% elderly were economically active and 79.8% elderly were non-active. Relatively larger proportions (76%) of elderly living alone were illiterate than elderly living with family.

Nutrition is an important element of health in the older population and affects the aging process. Older people often have reduced appetite and energy expenditure, which, coupled with a decline in biological and physiological functions such as reduced lean body mass, changes in cytokine and hormonal level, and changes in fluid electrolyte regulation, delay gastric emptying and diminish senses of smell and taste. Nutritional assessment is important to identify and treat patients at risk.

The main objectives of the study was to assess the socio-economic conditions and nutritional status of elderly population at Aurepalle and Dokur villages of Mahaboob Nagar District of Telangana and to compare the present socio-economic and nutritional status of the elderly population with the results of previous studies of ICRISAT in the same villages.

REVIEW OF LITERATURE

Chapter II

REVIEW OF LITERATURE

The assessment of nutritional status of elderly is pre-requisite for developing appropriate strategies and programmes for elderly. The literature pertaining to the nutritional status of elderly and other related factors is reviewed and presented under this section.

Ageing is a natural phenomenon and a biological reality. An individual can attain highest quality of life by adopting healthy practices like moderate physical activity, healthy eating, abstinence from any form of addiction and rational use of medications. Nutrition is an important determinant of active and graceful ageing. Elderly living in rural areas constitute good number, majority of people living in slum areas enter old age after a lifetime of poverty, deprivation, disease and poor access to health services. Malnourished elderly are more likely to require health and social services need more hospitalization and demand extra challenges from caregiver. So, early detection and prompt interventions are essential for prevention of malnutrition in this group. However, limited information is available in India regarding nutritional status of elderly in slum areas. This is the need of the hour to have data base which would help to prioritize interventions and resource allocations.

An ideal preventive health package for elderly should include various components such as knowledge and awareness about disease conditions, steps for their prevention and management, good nutrition, balanced diet and physical exercise. Considering all these facts, the present study ‘Nutritional profile of elderly in SAT villages of Mahaboob Nagar District, Telangana State, India’ was undertaken to assess the nutritional status of elderly living in rural area. This chapter reviews the work done by various researchers on related aspects under the following heads.

2.1 Physiological and psychological changes in aging

2.2 Socio- economic status of the elderly people

2.3 Nutritional status of the elderly

2.4 Nutrient intake of the elderly

2.5 Health status of the elderly people

2.1 PHYSIOLOGICAL AND PSYCOLOGICAL CHANGES IN AGING

The process of aging brings about a decline in biological, physiological, psychological functions and immunological changes. Which have an influence on the nutritional requirements. Physiological systems are adversely affected in the aging process including neuromuscular, gastrointestinal and renal system (Antia and Abraham, 2001).

Correlate *et al.,* (2001) studied cognitive functions among 1651 subjects of elderly and found that 30 per cent of the men and 48 per cent of the women had mild and severe cognitive deficit. The results also indicated that a better healthy diet score was associated with a lower prevalence of cognitive deficit.

Tyagi and Kapoor (2010) reported that there was a significant association between the indices of adiposity, lung functions, muscular strength and blood pressure among the elderly. More than 50 per cent of the elderly females were found to be overweight /obese. More than 60 percent of the females were found to belong to pre-hypertensive/ hypertensive category.

According to statistical projections of the WHO (2007) and Ana Lucia and Maria (2009), the growth rate of elderly will be 15 times during 1950 and 2050 and the increasing risk of chronic-degenerative diseases will be higher among elderly population.

Kim- Choii and Lee Haengshin (2001) conducted a survey on 585 elderly residing in three metropolitan cities of Korea. Results revealed that the female elderly were more vulnerable to malnutrition and the elderly living alone showed the poorest pattern of nutrient intake and anthropometry. Living arrangements is considered as one of the most important factors affecting the health and nutritional status of the elderly.

In multivariate logistic regression model studied by Zohoori Namvar (2001) among Russian population, it was reported that after adjusting for a number of chronic diseases and socio-economic factors, a weight loss of >3.00kg was significantly associated with an 87 % higher risk of having a disability 2 years later.

Prabhavathy Devi (2011) revealed that, the anthropometric measurements of majority of the women were in normal BMI, but except fat, the other nutrients intake were found to be lower than RDA, which shows that nutritional knowledge is essential.

Kalyan Bagchi (2000) reported that the preference for food alters significantly with age. There is a craving for sweet foods in general. Loss of teeth is a common feature in elderly.

Strandhangen *et al.* (2000) reported that there was a significant lower mortality among men with a high fruit consumption during 16 years follow up study until the age of 70 (P=0.042) after taking into the account of smoking, cholesterol and hypertension.

Daniel Bunout *et al.* (2001) reported that the elders who were receiving nutritional supplementation and training programme maintained functionality, bone mineral density and serum cholesterol levels and improved their muscle strength compared to the non-supplemented group.

Fiatarone *et al.* (1993) found that lower extremity muscle weakness in the elderly was consistently related to impaired mobility.

Lohman (1994) reported as the age advances both in men and women, there was a decrease in fat free mass (FFM). This was mainly due to loss of muscle, bone and viscera. The loss of tissues accompanies loss of body water, minerals and protein and fat free mass could decrease by about 30 per cent. The rate and degree of loss varies according to level of activity, gender and from individual to individual.

Kyle *et al.* (2001) study showed that the decline in FFM, BCM, and TBK cell accelerated in men and women after 60 years of age.

Daniela *et al.* (2013) reported that no significant correlation between the estimated glomerular filtration rate and either the percentage of CD4, CD8, and B cells or CD4/CD8 ratio was identified. The median percentage of CD8 +T cells was significantly lower in individuals with an estimated glomerular filtration rate of 60 ml/min/1.73m2.

2.2 SOCIO ECONOMIC STATUS OF THE ELDERLY PEOPLE

Grundy and Holt (2001) reported that all socio-economic indicators of elderly were significantly associated with differences in self reported health. The best pair of variables, according to criteria used, was educational qualification or social class paired with a deprivation indicator.

Niharika and Vibha (2013) reported that the socio- economic status of the families of elderly was poor and 48.3 per cent of them were from lower class and 46.6 per cent from middle class.

Rajbir Sachdeva *et al.* (2008) showed that urban elderly scored more than their rural counterparts as they were more literate and were exposed to media like TV, radio, newspaper etc. It was suggested that the intervention programme at the community level should be multi pronged and minimum for six months.

Vani Bhushanam *et al.* (2013) found that the clinical signs of nutritional disorders were, in general, not specific and mostly associated with old age. The awareness level of elderly in trends of nutrition knowledge was only 36%. However, individual differences were observed within the homes in all the criteria assessed.

Samad and Zoleikani (2013) reported that among socio-economic variables, age, marital status, income and literacy had significantly affected the quality of life of elderly people.

2.3. NUTRITIONAL STATUS OF THE ELDERLY

Nutritional status of the individual is very important as it gives the information regarding the food and nutrient intake, clinical and biochemical status. The increased proportion and number of elderly persons in the society caused growing concern about the role of nutrition in health and longevity. Very little information is available on nutritional status. It is important to assess the nutritional status of elderly because of its role in ensuring a better quality of life and their functional ability.

Prabhavathy Devi (2011) revealed that anthropometric measurements of majority of the elderly women showed of normal BMI. Except fat, the other nutrients intake was found to be lower than RDA. The major health problems were anemia and cataract. Bio-chemical profile showed that serum Hb level was lower.

2.3.1 Food and Nutrient Intake

Rossum *et al.* (2000) conducted a study on 2213 and 3193 elderly men and women to assess the dietary habits, dietary intake and knowledge. Results revealed that almost the intake of all macronutrients were higher in less educated subjects when compared with highly educated subjects. The intake of fiber was lower among the lesser educated subjects.

Jeya (2003) reported that the use of natural food flavors in the hospitalized elderly increased food and macronutrient intake. Although total energy and protein intakes were increased by 13-26 per cent and 15.28 per cent respectively, nutrient intakes remained low compared with requirements.

WhaYoung Kim *et al*. (2003) showed that elderly require about hundred fold higher concentrations of odor components except isovaleric acid, than the young people to recognize a particular smell.

Kimaya and Sharma (2013) reported that 74% elderly female and 73% males were found to be consuming 4-5 meals in a day and 92% and 91% of elderly females and males respectively consumed meals regularly. The mean intake of pulses ($z = 2.07$ $p<0.05$), other vegetables ($z = 2.03$ $p<0.05$), fruits ($z = 2.04$ $p<0.05$) and fat ($z = 2.53$ $p<0.05$) was found to be significantly higher in elderly males of 60-70 years than 70-80 years. However, the dietary intake amongst the elderly female of 60-70 years and 70-80 years did not show any significant difference. The macronutrient intake in the elderly showed a significant negative correlation with age and positive correlation with number of meals consumed.

Kamla Raj (2009) reported that studies on the nutritional status of a community with occupation, revealed that 53.1% of women were in the under nutrition category. This study showed that age of these women, age was significantly negatively correlated with anthropometric and body composition variables and indices.

Olayiwola *et al*. (2013) found that less than half (44%) have the knowledge that biological age of elderly begins at 60 years. About half had the knowledge that life expectancy has increased in Nigeria, and 70% strongly agreed on health policy for the elderly.

The knowledge of undergraduate toward the nutrition of elderly illustrated that those with food science and nutrition background had a good score (99%), while those without nutrition background (62%) had a poor score. A correlation existed between knowledge of ageing and elderly nutrition ($r = 0.23$; $p<0.05$).

Ravi Shankar *et al.* (2014) reported that the significantly higher percentage of individuals' ≥ 70 years of age (59.21%) had chronic energy deficiency than those between 60-69 years (45.12%) [2=4.17, df=1 p<0.02,]. Only 3.3% of elderly individuals were obese and had BMI >25. Chronic energy deficiency increases significantly with lowering of socio-economic status [2=32.82, df=2 p<0.001].

Ozge Kucukerdonmez (2005) reported that the MNA results (<17 points) indicated that 6.5% of the male and 8.8% of the female participants had inadequate nutrition. According to NSIC, 34.3% of males and 36.9% of females were classified as having a high risk of nutritional deficiency.

The higher incidence of malnutrition in elderly is well documented by Kirtana Pai, (2011) in a study and it was found that elderly nursing home residents have a higher risk of malnutrition with respect to the community dwelling.

Suzana *et al.* (2007) showed that majority of the elderly subjects (87.2%) were fully independent in performing daily tasks, with men having a significantly higher score compared to women ($p<0.001$). However, men were less likely to be able to perform a flexibility test (50.7%) than women (27.0%) ($p<0.05$). The mean energy intake for men (1412±461 Kcal/d) and women (1201±392 Kcal/d) were below the Recommended Nutrient Intake (RNI) for Malaysia. Moreover, 52.5% of men and 47.5% of women might have under reported their food intake. Dietary micronutrients most likely to be deficient were thiamin, riboflavin and calcium.

Anish Khanna and Prathiba Gupta (2013) reported that the nutritional status was significantly linked to age while sex was not found to be significantly associated. It was also found that nutritional status was significantly associated with socio- economic status as well as literacy status. It is thus recommended that income level as well as literacy levels should be paid greater attention in dealing with the elderly.

Nadine *et al. (*2004) reported that nutrition interventions could provide a basis for designing effective and measurable nutrition education programs for older adults.

A study conducted by Sachdeva *et al.* (2006) on "Efficacy of nutrition counseling on the nutritional and hematological profile of elderly males of urban and rural areas" reported that there was significant improvement in the nutrient intake and hematological profile of the subjects after nutrition counseling, but it did not meet the recommendations. The poor status could be due to low income, illiteracy, ignorance, low availability of foods, loneliness, depression etc. There should be multi pronged nutrition and health education programme, keeping in view the cost benefit analysis and severe financial constraints.

Sergio *et al.* (2007) reported that the average weights were 62.7kg for women and 70.3kg for men ($p < 0.05$), and the mean heights were 1.52m for women and 1.63m for men ($p < 0.05$). Age related changes in anthropometric values were identified. BMI values indicated that 62.3% of the population was overweight, and 73.6% of women and 16.5% of men had high fat tissue distribution.

Maria *et al. (*2009) reported that among the ADL variables, eating partial (42.9%) or complete (12.9%) dependence was found in more than half of the malnourished elderly, and 13.4% of those were at risk of malnutrition and 2.5% without malnutrition.

Mohapatra *et al.* (2009) reported that the average total energy consumption, as well as protein, iron and calcium were found to be significantly more for male than female elderly subjects, in urban and rural areas of Varanasi district. About 44% male and 40% female elderly patients were underweight and according to age group of male subjects; BMI was insignificant while it was significant for the females.

Nyaruhucha *et a*l. (2004) reported that 30% and 26% of the institutionalized males and females, respectively, and none of the non-institutionalized males was observed to be overweight. On the other hand, 39% and 23% of the non-institutionalized males and females, respectively, were underweight or malnourished.

Neelam yadav *et al. (*2012) showed that 38.9% elderly were 'well nourished' and 37.09% were 'at risk' while 24.97% were 'malnourished'. According to BMI, maximum subjects (48.46%) were normal whereas 36.92% were obese, 14.61% were found to be under weight. Correlation was found to be not significant in the case of vitamin-C in rural males, females and urban females and highly correlated ($r=0.71$; $p>0.01$) in the case of urban males. The intakes of all the nutrients were significantly less in malnourished group in comparison to well nourished group. Half of the elderly subjects consumed more calories than the RDA.

Lisette *et al.* (2004) showed that a healthy lifestyle at older ages is related to a delay in the deterioration of health status and a reduced mortality risk.

Anku Moni and Neelakshi (2013) reported that the prevalence of under nutrition (BMI <18.5) was found to be 22.2% and over nutrition, which includes overweight (BMI >25-29.99) and obesity (BMI ≥30) was 12.5%. Significant association was found between nutritional status, socio-economic status and number of major meals a day. No significant relationship could be elicited between living status and nutritional status.

Sarah Forster and Gariballa (2005) reported that the body weight, body mass index, mid-upper arm circumference, haemoglobin, serum albumin and plasma ascorbic acid were all significantly lower in people aged ≥ 75 years compared with those < 75 years of age. Although riboflavin (vitamin B2), 25OH Vitamin D3, red-cell folate and vitamin B12 concentrations were lower in those aged ≥ 75 years, differences were not statistically significant. After adjusting for disability and co-morbidity in a multivariate analysis, age alone had a significant and independent effect on important anthropometric and biochemical nutritional assessment variables.

2.4 NUTRIENT INTAKE OF THE ELDERLY

Maria *et al.* (2015) reported that the nutritional status in the elderly was found to be negatively influenced by motoric eating difficulties including problems with manipulating food on the plate and transporting food to the mouth.

Gurpreet *et al.* (2012) reported that the lean body mass decreased significantly ($p \leq 0.05$) as the age progressed, the values for four age groups being 74.9, 68.9, 62.8 and 60.9%, respectively. The per cent adequacy of protein by four age groups was 69.6, 78.2, 80.0 and 66.3 respectively when compared to RDA while fat intake was much higher, *i.e.* 245.5, 271.8, 288.4 and 250.8%, respectively. The mean physical activity level (PAL) of the subjects ranged between 1.49 - 1.60. The physical activity level values showed that majority of the subjects (87% - 94%) from different age groups were having sedentary life style.

2.5 HEALTH STATUS OF THE ELDELY PEOPLE

Riyami *et al. (*2009) reported that about 45% of the elderly were overweight or obese. Overall, it was found that poor knowledge of nutrition plus some nutritional imbalances and low levels of physical activity were responsible for obesity.

Significant sex differences existed in elderly peoples' nutritional knowledge, consumption of fluids, milk and sweets, use of dietary regimens and experience of appetite change. The findings warrant reorientation of the existing health promotion strategy for the elderly.

Shraddha *et al.* (2012) reported that the disorders of oral cavity were more prevalent among aged male (40.6%), while diseases of skin were more prevalent among aged females (10%). Most common disorders reported among elderly were diseases of the eye (51.7%) followed by endocrine, nutritional and metabolic diseases (38.4%).

Sumon Kumar *et al.* (2012) reported that mean body mass index (BMI), hemoglobin, alanine transaminase (ALT), albumin, vitamin B12, and fasting blood sugar (FBS) were significantly lower and serum creatinine, vitamin D and folate were significantly higher among elderly compared to that of middle aged population.

Sherina *et al. (*2004) reported that the nutritional risks were found to be significantly associated with age ($p=0.015$), marital status ($p=0.00$), chronic illness ($p=0.000$), functional disability ($p=0.000$) and depressive symptoms ($p=0.010$).

Balamurugan and Ramathirtham (2012) found that majority of the elderly, both male and female, were unhealthy. The most common health problems faced by the aged people include eye sight, hearing, joint pains, nervous disorders, weakness, heart complaints, asthma, tuberculosis, skin diseases, urinary problems and others. More health problems were reported by women compared to men.

Kumari Suchetha *et al. (*2011) reported that women had a slightly higher mean BMI than men. None of them were found to be severely obese. Women were found to be more overweight and obese compared to that of men. Percentage of vitamin C deficiency increased significantly with age in both the sexes. Men were found to be slightly more deficient in vitamin C compared to that of women. Iron deficiency was more prominent in women.

Kirtana Pai (2011) showed that the elderly at home had higher BMI ($p<0.001$) and higher MNA (Mini nutritional assessment) scores ($p<0.001$) compared to those living in old age homes. The MNA results revealed that 19.4% of subjects were malnourished and 57.4% were at risk of malnutrition among the old age home residents. The prevalence of malnutrition by MNA was 2%, those at risk of malnutrition were 14.7% in free living elderly. The results of this study show a high risk of malnutrition ($p<0.05$) in the old age

home residents, and confirm the need for increased surveillance of nutritional status among residents of old age homes.

Smitesh Gutta *et al.* (2013) found that 45% of the elderly had a repeat fall after the age of 60 years owing mainly to poor vision, osteoporosis, anemia or the use of more than 3 chronic medications. Both the elderly and the caregivers were found to have poor knowledge regarding prevention of falls. Health education (OR 0.418; 95% CI: .176-.991) and compliance to a prescribed intervention for at least 6 months (OR 0.088; 95% CI: .032-.244) was found to be associated with less number of falls.

Ajitha *et al*. (2011) reported that nearly one fifth of elderly were obese. Overweight and obesity were reported more among females and nearly three fourths of the males were below or equal to normal BMI. Morbidities associated with musculoskeletal system (38.8%) were reported predominantly such as arthritis, lumbar pain etc. Patients reporting with communicable diseases were found to be low (1.7%). Similarly morbidities associated with ENT and other systems were also found to be low. Increasing age is associated with decline in prevalence of obesity and increase in prevalence of underweight. It is found that the burden of chronic diseases was high among the elderly. Overweight and obesity were high among females and characteristically prevalence of underweight increases with the advancing age.

Costa Bruna *et al. (*2012) reported that there was high prevalence of overweight (46.1%) among subjects, according to body mass index, as well as risk of malnutrition, according to the Mini Nutritional Assessment (67.3%), and inadequate intake of nutrients. In the decision tree analysis, it was found that the more independent elderly, who received visits and contributed financially less to the institution, had better nutritional status. Inadequate nutritional status associated with social conditions and mobility indicates the need to promote healthy eating habits by a nutrition team in conjunction with nursing staff and other professionals providing comprehensive health care for the elderly.

Zarina *et al*. (2006) reported that the study of BMI, 18.5-22kgm, indicating chronic energy deficiency, was found in 50% of the population. MNA revealed a prevalence of 26% for protein–energy malnutrition and 62% for risk of malnutrition. Health problems rather than age had a negative impact on nutritional status. Level of education and food expenditure were directly associated with nutritional status.

Olayiwola and Deji Samson (2013) found that health behaviors' include going for medical check-ups (38%), the use of quality drugs (70%) and a preference for traditional

medicine (28%). Food habit divulges the fact that 63% eat thrice daily; 50% buy food from vendors and 94% have favorite foods. Factors such as nutrition knowledge and body mass index (BMI) correlated significantly with health behavior ($p<0.05$). The mean nutritional vulnerability score was higher for women than men ($p<0.05$).

Shilpa Jose and Kumari (2014) reported that the study of MNA demonstrated a sensitivity of 90.2% per cent and specificity of 96.4% per cent in identifying well nourished and malnourished elderly, which is excellent. Use of BMI as a 'gold standard' also showed that MNA had excellent sensitivity (95.4%) and specificity (93.9%) in identifying malnutrition.

Olayiwola and Ketiku (2006) reported that based on Body Mass Index (BMI), more than half of the respondents had an acceptable nutritional status with a BMI between 18-25 (63% male; 58% female) whilst 15% of the males and 14% of the females were under weight with BMIs below 18 and 3% of the males had severe malnutrition (BMI below 15). According to the nutritional vulnerability checklist, only 10% of the males and 4% of the females were not nutritionally vulnerable. The majority were either moderately vulnerable or (50% male; 50% female) or highly vulnerable (39% male and 46% female).

Reddy and Papa Rao (2010) found that well-being and BMI are related to self-reported health status. Regarding BMI, subjects who rated their health as good/fair tended to have BMI in the normal range. In the poor self-rated health group, a maximum of 55% of males and 47% of females were below 19 units of BMI, which was reflected in the increase in odds ratio of 1.361 in males and 1.134 in females between good versus poor health ratings.

Syed *et al*. (2013) reported that an overwhelming majority (68.2%) of elderly enjoyed a good quality of life, while those having a fair/poor quality of life were $\leq$ 15%. Quality of life was better in males in physical, psychological, social and environmental domains. Majority of the subjects were anemic (64.5%), suffering from dental problems (62.2%) and joint pains (51.4%). Maximum numbers of subjects (92.7%) were utilizing non-government health care facility due to long distance from their houses (33.3%).

Ngatia *et al*. (2008) reported that the level of malnutrition using the mid upper arm circumference was 18.8% while by body mass index was 11.4%. Of the population assessed, 46.4% had normal nutritional status while 40.9% were overweight, with more females (48.0%) than males (25.9%) being overweight. The study established that many of the elderly persons suffered from dental problems, especially periodontitis with 89.9% having dental plaque, calculus 85.6%, gingival recession 82.5% and bleeding gums 77.4%.

The decayed index missing and filled teeth, was 7.173 with 19.7% caries free, 51.9% reported tooth mobility and edentulousness was common.

Peter *et al.* (2011) reported that the mean carbohydrate intake was significantly below the RDI in Non vegetarian only (female Vegetarian: 47.8±7.5E%, female Non vegetarian: 43.3±4.6E%, male vegetarian: 48.1±6.4E%, male Non vegetarian: 42.3±3.6E%), while protein (female vegetarian:17.3±3.4E%, female Non vegetarian: 19.5±3.5E%, male Vegetarian: 17.8±3.4E%, male Non vegetarian: 21.0±2.0E%), and saturated fat intake (female vegetarians: 25.4±8.2 g/day, female Non vegetarians: 32.2± 6.9 g/day, male vegetarians: 31.4±12.9 g/day, male Non vegetarians: 33.4±4.7 g/day) were too high in both Vegetarian and Non vegetarian. Mean blood concentrations for vitamin B12, folic acid, iron, and calcium were normal in all 4 groups. Mean zinc blood serum was below the reference value in all groups, whereas estimated zinc intake was in agreement with the RDI. The mean blood cholesterol concentration was above the 200 mg/dl upper limit in the Vegetarian group (213 40 mg/dl) and below that limit in the Non vegetarian (188±33 mg/dl) group.

MATERIALS AND METHODS

Chapter III

MATERIALS AND METHODS

The research on “Nutritional Profile of the Elderly in the SAT (Semi - Arid Tropics) Villages of Mahaboob Nagar District, Telangan State, India” was conducted during March - May 2014. The materials and methodology used for conducting the study and analysis of data are given in the following heads.

3.1 Research design

3.2 Location of study

3.3 Selection of sample

3.4 Selection of tools

3.5 Methodology

3.6 Data analysis

3.1 RESEARCH DESIGN

"Research is defined as a process of steps used to collect and analyze information to increase our understanding of a topic or issue.”

An exploratory research design was adopted to conduct the study. Exploratory research design is a type of research conducted for a problem, which is a process of gathering facts and doing research that later allows for the team to create the best research design or data collection method available for specific subjects. The present study is a part of longitudinal study of Research program on Markets, Institutions and Policies (RP-MIP) of ICRISAT, Patancheru and the results of the present study will be compared with available data of previous results ICRISAT.

3.2 LOCATION OF THE STUDY

The locations selected for the study were Aurepalle village of Mudgal mandal and Dokur village of Devarakadra mandal of Mahaboob Nagar district, Telangana State, India. The present Mahaboob Nagar district was earlier known as Palamooru located in the Telangana region (Plate 3.1). The geographical location and agricultural back ground of the two villages is given in the following sections.

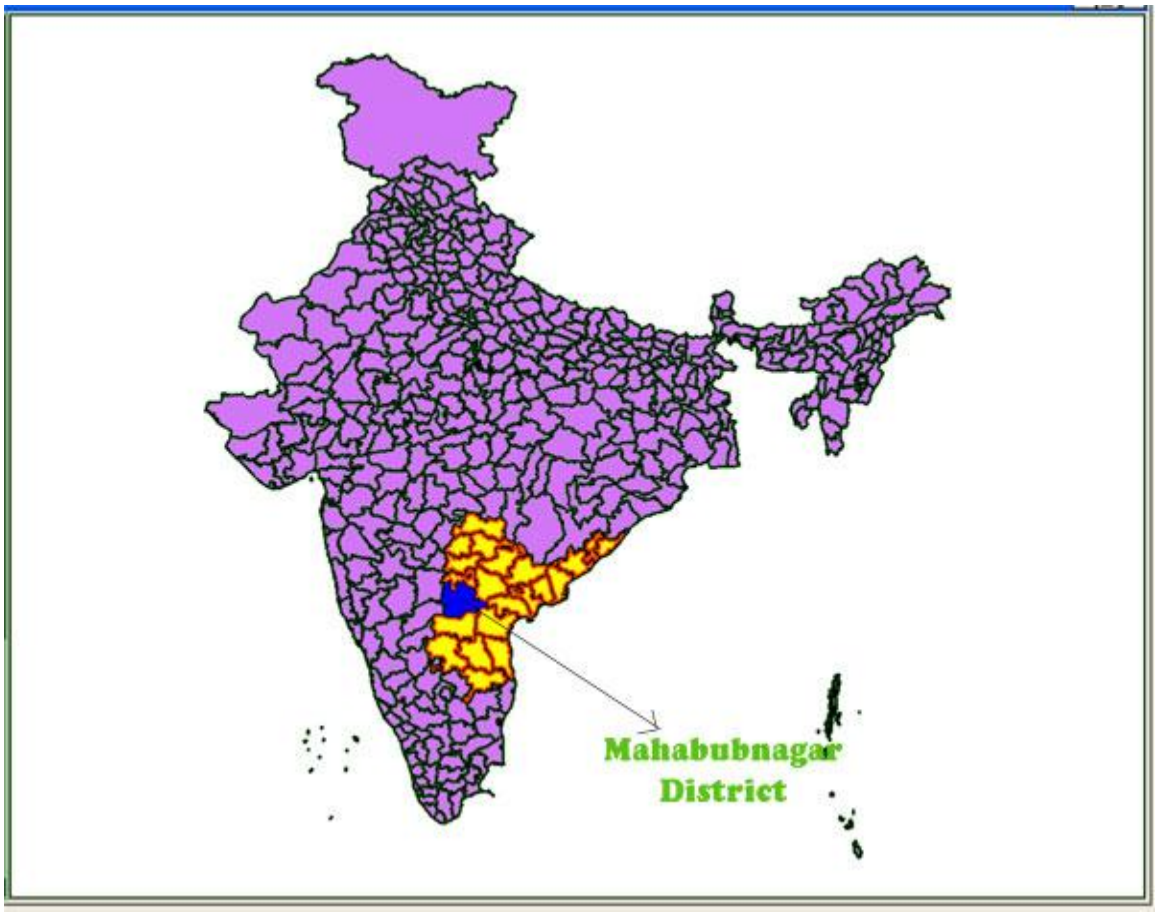

Plate 3.1. Location of Mahaboob Nagar district of Telangana State, India.

3.2.1. Aurepalle Village

Aurepalle village (16° 51'N 78° 37' E) is situated in Madgul mandal in Mahaboob Nagar district (16° 73' N and 77° 98' E) in the Telangana state (Plate 3.2). To reach Aurepalle, one needs to travel to Amangal town, which is about 60km from Hyderabad on the Hyderabad-Kalvakurthi State Highway and then travel a further distance of 10km East on a tar road.

Aurepalle has an annual rainfall of about 700 mm, distributed erratically. Soil depth ranges from 15 to 45cm. Cotton, paddy, sorghum, pearl millet, castor and pigeon pea are the major crops cultivated in the village.

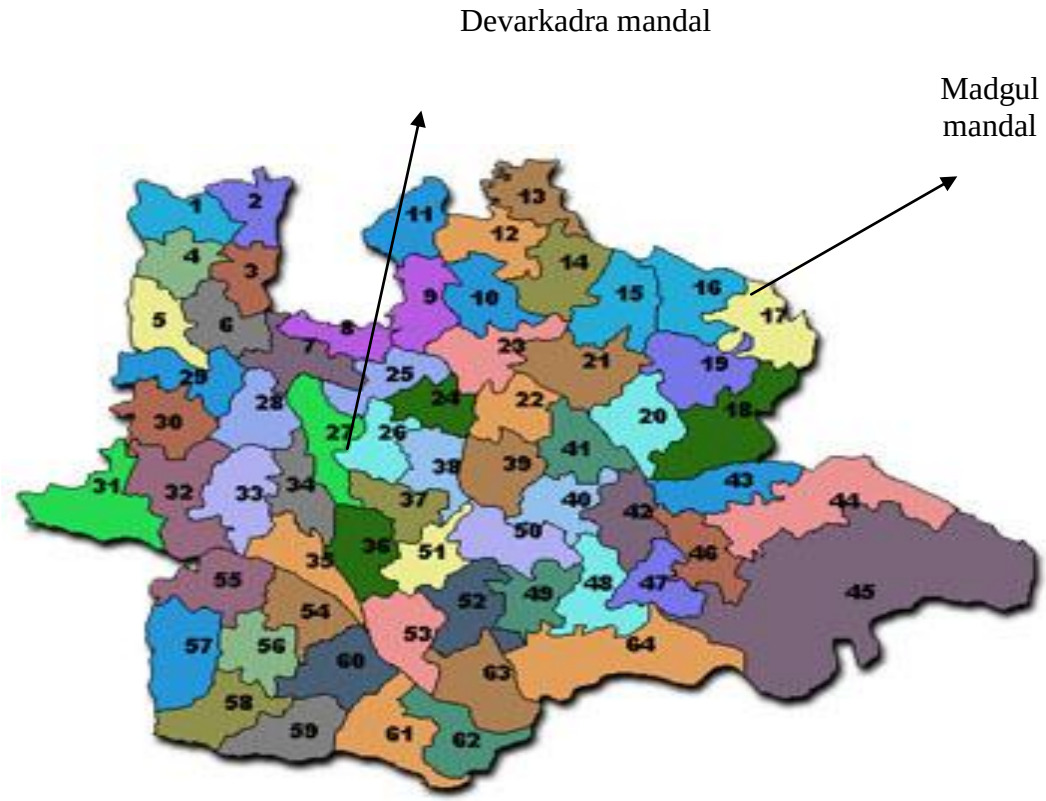

Plate 3.2. Location of Madgul mandal and Devarkadra mandal of MahaboobNagar.

3.2.2. Dokur village

Dokur village (77°50'E 16°36'E) in Devarkadra mandal of Mahaboob Nagar district (16°73'N 77°98'E) is about 125 kilometers south of Hyderabad and can be reached via Devarkadra on the Hyderabad-Raichur road (Plate 3.2). The village is 5 kilometres to the west of Devarkadra on an untarred road. The village fell under the jurisdiction of Atmakur mandal in 1975-76 and now falls under Devarkadra mandal. Dokur's original name was "Dakur" derived from the Indo-Persian Urdu word "daku," meaning "gang of armed dacoits". It is believed that dacoits used to take shelter in Dakur due to its thick vegetation. Eventually, the name Dakur became corrupted to Dokur.

The village is drought prone and adequately represents the semi-arid tropics. The annual maximum temperature of the village is 40°C and minimum temperature is 20°C while the normal rainfall in the village is 730mm, distributed erratically. Traditionally, agriculture has been the main livelihood of the villagers.

However, over time, due to persistent drought and drying up of irrigation water sources, agricultural productivity and cultivated area declined drastically. This led to

fallowing of land season after season, enabling bushes to grow wildly and increase in the wild boar population. The major crops grown are paddy, groundnut, castor, pigeon pea and cotton. Migration to cities, mainly Hyderabad, to work on construction projects has been on the rise, and has become an important source of income for many poor families.

3.3 SELECTION OF SAMPLE

Sixty households with elderly population from each of the two villages, Aurepalle and Dokur were selected for the study. Focus was made to include the households, which were covered by longitudinal study of RP-MIP programme of ICRISAT during 2012.

3.4 TOOLS USED

A detailed general interview schedule and nutritional assessment a questionnaire for recording anthropometric measurements observations and chemical, diet survey was developed to collect information and to evaluate nutritional status from the elderly respondents.

3.4.1 Interview Schedule

Interview schedule was prepared with questions related to factors related nutritional profile of elderly in the following broad heads i.e., socio-economic status which includes caste, religion, sources of income, housing details, education and health, and nutritional knowledge of elderly and morbidity among elderly in the past 14 days.

3.4.2 Nutritional Assessment

3.4.2.1 Anthropometric Assessment: The anthropometric measurements viz., height, weight, mid-upper arm circumference and calf muscle circumference were taken for elderly respondents.

Height: Standing height was measured on a stadiometer with a vertical backboard and a moveable headboard. The subject was asked to stand on the stadiometer with the heels of both feet together and the toes pointed slightly outward at approximately a 60ºangle. Made sure that the body weight was evenly distributed and both feet were flat on the stadiometer. Head was held in the Frankfurt position and the sliding head piece was lowered gently over the hair till it compressed the raised hair. Then height was read in centimeters, to an accuracy of 0.1cm without parallax error (plate 3.3).

Plate 3.3. Measuring height of the elderly.

Plate 3.4.Measuring weight of the elderly.

Plate 3.5. Measuring MUAC of the elderly.

Plate 3.6.Measuring Calf circumference.

Weight: Weight was measured using bathroom weighing scale on which the subject was asked to stand erect without bending the head and both the feet placed on the weighing machine in proper location (plate 3.4).

Mid Upper Arm Circumference: Mid Upper Arm Circumference (MUAC) is recognized to indicate muscle development. It is simple, easily accessible and is practical to measure. It has been reported to correlate well with weight, height and clinical signs. Mid-upper arm circumference (MUAC) and the calf circumference (CC) were measured in standing position, using a fiber–glass tape. Measured the arm circumference with the subject standing upright, shoulders relaxed, and the left arm hanging loosely. It is important to be certain that the muscle of the arm is not flexed or tightened, which could yield a larger and inaccurate reading. Stood facing the subject's left side and placed the measuring tape around the mid upper arm at the crossed point (+), perpendicular to the long axis of the upper arm and the circumference was recorded in centimeters (plate 3.5).

Calf Circumference: Calf circumference (CC) is considered to provide the most sensitive measure of muscle mass in the elderly and is superior to arm circumference. Calf circumference is also an indicator of muscle development as the adipose tissue is evenly distributed around the area. WHO (1995) suggested calf circumference along with MUAC as an indicator of protein malnutrition as it indicates the changes in fat free mass that occur with ageing and decreased activity. Measured the maximal calf circumference on the left calf, while the subject was sitting on a chair, knee bent at 90^{o} angle and placed the measuring tape around the calf and moved it up and down to locate the maximum circumference in a plane perpendicular to the long axis of the calf. Held the zero end of the tape below the measurement value, snugly but not tight and recorded the calf circumference to the nearest 0.1cm (plate 3.6).

3.4.3 Clinical Assessment

Clinical examination is an important practical method for assessing the nutritional status of community. It is based on the examination for changes, believed to be related to inadequate nutrition that can be seen or felt in superficial epithelial tissues especially skin, eyes, hair and buccal mucosal and in organs near the surface of the body such as parotids and thyroid glands.

Typical nutrient deficiency symptoms were observed for Protein malnutrition, thiamine, riboflavin, niacin, vitamin C, deficiency, and iron and iodine deficiency for excess fluoride toxicity as fluorosis in elderly. The questionnaire used for clinical assessment is given under appendix B.

3.4.4 Dietary Assessment

3.4.4.1 Dietary Diversity: Dietary diversity is a qualitative measure of consumption that reflects household access to a variety of foods and is also a proxy for nutrient adequacy of the diet. The dietary diversity scores are given based on simple count of food groups that a household or an individual has consumed over the preceding 24 hours. The household dietary diversity score (HDDS) is meant to reflect, in a form, the economic ability of a household to access a variety of foods. Scoring is given based on consumption of each food group i.e. score 1 is given for consumption of particular food group and score 0 is given for no consumption of a particular food group. The food groups categorized under 12 groups is given appendix D.

3.4.4.2 Weighment Method: It is a diet survey method conducted by weighing edible raw and cooked foods consumed by an individual or family. All the raw food ingredients are weighed in grams and calculated per consumption unit per day (plate 3.7). Consumption is based on the energy requirement, an arbitrary caloric coefficient values have been assigned for persons of different age, sex and activity groups, then total consumption units was assessed, which is utilized to calculate the total food intake of raw food items using table of Nutritive Value of India Foods. Intake/CU/day (g) = Raw amounts of each food/Total CU. Proximate nutrient consumption as total calorie intake, protein and fat intake were calculated along with per cent adequacy of nutrients consumed was calculated.

In the field one day weighment method was followed where all the raw food ingredients to be utilized for that day before cooking by the whole family/household was done on a sub sample 15 elderly subjects from each village by weighing accurately raw ingredients using a 1 kg food balance with the help of a structured diet survey questionnaire appendix-E. Intake of quantity of each food item, total energy, protein, fat intake and per cent adequacy of nutrients and of total quantities of each food group (cereals, pulses, fat, vegetables, milk, meat, fruits and sugar) per day was calculated.

After the preparation of the schedule, it was pre-tested on 10 samples to test the validity and reliability. Depending on the data gathered and gaps found, the schedule was modified and final schedule was prepared.

Plate 3.7. Diet survey through food weighment method.

3.4.5 Mini Nutritional Assessment

The Mini Nutritional Assessment (Vellas *et al.,* 2006) has been increasingly used worldwide but its efficacy has been assessed in few countries. The Mini Nutritional Assessment (MNA) has been increasingly employed, worldwide, for the brief evaluation of older person's nutritional status as per the guidelines of ICRISAT. This MNA is composed of an anthropometric assessment, a brief questionnaire about diet characteristics, global health and environment and a self evaluation of health and nutritional state. The MNA survey schedule is given in appendix E. All the elderly were evaluated based on the MNA schedule and the scores were pooled in to two categories, namely, screening scores and assessment scores and based on the scores elderly were classified as normal nutritional status, at risk of malnutrition and malnourished.

3.5 METHODOLOGY

The data was collected by administering the structured interview schedule to the respondents. The statements were asked in religion language Telugu. The respondents were personally interviewed by the investigator, which enabled her to get first hand information and provided her an opportunity to observe their reactions. It was made sure that the statements mentioned in the schedule were correctly understood by the respondents by repeating and clarifying them where ever necessary. A friendly atmosphere was maintained throughout the interview so that the respondents were at ease and expressed their opinion fairly, freely and frankly. The survey schedule was used on the selected 120 elderly households and information was collected. The assessment of elderly population through anthropometry, and clinical examination was done by the researcher through household visits and measuring and observation of the elderly and recorded in the book. Survey data of elderly population was analyzed and compared with previous data of ICRISAT.

3.6 DATA ANALYSIS

The statistical tools used for analysis of general information like age, education, caste, occupation, income and marital status were presented as average, percentages, means and standard deviations. For comparison of income and educational status of elderly in the two villages, t-test was used. For food frequency and dietary diversity, percentage was done and for nutrient intake paired t-test was used.

RESULTS AND DISCUSSION

Chapter IV

RESULTS AND DISCUSSION

During the past thirty years, there has been a significant increase of interest in the nutritional problems of the elderly population sparked by the certainty of an ever-increasing number and percentage of citizens in this age group. The present study entitled "Nutritional profile of elderly people in SAT (Semi Arid Tropic) villages of Mahaboob Nagar District of Telangana state, India" was conducted in the households of RP-MIP (Research Program on, Markets, Institutions and Policies) of ICRISAT in the villages Aurepalle and Dokur of Mahaboob Nagar District.

One hundred and twenty elderly were interviewed using a structured questionnaire for demographic, socio-economic and morbidity conditions and evaluated for their nutritional status through anthropometry, clinical and diet survey methods. The results of the study are presented under the following heads.

4.1Demographic and socio-economic status of elderly

4.2 Nutritional status of elderly

4.3 Nutritional and lifestyle problems of elderly

4.4 Incidence of morbidity among elderly

4.5 Nutritional knowledge and beliefs of elderly

4.6 Mini nutritional assessment of elderly

4.7 Comparative assessment of nutritional status of elderly from past to present

4.1 DEMOGRAPHIC AND SOCIO-ECONOMIC STATUS OF ELDERLY

The demographic and socio-economic information of the elderly living in rural areas of Aurepalle and Dokur villages of Mahaboob Nagar District was compiled under headings age, gender, religion, caste, family size, housing, land holding etc.

4.1.1 Age and Gender

The distribution of selected elderly was done in the age groups of 66-75, and 76-85years; the survey revealed that elderly above 86 years were not found in both the villages. Classification of elderly based on age and gender is presented in Table 4.1.

Table 4.1. Classification of elderly by age and gender

Criteria	Classification	Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
Age (years)	66-75	50 (83.3)	47 (78.3)	97 (80.8)
	76-85	10 (16.7)	13 (21.7)	23 (19.2)
	Total	**60 (100)**	**60 (100)**	**120 (100)**
Gender	Female	29 (48.0)	41(68.0)	70 (58.0)
	Male	31 (52.0)	19 (32.0)	50 (42.0)
	Total	**60 (100)**	**60 (100)**	**120 (100)**

Figures in the parenthesis indicate per cent values.

Among the sixty elderly selected from each village, 83.3% and 78.3% of elderly from Aurepalle and Dokur villages, respectively, were in the age group of 66-75 years, while 16.7% and 21.7% from the respective villages were between 76-85 years (fig 4.1). In total, the largest number of elderly (80.8%) was in 66-75years age and 19.2% were in 76-85 years age.

The per cent of elderly in the age group of 66-75 was higher by 5% in Aurepalle, while in the age group of 76-85 years, it was 5% higher in Dokur, indicating that Dokur village has better longevity among elderly. The situations from a pooled data of both the villages indicate that not more than 20% are surviving after the age of 76 years.

The gender classification of selected elderly is shown in table 4.1 and figure 4.2 Aurepalle had 48% female and 52% male elderly and it was 68% female and 32% male elderly in Dokur. There was a wide variation in the male, female ratio among the two villages. While there was a very small gap between male and female ratio in Aurepalle

indicating relatively similar longevity, in Dokur village, the number of female elderly outweigh the number of males. Women were more than double the percentage of males in Dokur suggesting that there could have been a higher mortality among older men compared to older women of Dokur and less longevity among men of Dokur compared to Aurepalle. There seem to be a strong difference in the health and nutritional status of elderly men of Dokur village compared to Aurepalle, which requires a thorough investigation.

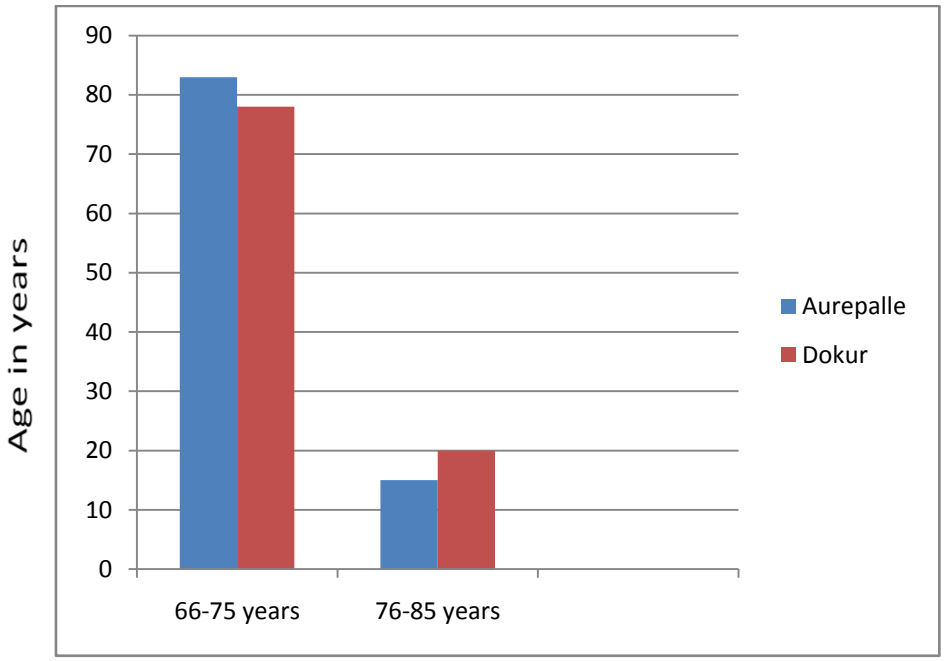

Fig. 4.1. Per cent distribution of elderly based on age.

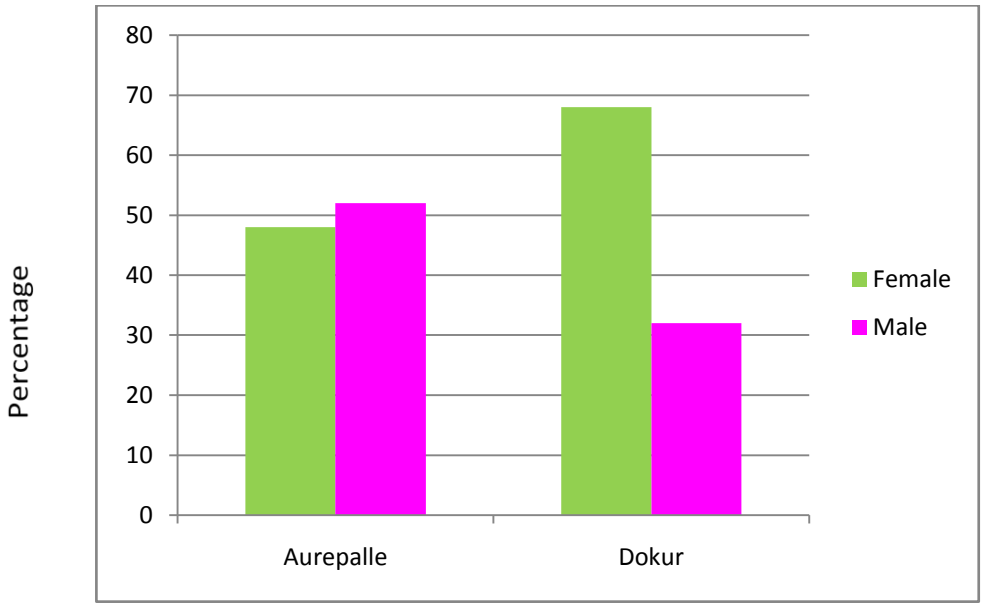

Fig. 4.2. Per cent distribution of elderly based on gender.

The mean age of the male elderly was 71.3 ± 4.5 and 72.9 ± 6.6 years and that of female elderly was 73.3 ± 6.2 and 70.6 (±4.8years) in Aurepalle and Dokur villages respectively (table 4.2). The mean age of elderly women of Aurepalle was the highest compared to men of both the villages and women of Dokur (Fig.4.3).

Samad and Parsa (2003) reported that among socio-economic variables age, marital status, income and literacy had significantly affected the quality of life of elderly people.

Sherina *et al*. (2004) reported that the nutritional risks were found to be significantly associated with age.

Table 4.2. Mean age of the elderly

Village	Men (yrs) (n=60)	Women (yrs) (n=60)	Total (n=120)
Aurepalle	71.3 ± 4.5	73.3 ± 6.2	72.3 ± 5.42
Dokur	72.9 ± 6.6	70.6 ± 4.8	71.3 ± 5.45
Total	**71.9 ± 5.3**	**71.7 ± 5.6**	**71.8 ± 5.43**

Values are mean ± standard deviation.

Anish Khanna and Prathiba Gupta (2013) reported that the nutritional status was significantly linked to age, while sex was not found to be significantly associated.

Sergio *et al*., 2007 reported that the overall mean age was 68.6 (± 7.0) years; 67.8 ± 7.0 for women and 69.4 (± 6.8) for men. The age group with the largest number of individuals was the 60–64 years (35.0% of the total population), followed by 65–69 years group (26.8%).

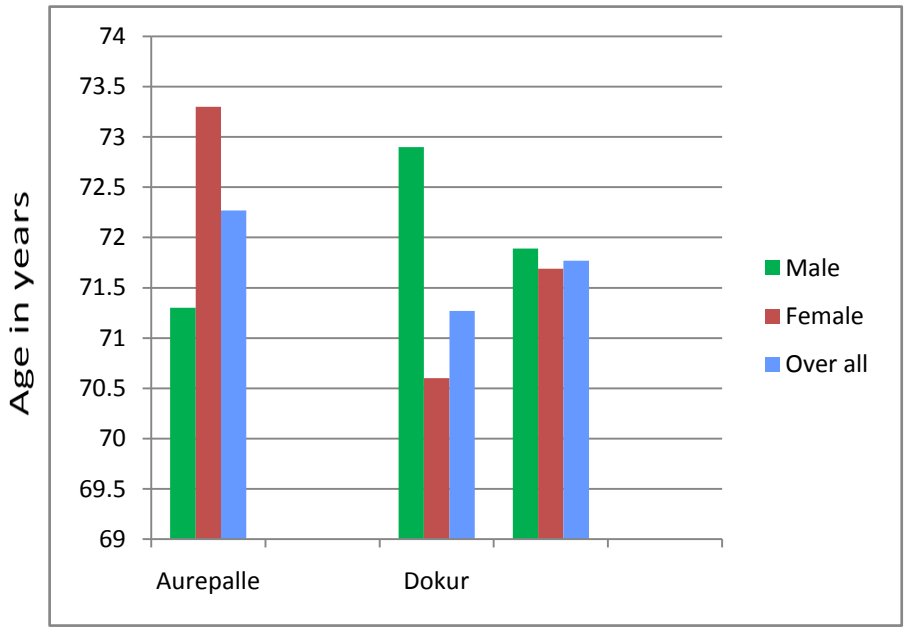

Fig.4.3. Mean age of elderly.

4.1.2 Religion and Caste

The elderly were classified into religion and caste groups and the results are given table 4.3. Majority of the subjects belonged to Hindu religion in both Aurepalle and Dokur with 98% elderly in each village, while 2% in each village belonged to Muslim religion (Fig.4.4). The area was predominantly a Hindu residential place and there is a likelihood of similarities in culture, food habits, nutritional and health conditions.

Table 4.3. Classification of elderly in religion and caste groups

Criteria	Classification	Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
Religion	Hindu	59 (98)	59 (98)	118 (98.3)
	Muslim	1 (02)	1 (02)	2 (01.7)
	Total	**60 (100)**	**60 (100)**	**120 (100)**
Caste	Open Caste	4 (06)	9 (15)	13 (10.83)
	Backward Caste	36 (60)	40 (66)	76 (63.33)
	Scheduled Caste	20 (34)	11 (19)	31 (25.83)
	Total	**60 (100)**	**60 (100)**	**120 (100)**

Figures in the parenthesis indicate per cent values.

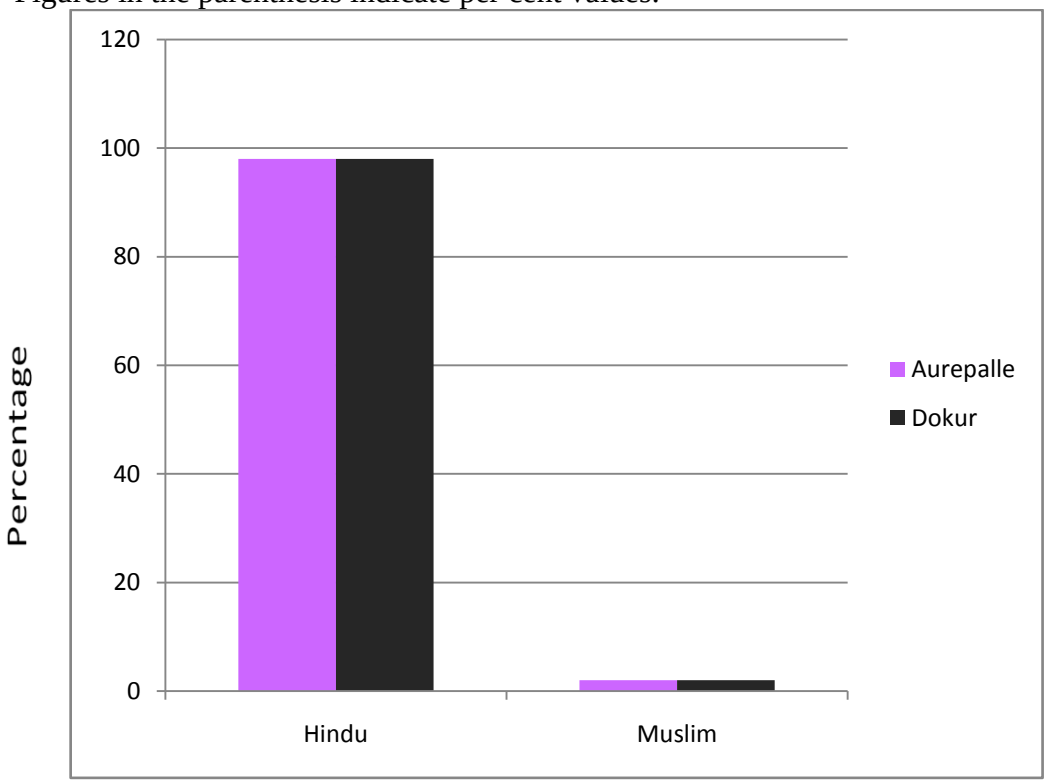

Fig. 4.4. Distribution of elderly by religion.

Majority of the households (63% overall) belonged to BC category of community, with 60% and 66% elderly in Aurepalle and Dokur villages respectively, followed by 26% (overall) SC communities with 34 and 19% in Aurepalle and Dokur, respectively (Figure.4.5). The OC elderly formed the least per cent by about 11% overall, with 6 and 15% in Aurepalle and Dokur villages, respectively. The differences in cultural practices of the three communities might have an influence on the nutritional and health status of elderly.

Niharika and Vibha (2013) the findings of research on elderly reported that socio-economic status of the families was poor with 48.3 per cent of them belonged to lower caste.

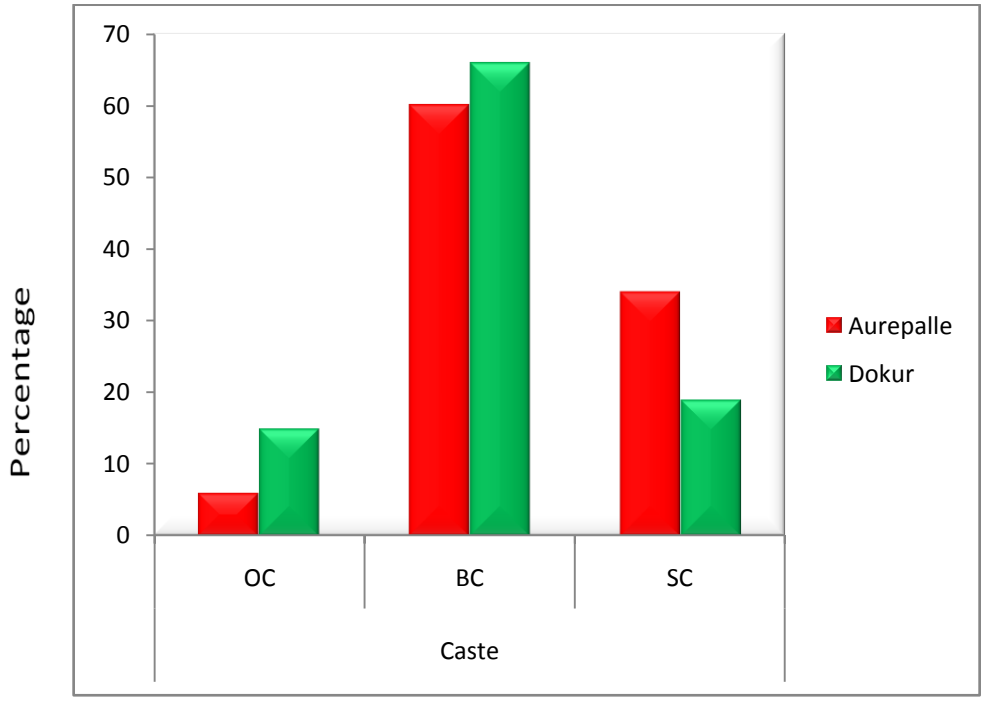

Fig. 4.5. Distribution of elderly by caste.

4.1.3 Education, Occupation and Income

Information on the education level, their present occupation and income, if they were in active occupation was elicited from the elderly during the survey and the details are presented in table 4.4.

Highest per cent of elderly (81% overall) were illiterates, with 75% elderly in Aurepalle and 86% in Dokur villages, while 10% and 5% had primary education in the respective villages.

Five per cent and 9% of elderly had schooling up to upper primary level in Aurepalle and Dokur villages respectively, while 6% studied up to high school education and 4% above high school from Aurepalle village (Fig 4.6).

Literacy level was very poor in Dokur village with highest per cent of illiterates, with a meager per cent of elderly, who studied up to primary or upper primary education and none reaching high school education. Comparatively in Aurepalle, 25% of the elderly had education up to either primary or upper primary or high school level and above. Educational background of elderly has an influence on the status of the elderly in the family and in neighborhood. Education will also impact the health and nutritional status of elderly.

Table 4.4. Classification of elderly under education, occupation and income levels

Criteria	Classification	Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
Education	Illiterate	45 (75)	52 (86)	97 (80.8)
	Primary school	6 (10)	3 (5)	9 (7.5)
	Upper primary school	3 (5)	5 (9)	8 (6.7)
	High school	4 (6)	0	4 (3.3)
	Above high school	2 (4)	0	2 (1.7)
	Total	**60 (100)**	**60 (100)**	**120 (100)**
Occupation	Barber	3 (5.0)	2 (3.3)	5 (4.2)
	Domestic work	2 (3.3)	2 (3.3)	4 (3.3)
	Farm labor	16 (26.6)	17 (28.0)	33 (27.5)
	Farmer	13 (21.6)	14 (23.3)	27 (22.5)
	Gold smith	1 (1.7)	2 (3.3)	3 (2.5)
	Washer man	3 (5.0)	2 (3.3)	5 (4.2)
	Livestock	1 (1.7)	2 (3.3)	3 (2.5)
	Masonry work	2 (3.3)	0	2 (1.7)
	No work	19 (32.0)	19 (32.0)	38 (31.6)
	Total	**60 (100)**	**60 (100)**	**120 (100)**
Income/annum	Low income (Rs.≤30,000)	36 (60)	33 (55)	69 (57.5)
	Middle income (Rs.30,000-50,000)	3 (5)	4 (6)	7 (5.8)
	High income (Rs.50,000 above)	1(2)	2 (4)	3 (2.5)
	No income (0)	20 (33)	21 (35)	41 (34.2)
	Total	**60 (100)**	**60 (100)**	**120 (100)**

Figures in the parenthesis indicate per cent values.

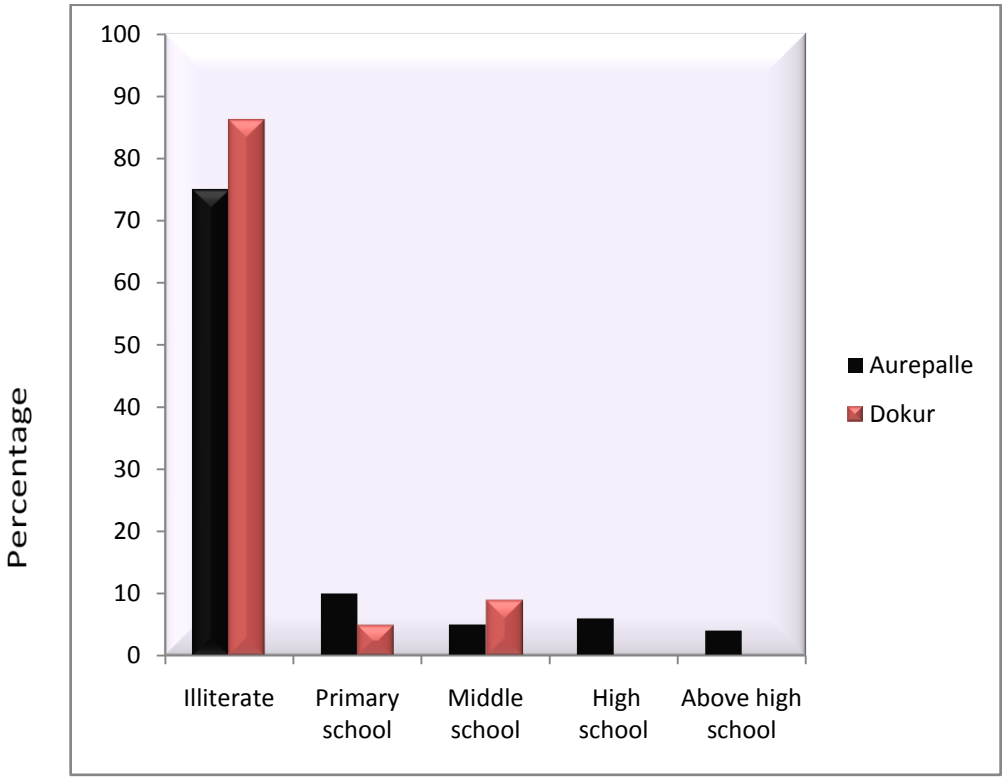

Fig. 4.6. Per cent distribution of elderly by educational status.

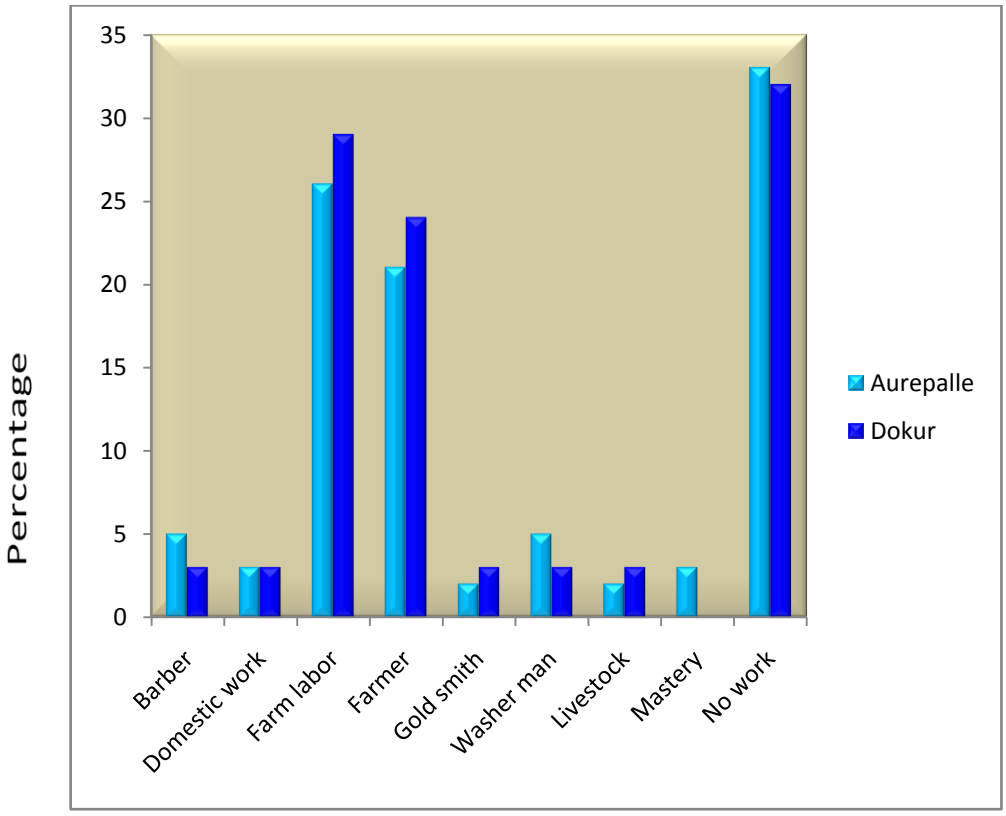

Fig.4.7. Per cent distribution of elderly by occupation.

While 32% of elderly in each of the villages or overall were not actively employed, but dependent on family members, 27% were farm labour and 23% were farmers, making a total of 50% active elderly involved in agricultural operations in both the villages and as an overall group.

A least number of elderly, 2-4 per cent each (18% total) were involved in works like, barber, domestic work, gold smith, shepherds rearing goats or buffalos, washer man or masonry work (Fig.4.7).

Classification of elderly based on their own income in the two villages Aurepalle and Dokur revealed that 60% and 55% belonged to low income group, 5% and 6% belonged to middle income group and 2% and 4% belonged to high income group in the respective villages. A group of 33% elderly in Aurepalle and 35% from Dokur did not have income of their own; they were dependent on children (Fig. 4.8)

Agriculture was the main occupation of the majority of the households three decades ago. However, persistent drought and drying up of irrigation sources led to drastic decline in farm income, which resulted in diversification of means of livelihood beyond agriculture. Of the 545 families presently residing in the village, 130 depend on agriculture, 83 on caste occupations, 145 on agricultural labor, 110 on non-farm labor, including that requiring migration, and 77 on other non-farm activities such as driving auto rickshaws, rice and flour milling, selling milk, running petty businesses or performing monthly salaried jobs in the government or NGOs.

With the decline in incomes from agriculture during the last decade, non-farm sector, migration and other occupations became more important sources of income. Owing to this, net household income and per capita incomes have increased, despite the general decrease in the viability of agriculture. The household real income has more than doubled in the last decade. Poverty levels have declined and consumption levels improved considerably although a few households still suffer from energy- and protein deficiency.

Migration is rampant in Dokur. Lack of employment opportunities in the village, especially during recurrent droughts, has led to migration of villagers to cities within and outside the state in search of non-farm employment. The majority of the households depend on labor earnings although they own farmland. The majority of the permanent migrants are generally interested in returning to the village to work on their fields if the rainfall is favorable for agriculture.

Anish Khanna and Prathiba Gupta (2013) found that nutritional status was significantly associated with socio- economic status as well as literacy status. It is thus recommended that income level as well as literacy level should be paid greater attention in dealing with the elderly.

In a socio economic status study Niharika and Vibha, reported that 46.6% of elderly families were in middle income (2013) from the findings of research on elderly reported that socio-economic status of the families was poor with 48.3% of them belonged to lower caste and 46.6 % were of medium income.

Kamla-Raj (2009) reported that studies on the nutritional status of a community with agarian occupation among women revealed that 53.1% of women were in the under nutrition category.

Saikia and Neelakshi (2013) reported that a significant association was found between nutritional status, socio-economic status and number of major meals a day. No significant relationship could be elicited between living status and nutritional status.

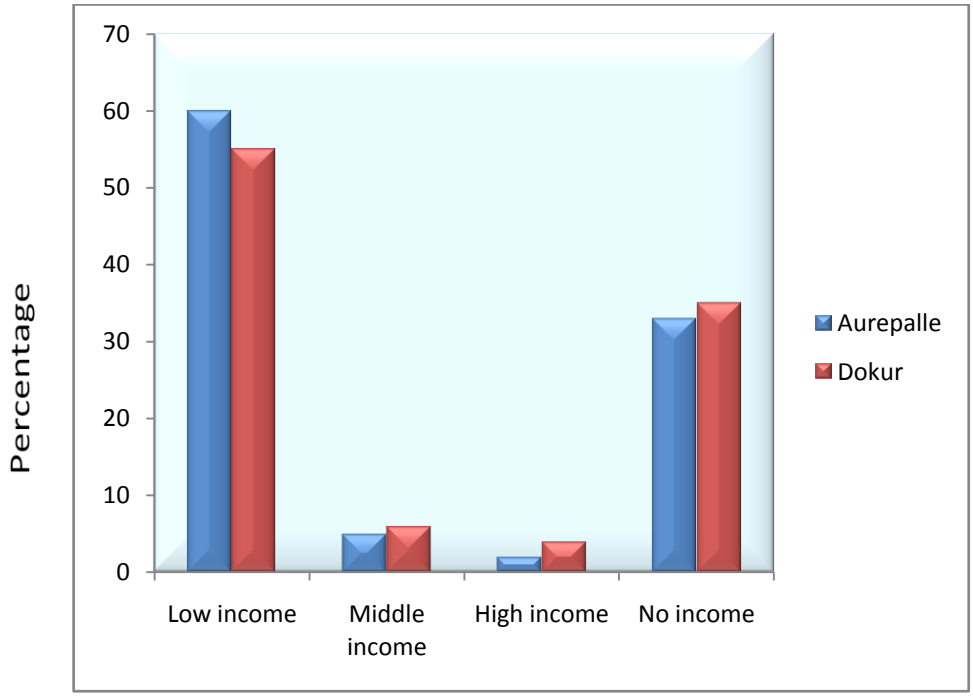

Fig.4.8. Per cent distribution of elderly by income classification.

4.1.4 Family Size and Type of House

The elderly lived either single or along with spouse in most of the households. A few of them lived along with children or grand children. The details of family size and the type of house are given in table 4.5 and in figures 4.9 and 4.10.

Table 4.5. Family size and type of house of the elderly

Criteria	Classification	Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
Family size	Single elderly (1 no)	45 (75)	40 (66.7)	12 (10)
	Elderly couple (2 nos.)	5 (8.3)	7 (11.6)	85 (70.8)
	Elderly with children/grand children (3-6 nos.)	10 (16.7)	13 (21.7)	23 (19.2)
	Total	**60 (100)**	**60 (100)**	**120 (100)**
Type of house	Pakka house	49 (81)	47(78)	96 (80)
	Shed	8 (13)	4 (7)	12 (10)
	Thatched house	2 (4)	7 (11)	9 (7.5)
	Hut	1(2)	2 (4)	3 (2.5)
	Total	**60 (100)**	**60 (100)**	**120 (100)**

Figures in the parenthesis indicate per cent values.

Forty five per cent of elderly of Aurepalle and 40% of Dokur villages lived single, while 8% and 12% percent in the respective villages lived with their spouse. Seventeen percent and 21.7% of elders from Aurepalle and Dokur, respectively, lived with their children. The nuclear family system has brought many changes even in rural families, with children moving in to another house immediately after marriage. Thus most of the elderly live together with their spouses. This type of situation was mostly seen in Aurepalle.

Eighty one per cent of elderly in Aurepalle and 78% in Dokur villages were living in pakka houses and 13% and 7% were living in pakka houses with metal sheet roofing in the respective villages. Four and 11% of elderly were living in thatched houses in Aurepalle and Dokur, respectively, where as 2% and 4% of elderly in the respective villages live in the huts. Majority of the elderly were comfortable within their own housing facilities.

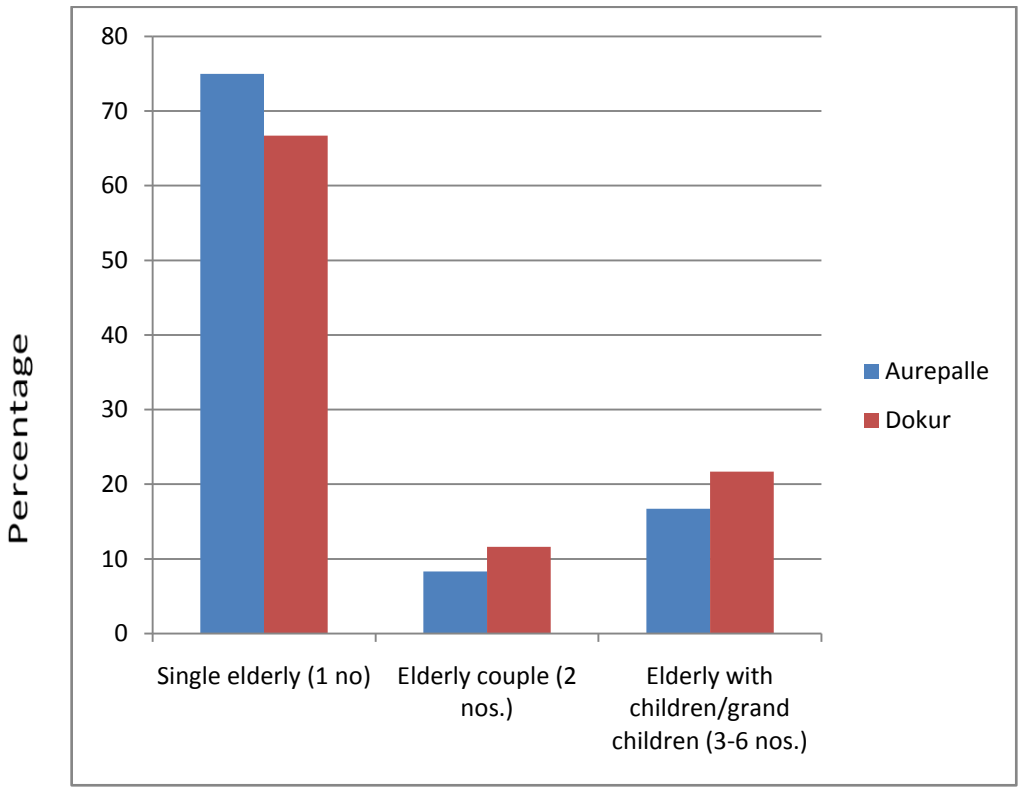

Fig. 4.9. Per cent distribution of elderly by family size.

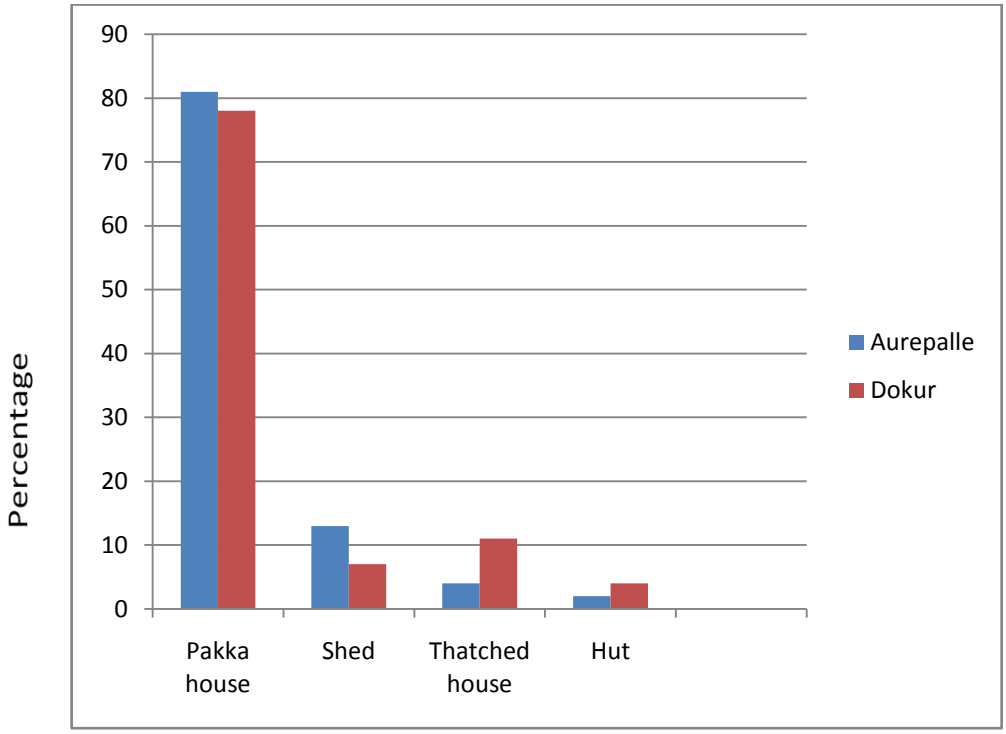

Fig. 4.10. Per cent distribution of elderly by type of housing.

4.2 ASSESSMENT OF NUTRITIONAL STATUS OF ELDERLY

Nutritional status has been assessed through anthropometry, clinical, and diet survey techniques, using standard methods of WHO and the results are given below.

4.2.1 Anthropometric Assessment

4.2.1.1 Height, Weight and BMI: The elderly were measured for the body weight and height and the body mass indices (BMI) were calculated. The means of height, weight, BMI are given in table 4.6 and in Fig.4.11, 4.12 and 4.13 respectively.

The mean height and weight of elderly men were 160.4 ± 5.8cm and 52.0 ± 10.3kg respectively, in Aurepalle and 163.9 ± 4.7cm and 58.0 ± 12.8kg in Dokur in the respective order. The mean height and weight of elderly women were 147 ± 6.0cm and 45.3 ± 8.4kg respectively, in Aurepalle and 144.4 ± 6.3cm and 51.4 ± 9.5kg in Dokur in the respective order. Elderly men of Aurepalle were shorter than those of Dokur by 3.5cm, while elderly women of Aurepalle were taller than women of Dokur by 2.5cm approximately.

Niharika and Vibha (2013) studied the distribution of elderly subjects on the basis of height (cm), weight (kg) and BMI (kg /meter^2) and showed that 70 per cent of elderly male and 84 per cent female were suffering from different grades of malnutrition.

Table 4.6. Height, weight and BMI of elderly

Village	Elderly subjects	Height (cm)	Weight (kg)	BMI (kg/m^2)
Aurepalle	Men(n=31)	160.4 ± 5.9	52.0 ±10.3	20.4 ± 3.6
	Women(n=29)	147.0 ± 6.0	45.3 ± 8.4	21.1 ± 3.4
Dokur	Men(n=19)	163.9 ± 4.7	58.1 ± 12.8	21.7 ± 4.5
	Women(n=41)	144.4 ± 6.3	51.4 ± 9.5	23.5 ± 3.6

Values are mean ± standard deviation

With ageing, there is a likelihood of reduction in the height of men and women with every increasing decade. Body weight of elderly men showed similar trends like height measurements. Men of Aurepalle had a mean weight of 52.0 kg which was comparatively lower than the mean weight of men of Dokur with 58.0kg.

Trends in height and weight measurements showed similarities in Aurepalle and Dokur; lower the height, lower were the weight readings. Contrary to this synchrony in height and weight measurements of men, women showed a different picture; with lower mean weight of 45.0kg for taller women (147cm) of Aurepalle, and high mean weight of 51.0kg for shorter women (144cm) of Dokur.

The trends in the weight gain for height among men and women seem to be different, the shorter the women, the heavier the weight, the taller the men, the heavier the weight. Women with short stature and reduced activity seem to be gaining more weight.

In general the mean weight of elderly men and women subjects respectively were lower than their reference body weights during adulthood.

The average BMI of elderly men was 20.4 ± 3.6 and 21.7 ± 4.5 in Aurepalle and Dokur respectively and among women; it was 21.1 ± 3.4 and 23.5 ± 3.6 in the respective villages. Body mass indices of men of the both villages, and women of Aurepalle were slightly above normal with the exception of elderly women of Dokur, who were found to be at risk of overweight (WHO 2007 cutoffs). It is ideal for elderly men and women to maintain slightly lower weight than the ideal body weight and to maintain normal BMI.

Sergio *et al.,* 2007 reported that the average weights were 62.7kg for women and 70.3kg for men ($p < 0.05$), and the mean heights were 1.52cm for women and 1.63cm for men ($p < 0.05$). Age related changes in anthropometric values were identified. BMI values indicated that 62.3% of the population was overweight, and 73.6% of women and 16.5% of men had high fat.

Relatively the height, weight and BMI measurements of elderly of were higher than those of mahaboobnagar district and the difference could be attributed to regional food life style practices.

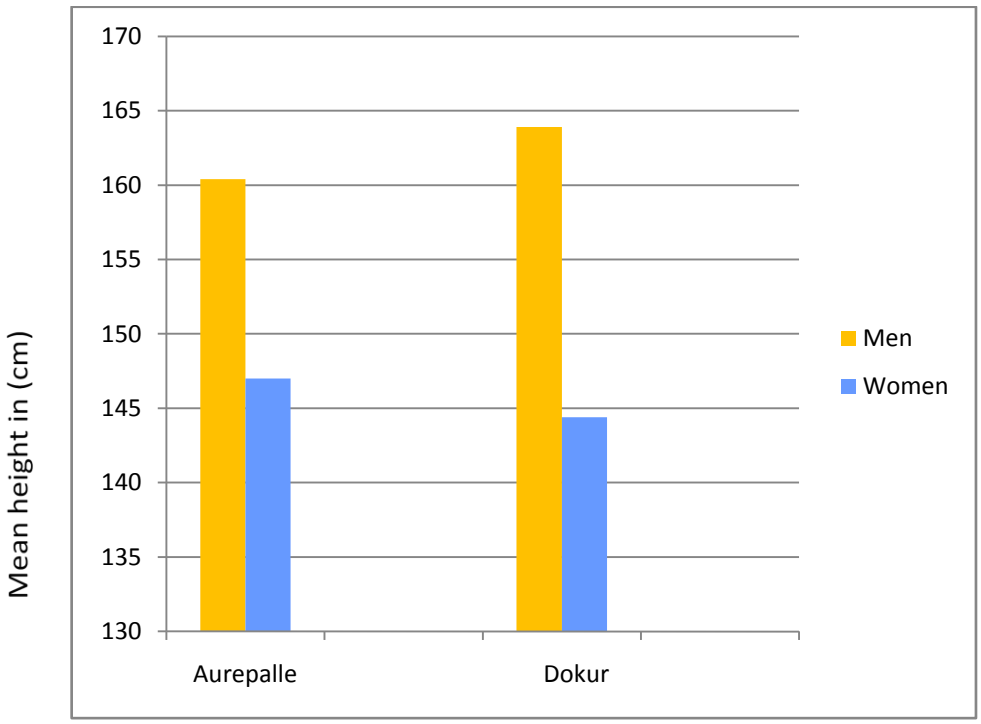

Fig. 4.11. Mean height of elderly men and women.

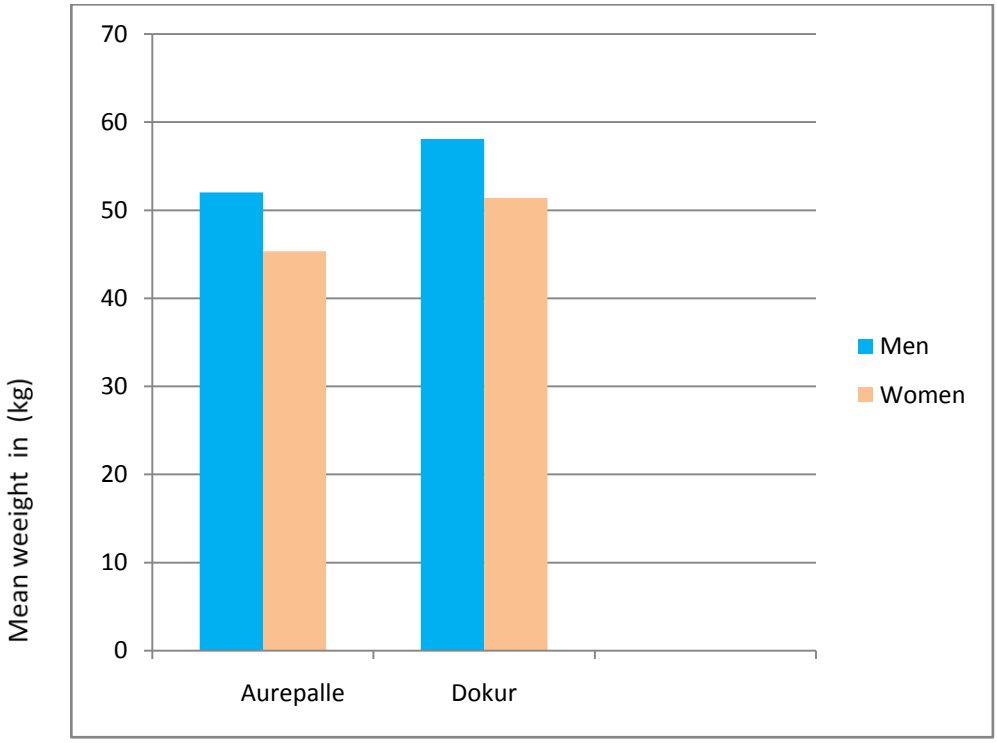

Fig. 4.12. Mean weight of elderly men and women.

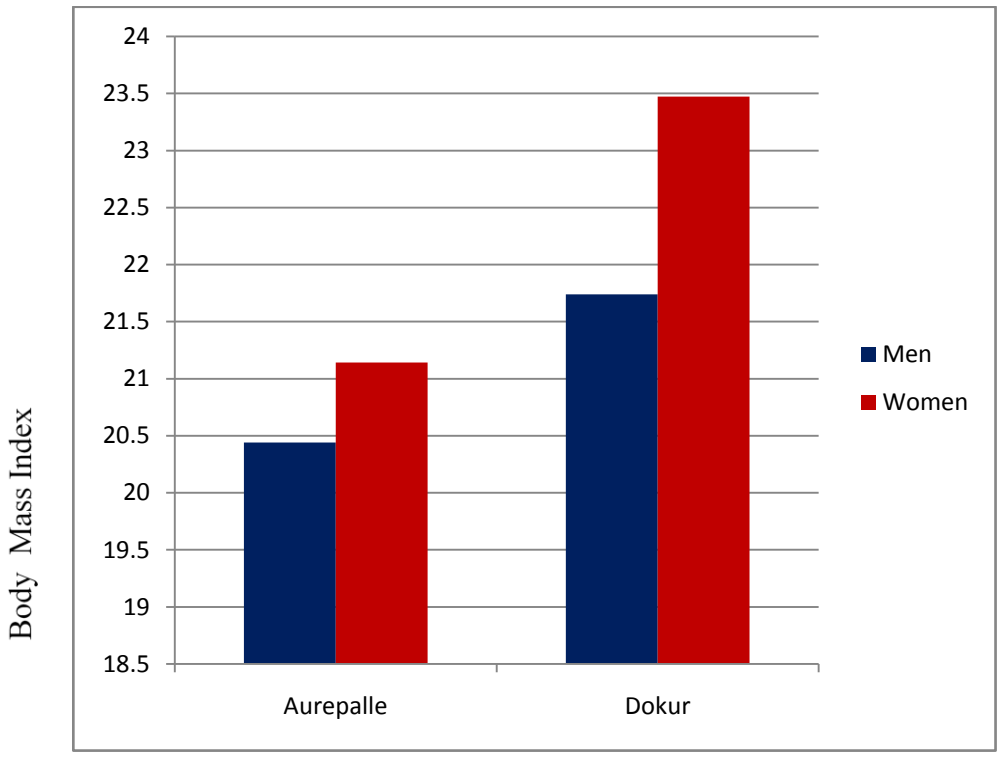

Fig. 4.13. Mean BMI of elderly men and women.

Based on the BMI, elderly men and women of Aurepalle and Dokur were classified in to several BMI cut off groups as given in table 4.7, where they were described as underweight, normal weight, overweight or obese.

Table 4.7. Classification of elderly according to Body Mass Index (WHO 2007)

Description of BMI	BMI	Villages	
		Aurepalle (n=60)	**Dokur (n=60)**
Underweight	<18.5	10 (16.7)	7 (11.7)
Normal range	18.5 - 24.9	46 (76.6)	47 (78.3)
Overweight	≥ 25.0	4 (6.7)	6 (10.0)
Obesity (class I)	30.0 – 34.9	-	-
Obesity (class II)	35.0 - 39.9	-	-
Obesity (class III)	≥ 40.0	-	-

Figures in the parenthesis indicate per cent elderly

Nearly 17% elderly from Aurepalle and 12% from Dokur were under weight with BMI less than 18.5. A majority of the elderly in both the villages 77-78% were in the normal BMI range of 18.5 to 24.9. Nearly 7% of elderly in Aurepalle and 10% in Dokur had a BMI >25.0, indicating that they were overweight. None of the elderly fell in the obese category. According to the latest BMI cutoff points, a BMI of >23.0 indicates the risk of metabolic diseases like diabetes, cardiovascular diseases etc.

Prabhavathy Devi (2011) reported that the anthropometric measurements of majority of the women showed a normal BMI.

Riyami *et al. (*2009) found that about 45% of the elderly were overweight or obese.

Kumari Suchetha *et al.* (2011) reported that the largest percentage of men (56.2%) and women (51.7%) were found to be in the normal BMI classification. Women had a slightly higher mean BMI than men during the study. None of them were found to be severely obese. Women were found to be more overweight and obese compared to that of men.

Ajitha Katta *et al*. (2011) reported that nearly one fifth were found to be obese. Overweight and obesity were reported more among females and nearly three fourth of the males were below or equal to normal BMI.

Kamala (2009) reported that in a study on the nutritional status of a community with occupation, 53.1% of women were in the under nutrition category.

Nyaruhucha *et al.* (2004) reported similarly, showing that 30% and 26% of the institutionalized males and females respectively, and none of the non-institutionalized males were observed to be overweight. On the other hand, 39% and 23% of the non-institutionalized males and females, respectively, were underweight or malnourished.

Anku Moni and Neelakshi (2013) reported that the prevalence of under nutrition (BMI <18.5) was found to be 22.2% and over nutrition, which included overweight (BMI >25-29.99) and obesity (BMI $\geq$ 30) was 12.5%. Significant association was found between nutritional status, socio-economic status and number of major meals a day. No significant relationship could be elicited between living status and nutritional status.

Kirtana Pai (2011) reported a high risk of malnutrition ($p<0.05$) in the old age home residents, and confirmed the need for increased surveillance of nutritional status among residents of old age homes.

Ngatia *et al*. (2008) reported that among the population assessed, 46.4% had normal nutritional status, while 40.9% were overweight, with more females (48.0%) than males (25.9%) being overweight.

Jenkins *et al*. (2007) reported that the Philippines showed about 30 per cent of the elderly being underweight.

4.2.1.2 Evaluation of height, weight and BMI in relation to age of elderly:

Anthropometric measurements of elderly in relation to their age groups were observed and the results are given in below.

The mean height of male and female elderly in the two age groups of 66-75 and 76-85yrs is given in table 4.8. The mean heights of 66-75yrs men were 159.2±5.6cm and 162.2±5.5cm and that of women were 148.3±7.5cm and 148.4±6.5cm in Aurepalle and Dokur villages, respectively. In the age group of 76-85 years the heights of male elderly were 166.6±7.2cm and 166±2.5cm and heights of female elderly were 148.6±8.8cm and 146.6±4.7cm in Aurepalle and Dokur respectively (fig.4.14).

Elderly men in the age group of 76-85 years in both the villages were taller than 66-75 years age group. The heights of female elderly in Aurepalle did not show much difference between two age groups, whereas in Dokur, 77-85yrs aged women were slightly shorter than 66-75 years women.

Table 4.8. Mean height of elderly in classification in two age groups

Age(yrs)	Height of elderly (cm)			
	Aurepalle (n=60)		Dokur (n=60)	
	Male	Female	Male	Female
66-75 (n=97)	159.2 ± 5.6	148.3 ± 7.5	162.2 ± 5.5	148.4 ± 6.5
76-85 (n=23)	166.6 ± 7.2	148.6 ± 8.8	166.0 ± 2.5	146.6 ± 4.7

Values are mean ± standard deviation.

Since height is influenced by heredity, food intake, and nutritional status since childhood and the male elderly of 76-85yrs were taller compared to 66-75 years. Changing food habits and life styles over the past few decades' might have also contributed to the diminished height in men who were 10 years younger to the older groups. Physiologically if the same subjects were evaluated longitudinally, the overall height keeps declining with every decade of increasing age.

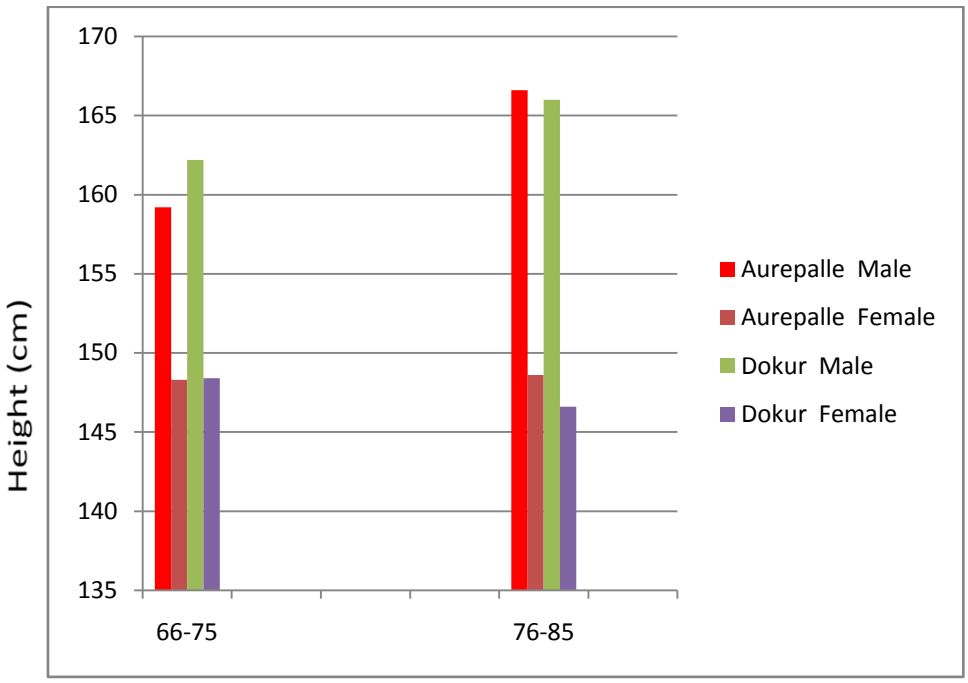

Fig.4.14. Mean height of elderly classified in two age groups.

The body weight of male and female elderly was divided in two age groups, 66-75 and 76-85 years under both the villages and the details are given in table 4.9 and fig 4.15. The mean body weights of male elderly between 66-75years were 51.3±10.9kg and 60.7±14.8kg in Aurepalle and Dokur villages respectively, and that of female elderly were 47.2±9.2kg and 53.3±9.8kg in the respective order. Whereas, the body weights of 76-85yrs male elderly were 48.9±2.9kg and 53.2±8.5kg in Aurepalle and Dokur villages respectively and that of female elderly were 41.0±2.5kg and 48.4±6.8kg in the respective order.

Table 4.9. Mean weight of elderly classified in two age groups

Age (yrs)	Mean weight of elderly (kg)			
	Aurepalle (n=60)		Dokur (n=60)	
	Male	Female	Male	Female
66-75 (n=97)	51.3 ± 10.9	47.2 ± 9.2	60.7 ± 14.8	53.3 ± 9.8
76-85 (n=23)	48.9 ± 2.9	41.0 ± 2.5	53.2 ± 8.5	48.4 ± 6.8

Values are mean and standard deviations.

The body weights of elderly male and female in the age group of 66-75yrs were much higher than the body weights of 76-85yrs age in both the villages indicating that the body weight decreased along with aging process.

There might have been a decrease in the food intake with increasing age, thereby, showed a decline in body weight as the age increased by a decade.

The mean body weights of male and female elderly of Dokur village in both the age groups (66-75, 76-85 years) were higher than elderly of Aurepalle indicating that elderly of Dokur were well nourished compared to those of Aurepalle.

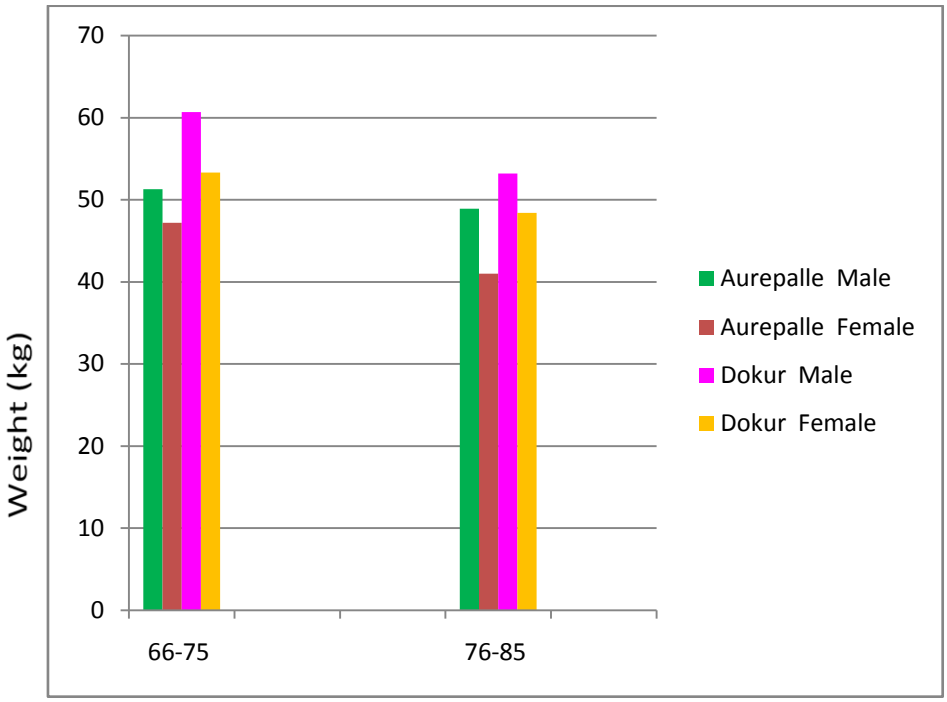

Fig.4.15. Mean weight of elderly classified in two age groups.

BMI of elderly male and female was classified under the two different age groups 66-75, and 76-85 years (table 4.10 and fig 4.16). The body mass indices of male elderly in Aurepalle in the age groups of 66-75 and 76-85 years were 20.5±3.6 and 18.2±1.6 respectively, which were relatively lower compared to BMI of men of Dokur, with 22.7±5.3 and 24.3±3.7 in the respective age groups indicating good nutritional status of male elderly in Dokur village compared to Aurepalle. The mean BMI of male elderly decreased with age in Aurepalle but increased in Dokur.

Table 4.10. BMI of elderly in age classification

Age (yrs)	Body Mass Index			
	Aurepalle (n=60)		Dokur (n=60)	
	Male	Female	Male	Female
66-75 (n=97)	20.5 ± 3.6	21.6 ± 3.2	22.7 ± 5.3	20.0 ± 1.9
76-85 (n=23)	18.2 ± 1.6	18.9 ± 1.7	24.3 ± 3.7	22.3 ± 1.5

Values are mean and standard deviations.

While the BMI of 66-75years elderly women of Aurepalle and Dokur were 21.6±3.2 and 20±1.9 respectively, women of 76-85 years had 18.9±1.7 and 22.3±1.5 in the respective villages. BMI of elderly women in the age group of 66-75 did not show much difference between the villages, but 76-85 years women of Aurepalle had lower BMI when compared to women of Dokur, showing that women in Dokur were better nourished compared to Aurepalle.

As age increased from 66-75 to 76-85 years, the body mass index reduced from an average BMI of 21 to 18.5 in both male and female in Aurepalle village. Contrary to this, an increase in BMI was observed in both male and female elderly in Dokur village from 21 to 23, which once again confirmed that Dokur subjects were well nourished comparatively. Better BMI among elderly of Dokur compared to elderly of Aurepalle could be attributed to the high socio- economic status in terms of high literacy and high income levels and improved lifestyles due to migration of children from Dokur. There seems to be no difficulty in food availability, intake and it’s metabolism with increasing age in Dokur village.

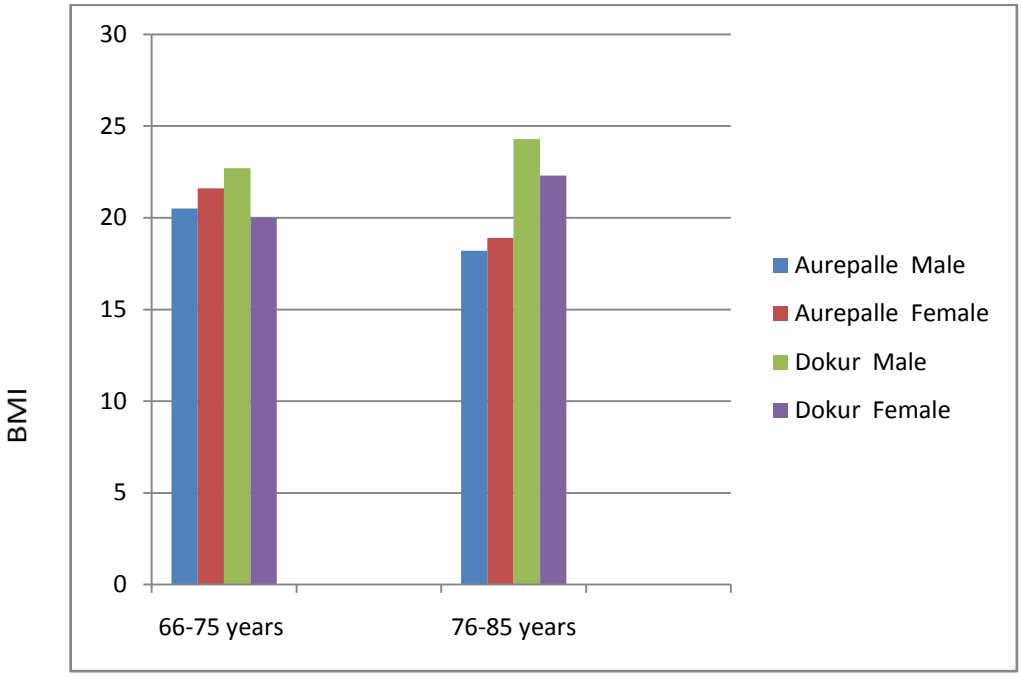

Fig. 4.16. Distribution of two age groups of elderly according to BMI.

Komal Chauhan *et al.* (2009) reported that nutritional status of the elderly females as per BMI classification showed prevalence of obesity to higher among young elderly females (62%) as compared to old elderly females (34%)

Mohapatra *et al.*, 2009 reported that about 44% male and 40% female elderly patients were under weight and according to age group male subjects; BMI was insignificant while it was significant for the females.

4.2.1.3 Mid arm and calf circumference of elderly: The elderly were measured for mid arm circumference and calf circumference and the readings were compared with the cutoff points suggested in the Mini nutritional assessment tool of Nestle 2006. Subjects were measured for their mid arm circumference (MAC) and calf circumference (CC) which reflects the muscle mass of the elderly. The mid arm circumference was categorized in to less than 21cm and 21-22cm and ≥22cm and were given a score 0.0, 0.5 and 1.0, respectively. The distribution of elderly in the mid arm circumference categories is given in table 4.11.

Table 4.11. Distribution of elderly in mid upper arm circumference categories

Scores for Mid-arm circumference (cm)	Aurepalle (N=60)		Dokur (N=60)		Grand Total (n=120)
	Male n=31	Female n=29	Male n=19	Female n=41	
0.0 = MAC <21 cm	15 (48)	10 (35)	5 (26)	21 (51)	51 (42.5)
0.5 = MAC 21 to 22cm	10 (32)	12 (41)	5 (26)	9 (22)	36 (30.0)
1.0 = MAC >22cm	6 (20)	7 (24)	9 (48)	11 (27)	33 (27.5)
Total	31 (100)	29 (100)	19 (100)	41(100)	120 (100)

Figures in the parenthesis indicate per cent elderly

The score of mid arm circumference was taken as criteria to conduct Mini Nutritional Assessment of Elderly (Vellas *et al.*, 2006). Distribution of the elderly in the 3 categories of mid arm circumference (Table 4.11) showed that 48% male elderly and 35% female elderly from Aurepalle, 26% of male elderly and 51% of female elderly from Dokur had MAC less than 21cm, which is a sign of malnourishment. Whereas, 32% male and 41% female elderly from Aurepalle and 26% male and 22% female elderly from Dokur had their MAC at 21-22cm, while 20% male and 24% of female elderly from Aurepalle and 48% male and 27% female elderly in Dokur had high MAC, greater than 22cm indicating that majority of the elderly had good MAC and were healthy as against a total of 42.5% of the under nourished elderly. A good score of MAC is an indication of adequate muscle mass among the elderly.

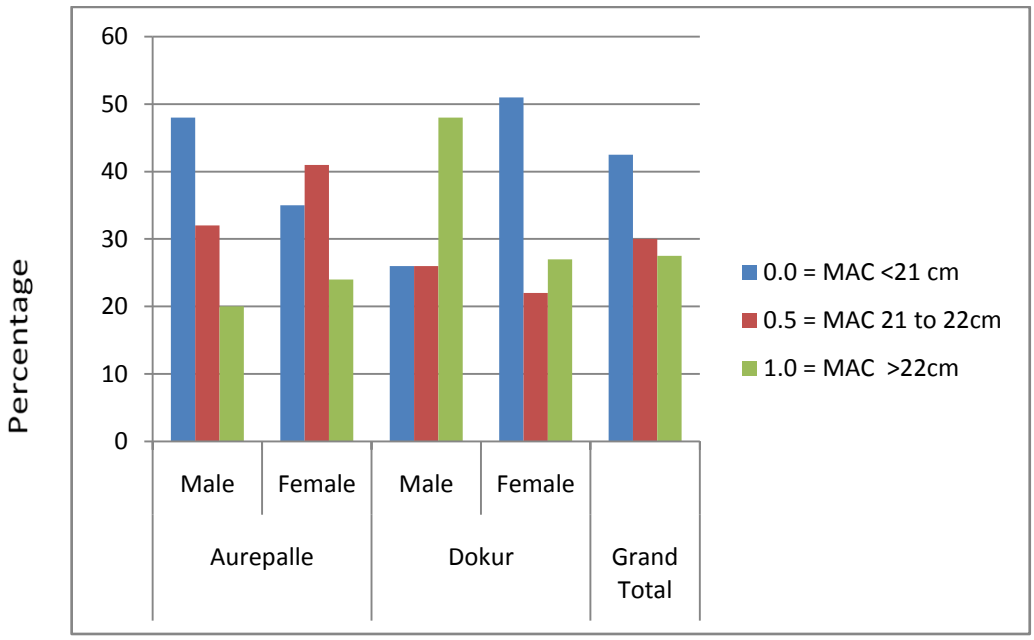

Fig. 4.17. Distribution of elderly in mid arm circumference classification.

Ngatia *et al*. (2008) reported that the level of malnutrition using the mid upper arm circumference was 18.8%, while by body mass index was 11.4%.

Calf circumference of the elderly was taken at the point where the calf muscle takes the maximum circumference. The calf muscle circumference of each elderly was categorized into two categories 0=CC <31cm and 1=CC 31 or >31cm, with a score of 0 and 1 respectively (Vellas *et al.,* 2006) and the elderly were distributed into these categories (table 4.12 and fig.4.18).

Table 4.12. Distribution of elderly in calf circumference categories

Scores for Calf circumference (cm)	Aurepalle (n=60)			Dokur (n=60)			Grand Total (n=120)
	Male n=31	Female n=29	Total n=60	Male n=19	Female n=41	Total n=60	
0=CC <31cm	20 (64)	19 (65)	39 (65)	8 (42)	22 (53)	30 (50)	69 (57.5)
1=CC ≥31cm	11 (36)	10 (35)	29 (35)	11(58)	19 (47)	30 (50)	51(42.5)
Total	31 (100)	29(100)	60 (100)	19 (100)	41(100)	60(100)	120(100)

Figures in the parenthesis indicate per cent elderly.

Calf muscle circumference was less than 31cm in 64% and 42% male from Aurepalle and Dokur respectively and in 65% and 53% of female elderly from Aurepalle and Dokur respectively. A less percentage of elderly i.e., 36% male and 35% female elderly from Aurepalle had a good CC of ≥31cm indicating not an adequate muscle mass due to poor nutritional status. Whereas, in Dokur village 58% male and 47% female elderly had good calf muscle mass with ≥31cm CC reflecting their good nutritional status.

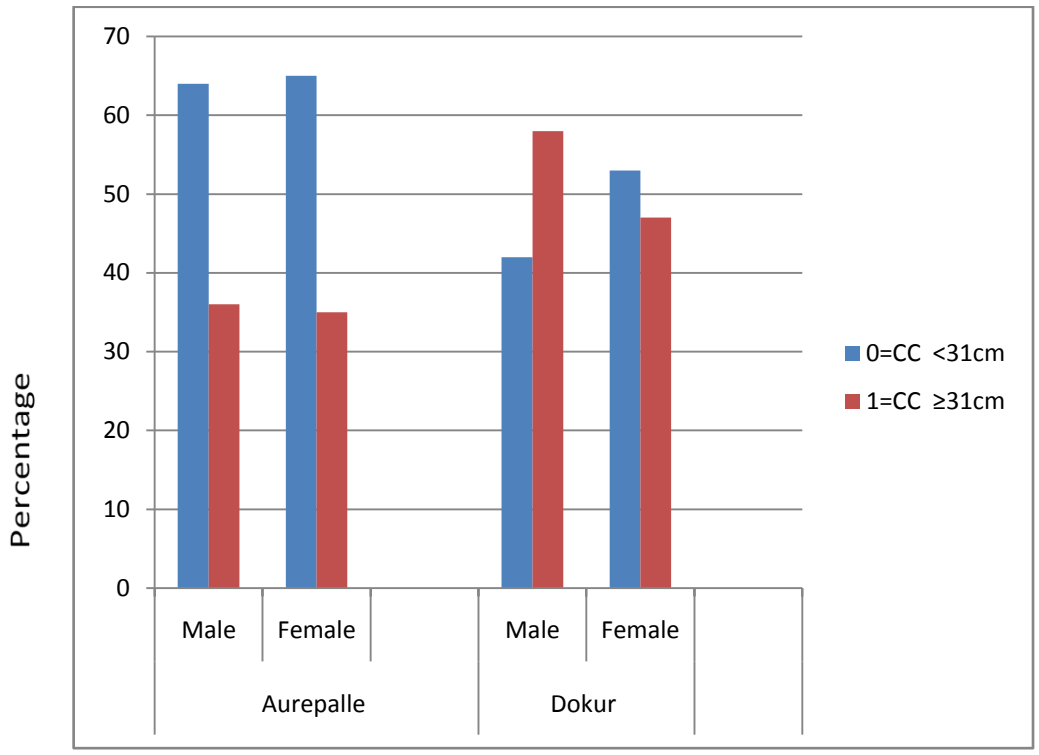

Fig. 4.18. Distribution of elderly in calf circumference classification.

4.2.2 Clinical Assessment

All the elderly were assessed for the signs and symptoms of nutritional deficiencies by observing different parts of the body for pathological changes. Distribution of elderly with various deficiency signs and symptoms are listed in (table 4.13. and fig 4.20)

Clinical signs of iron deficiency anemia and B-complex deficiencies are quite prominent among the elderly in both Aurepalle and Dokur villages. Nearly 20% of elderly showed signs of tiredness and had symptoms like pale conjunctiva, paller of tongue, lips, face, and skin. Fifteen per cent had spoon shaped nails indicating severe iron deficiency anemia. Cheilosis due to riboflavin deficiency was seen in 9% elderly, while 11-20% showed loss of ankle or knee jerks, with loss of sensation and muscle function due to thiamine deficiency and nearly 2-10% was suffering from fissures on tongue and magenta red tongue due to niacin deficiency. Thyroid enlargement due to iodine deficiency was seen in 11% of elderly and 14% had mottled teeth due to florosis. These results indicate mild to moderate degrees of nutritional deficiencies in elderly.

Table 4.13. Nutritional deficiency signs and symptoms in elderly

Clinical assessment	Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
Iron deficiency			
Pale eyes, tongue, lips, and face, skin	10 (17)	14 (23)	24 (39)
Tiredness/lack of energy	9 (15)	11 (18)	20 (33)
Spoon shaped nails	5 (8)	10 (16)	15 (24)
Riboflavin Deficiency			
Cheilosis	2 (4)	3 (5)	5 (9)
Thiamine deficiency			
Loss of ankle and knees jerks	4 (7)	5 (8)	9 (15)
Edema of body parts	2 (4)	3 (5)	5 (9)
Loss of sensation	8 (13)	12 (20)	20 (33)
Loss of muscle function	8 (13)	12 (20)	20 (33)
Niacin deficiency			
Majenta red tongue	3 (5)	9 (15)	12 (20)
Fissures on tongue	1(2)	2 (4)	3 (6)
Iodine deficiency			
Thyroid gland swelling	2 (4)	4 (7)	6 (11)
Protruding eyes	1 (2)	3 (5)	4 (7)
Deaf ness	2 (4)	2 (4)	4 (8)
Florosis due to excess fluoride in water			
Mottled teeth	2 (4)	6 (10)	8 (14)

Figures in the parenthesis indicate per cent elderly.

Some of the signs and symptoms observed and recorded might have not been due to nutritional deficiencies, but those could have been manifestations of ageing process resulting in changes on the skin, teeth, nails etc. Never the less the obvious signs of iron deficiency, iodine deficiency and some B-complex vitamins deficiencies cannot be ignored.

Kumari Suchetha *et al. (*2011) reported that the percentage of vitamin C deficiency increased significantly with age in both the sexes. Men were found to be slightly more deficient in vitamin C compared to that of women. Iron deficiency was more prominent in women.

Vani Bhushanam *et al.* (2013) found that the clinical signs of nutritional disorders were, in general, not specific and mostly associated with old age.

Niharika and Vibha (2013) reported that the prevalence of anemia was higher in low socio-economic (53.3%) group as compared to 46.6% elderly in high and middle socio-economic status.

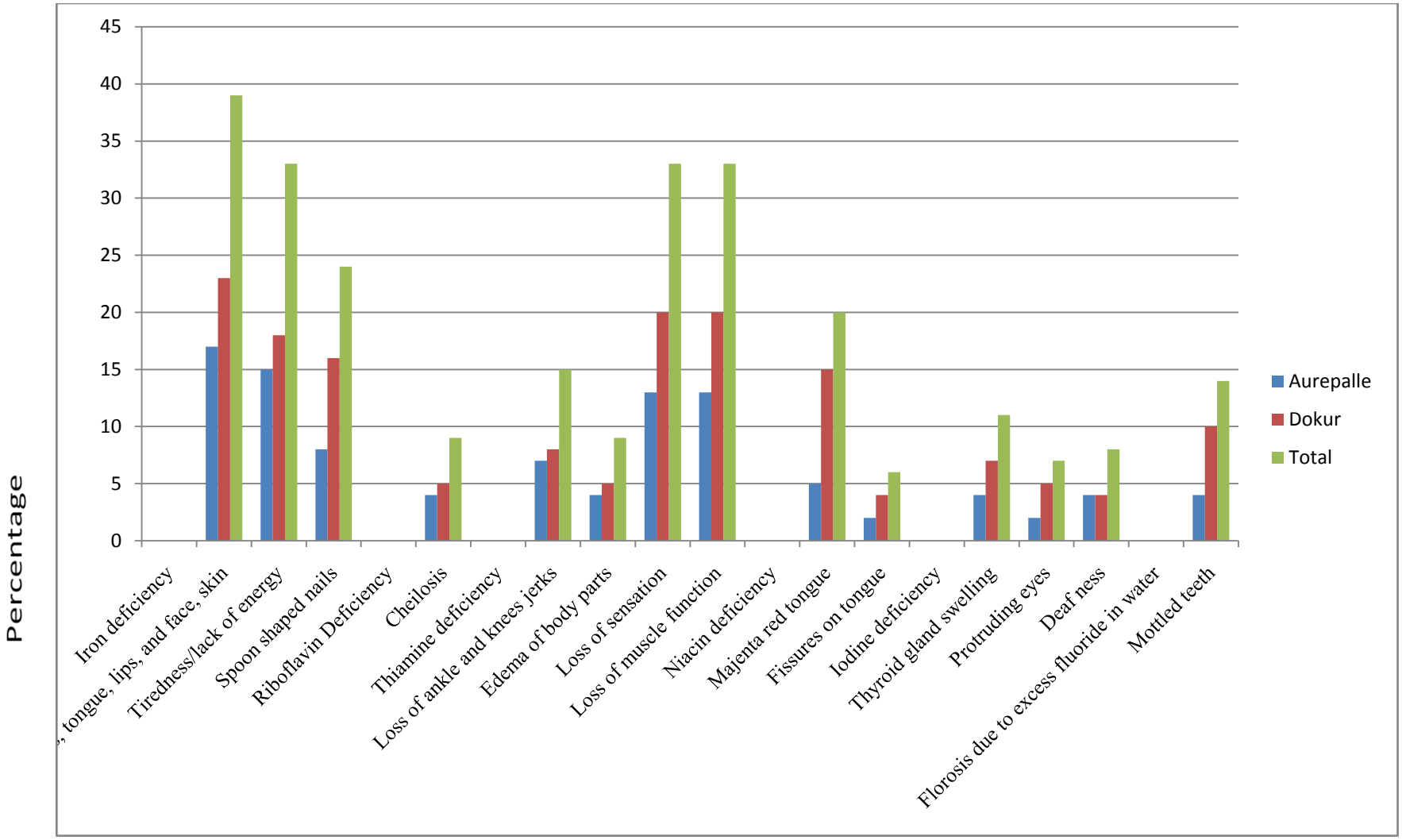

Fig.4.19. Clinical signs of nutritional deficiencies among elderly.

4.2.3 Dietary Assessment of Elderly

The food and nutrient intake of elderly was obtained through two diet survey techniques, namely dietary diversity and food weighment methods. While dietary diversity was based on frequency of food groups consumed, weighment method involved actual weighment of food that was consumed by the sub sample of15 in each village elderly.

4.2.3.1 Dietary Diversity: Dietary diversity is a measure of the number of individual foods or food groups consumed in a given time period. It can reflect household access to a variety of foods and can also act as a proxy for individual nutrient adequacy.

Individual dietary diversity scores provide a good reflection of dietary quality as diverse diets are more likely to meet the nutrient adequacy of an individual's diet and also been associated with anthropometric outcomes in both children and women after controlling for socio-demographic and economic factors.

Household dietary diversity scores (HDDS), on the other hand, is a reflection of the economic ability of household food access and can therefore be useful as an indicator of predicting nutrient adequacy and should therefore not be used as an indicator of dietary quality. Evidence indicates that HDDS are associated with socio-economic status and household food security (household energy availability).

The dietary diversity was recording of foods frequently used from the list of 12 groups and the information was obtained through 24 hours dietary recall for 3 consecutive days. The per cent of respondents consuming any food from each of the food groups on the days of survey is given in table 4.14.

The dietary diversity food intake records showed that 100 per cent of the elderly consumed cereals and spices and beverages on all the 3 days. Nearly 93% of elderly of Aurepalle and 91% of elderly from Dokur consumed vegetables daily, and almost everybody (99%) consumed oils in both the villages. Next in dietary diversity of foods, an average of 43% elderly from Aurepalle and 10% from Dokur consumed milk and milk products on a regular basis. Consumption of milk was relatively poor in majority of elderly in both the villages, with 90% of the elderly of Dokur not taking any milk products. While 11% of elderly in Aurepalle were consuming meat regularly, only 5.6% of elderly in Dokur were in the habit of having meat on a regular basis. On an average around 2% of elderly of both the villages are in the habit of eating fish, at least once in

three days. Egg consumption was reported only by 5-6% in Aurepalle and Dokur within 3 days. Consumption of white roots was observed only in 4% on any one day in Dokur village. Similarly, consumption of legumes and nuts was seen in 2% of elderly of Aurepalle only on a single day and not on other days but not observed on any of the 3 days in Dokur village. Consumption of fruits and sweets was not observed at all on any of the 3 days of diet survey in both the villages.

Table 4.14. Dietary diversity of elderly through food consumption frequency

Dietary Diversity in food intake	Aurepalle (n=60)				Dokur (n=60)			
	Day-1	Day-2	Day-3	3 Days mean	Day-1	Day-2	Day-3	3 Days mean
Cereals	100	100	100	100	100	100	100	100
White roots and tubers	0	0	0	0	0	4	0	1.3
All vegetables	93	94	93	93.3	95	88	90	91
All fruits	0	0	0	0	0	0	0	0
Meat	20	9	5	11.3	4	9	4	5.6
Eggs	2	5	7	4.6	5	7	7	6.3
Fish	2	4	0	2	0	2	5	2.3
Legumes, nuts and seeds	10	18	2	10	10	5	5	7
Milk and milk products	42	45	42	43	12	10	10	10.6
Oils and fats	100	97	100	99	98	100	100	99.3
Sweets	0	0	0	0	0	0	0	0
Spices, condiments, beverages	100	99	100	99.6	100	100	100	100

Note: Figures are per cent of elderly

In general, the diets constituted cereals with vegetables cooked with some oil on regular basis; with occasional intake of meat or eggs is the typical food intake pattern of Aurepalle and Dokur. Milk consumption was seen among 42-45% in Aurepalle against 10-12% in Dokur. The dietary diversity indicates more of a carbohydrate diet with limited intake of protein consumption and protective foods in the form of milk and some amount of vegetables taken every day.

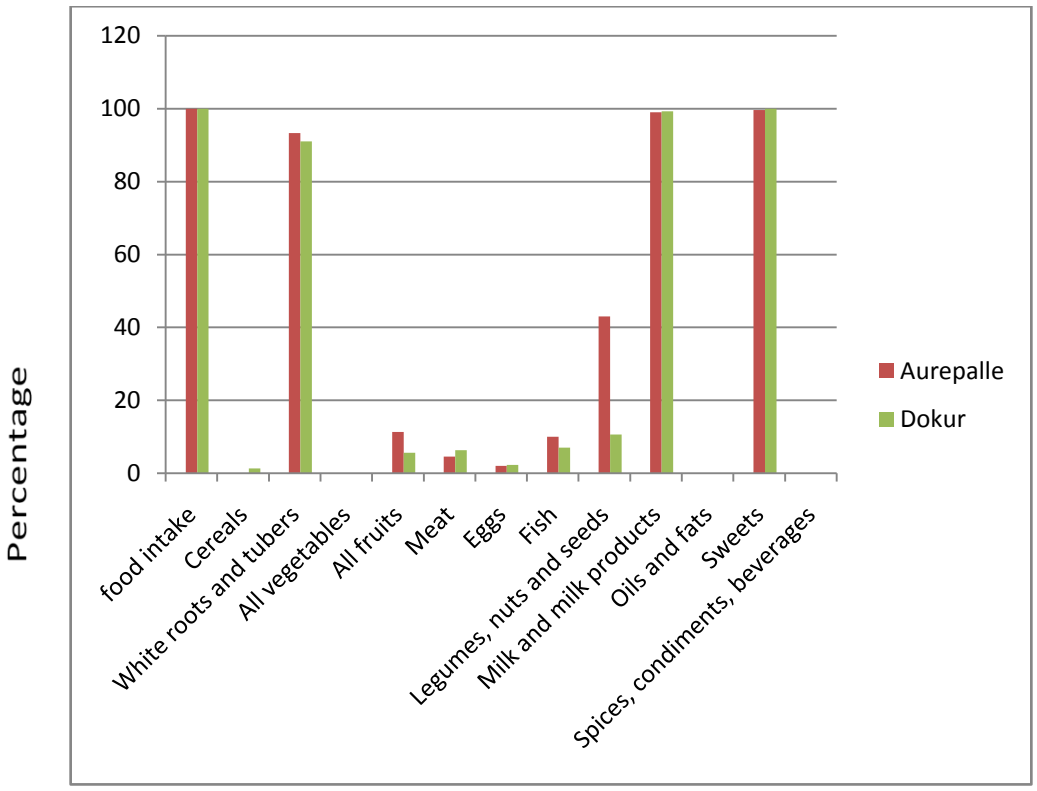

Fig.4.20. Distribution of elderly in food groups of dietary diversity.

4.2.3.1.1 Dietary Diversity Scores: Foods frequently consumed, as obtained through dietary diversity survey was quantified as dietary diversity scores (DDS) for each elderly by giving a score of 1 for each food group consumed from the total 12 food groups and the total no. of food groups consumed was added to get the dietary diversity score. Dietary diversity scores was drawn with less than, or equal to 3 food groups consumed as lowest dietary diversity (LDD) and 4-5 food groups consumed as medium dietary diversity (MDD) and > 6 food groups as high dietary diversity and (HDD) the elderly subjects of both the villages were distributed under these 3 dietary diversity groups (table 4.15).

Table 4.15. Distribution of elderly as per Dietary diversity scores

S.No	Dietary Diversity Scoring	Aurepalle (n=60)	Dokur (n=60)
1	Lowest dietary diversity (≤3)	0	0
2	Medium dietary diversity (4-5)	50 (83)	58 (97)
3	High dietary diversity (≥ 6)	10 (17)	2 (3)
4	Total	60 (100)	60 (100)

Figures in the parenthesis indicate per cent elderly.

Nearly 83% and 97% of elderly of Aurepalle and Dokur respectively, had medium dietary diversity, while 17% in Aurepalle and 3% in Dokur had a high dietary diversity. Diets of the elderly with 4 or 5 food groups might not be meeting the nutrient requirements, the possibility of protein and micronutrient deficiency cannot be over looked.

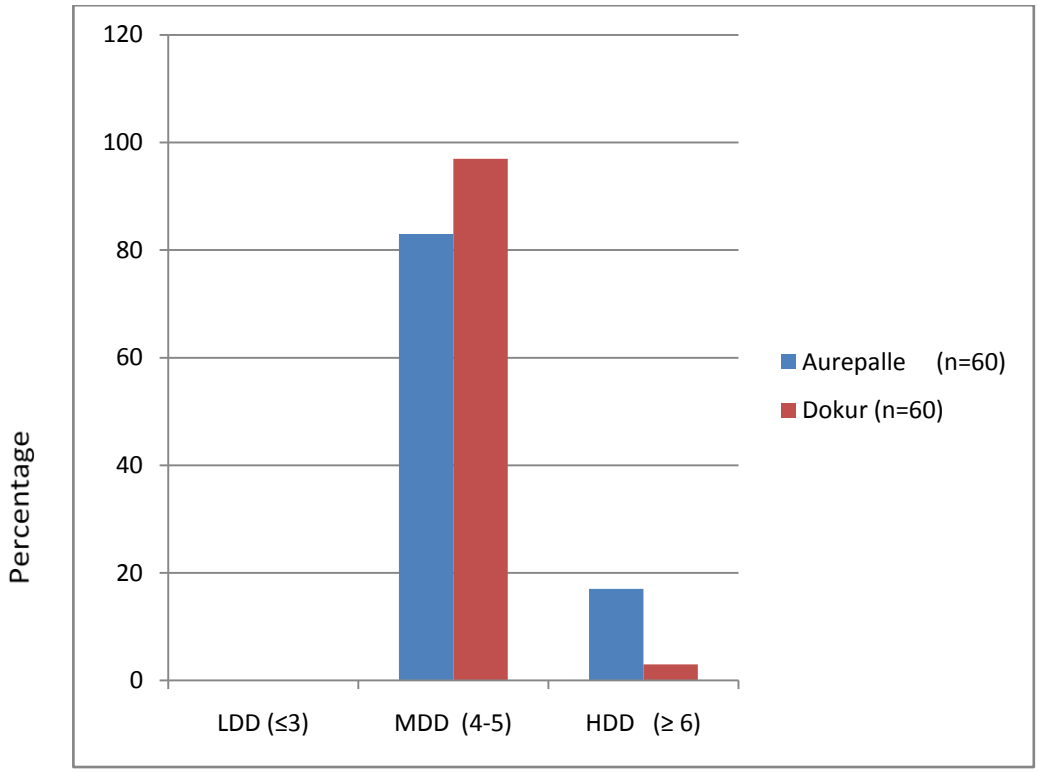

Fig. 4.21. Distribution of elderly under dietary diversity scores.

The elderly were divided in the three dietary diversity score categories based on gender in the table 4.16 and fig.4.22.

Table 4.16. Distribution of elderly in dietary diversity scores among gender groups

Dietary Diversity Scoring	Aurepalle (n=60)			Dokur n(=60)			Grand Total n=120
	Male n=31	Female n=29	Total n=60	Male n=19	Female n=41	Total n=60	
Lowest Dietary Diversity (≤3)	0	0	0	0	0	0	0
Medium Dietary Diversity(4-5)	28 (90)	23 (79)	51 (85)	18 (95)	40 (97)	58 (96)	108 (90)
High Dietary Diversity (≥ 6)	3 (10)	6 (21)	9 (15)	1 (5)	1 (3)	2 (4)	12 (10)
Total	31 (100)	29 (100)	60 (100)	19 (100)	41 (100)	60 (100)	120 (100)

Figures in the parenthesis indicate percent elderly.

Difference in the dietary diversity score of male and female elderly is shown in table 4.16. Medium dietary diversity was seen among 90% male and 79% female elderly in Aurepalle and 95% male and 97% female in Dokur village. High dietary diversity was seen in 10% and 21% male and female elderly respectively in Aurepalle, and 5% male and 3% female in Dokur village, while, lowest dietary diversity was not observed in any of the villages. Overall, high dietary diversity group was very small with only 10% of total elderly consuming 6 or more food groups in a day, while a majority of elderly (90%) cosumed 4-5 food groups every day. In spite of medium dietary diversity, anthropometric assessment revealed that elderly of Dokur, especially men had greater body weight and BMI compared to elderly of Aurepalle, which could be due to higher intakes of energy rich cereals and fats.

Kwon *et al*. (2006) reported that a study in Japan found a decline in dietary diversity to be associated with a reduction in functional ability.

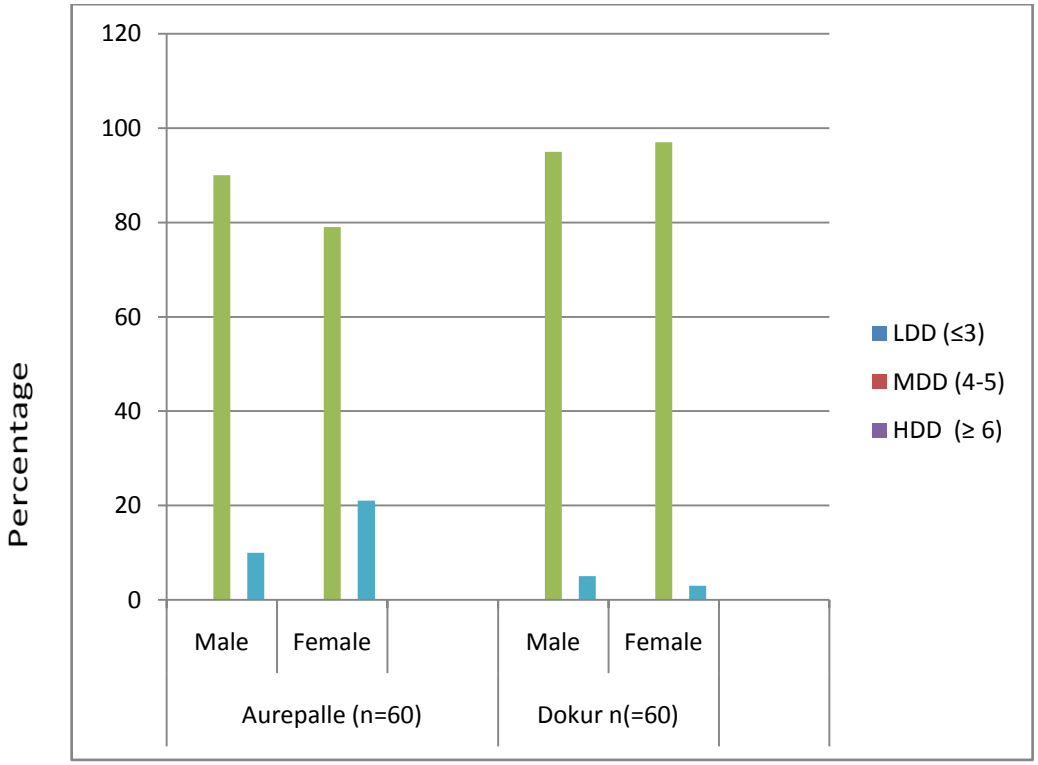

Fig.4.22. Distribution of elderly in dietary diversity scores based on gender.

Distribution of elderly in the dietary diversity classification in the two age groups is given in table 4.17 and fig.4.23. It was seen that most of the elderly between 66-75yrs in Aurepalle (86%) and Dokur (98%) and those between 76-85yrs, 73% in Aurepalle and 92% in Dokur had a medium dietary diversity score.

Table 4.17. Distribution of elderly in dietary diversity scores among age groups

Dietary Diversity Scoring	Aurepalle (n=60)			Dokur (n=60)			Grand total
	66-75y n=49	76-85y n=11	Total n=60	66-75y n=47	76-85y n=13	Total n=60	
Lowest Dietary Diversity = (≤3)	0	0	0	0	0	0	0
Medium Dietary Diversity = (4-5)	42 (86)	8 (73)	50 (84)	46 (98)	12 (92)	58(97)	108(90)
High Dietary Diversity = (≥ 6)	7 (14)	3 (27)	10 (16)	1(2)	1 (8)	2 (3)	12(10)
Total	49 (100)	11 (100)	60 (100)	47 (100)	13 (100)	60 (100)	120 (100)

Figures in the parenthesis indicate per cent elderly.

Fourteen per cent of the 66-75yrs and 27% of 76-85yrs aged of Aurepalle, and 2% and 8% of the 66-75 and 76-85yrs age group respectively of Dokur had high dietary diversity score. None of the elderly in Aurepalle and Dokur from the age group of 66-75 and 76-85 yrs had lowest dietary diversity score. Compared to Dokur, elderly of Aurepalle had a high diversity in food intake practices.

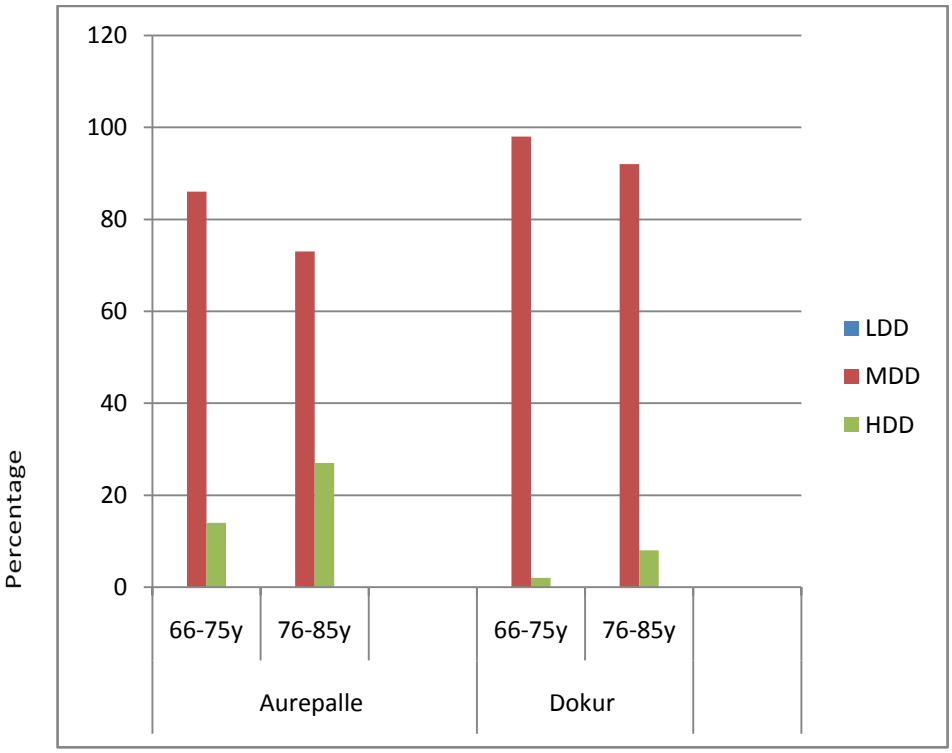

Fig. 4.23. Distribution of elderly in dietary diversity scores in the two age groups.

Based on dietary diversity score the elderly were divided in to caste groups as in table 4.18 and fig. 4.24. The three caste groups, OC, BC, and SC, had either medium or high dietary diversity in their food habits. Majority of the elderly OC, BC and SC (81-100%) had a medium dietary diversity from Aurepalle and Dokur villages, while 15-19% of all caste groups had a high dietary diversity in Aurepalle but not in BC and SC elderly of Dokur. Eleven per cent of OC elderly of Dokur had a high dietary diversity. There was a marked difference among the BC and SC elderly between the two villages, with more diversified food intake in Aurepalle, which could be due to the cultivation and availability of a variety of crops in Aurepalle.

Table 4.18. Distribution of elderly in dietary diversity score among caste groups

Caste wise	**Aurepalle (n=60)**			**Dokur (n=60)**		
Dietary Diversity Scores	**OC n=6**	**BC n=33**	**SC n=21**	**OC n=9**	**BC n=41**	**SC n=10**
Lowest Dietary Diversity (≤3)	0	0	0	0	0	0
Medium Dietary Diversity(4-5)	5 (83)	28 (85)	17(81)	8(89)	40 (98)	10 (100)
High Dietary Diversity (≥ 6)	1 (17)	5 (15)	4(19)	1 (11)	1 (2)	0 (0)
Total	6 (100)	33 (100)	21 (100)	9 (100)	41 (100)	10 (100)

Figures in the parenthesis indicate per cent elderly.

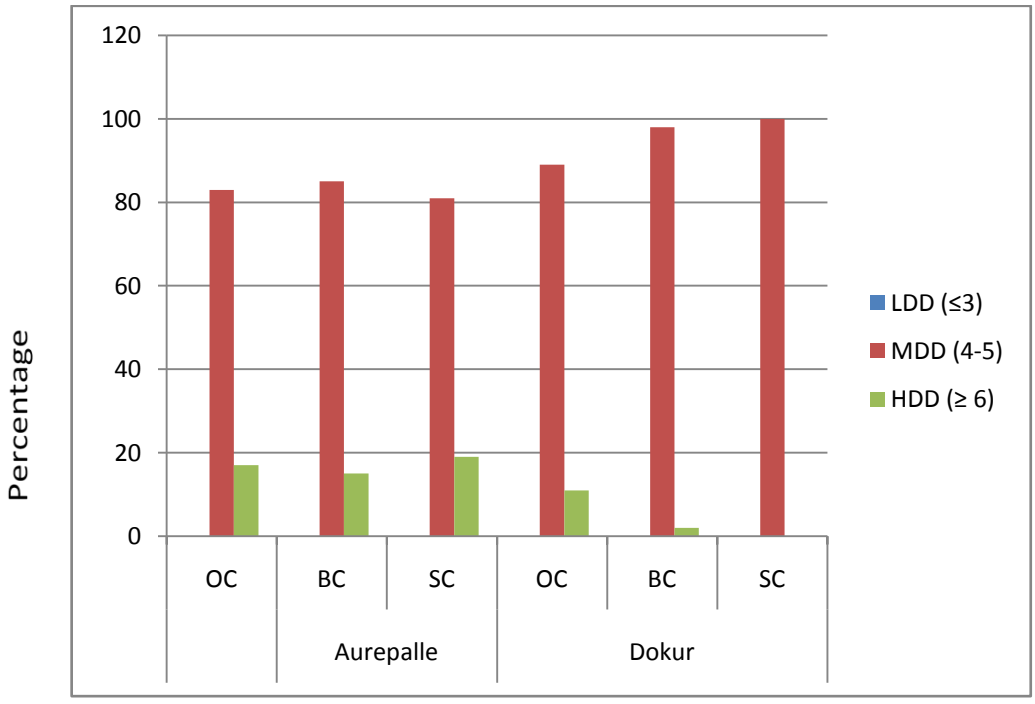

Fig. 4.24. Distribution of elderly based on caste in dietary diversity groups.

Distribution of per cent elderly in dietary diversity groups based on their income levels is given in table 4.19 and fig. 4.25. Majority and equal number of the elderly from both the villages belonged to either low income group or they were dependents on children and they were all in medium dietary diversity group.

Only 5 elderly were in the middle income group and 2 were in the high income group, and all had a medium dietary diversity, except one person in Dokur who exhibited high dietary diversity. Aurepalle had a high dietary diversity score. While majority of the dependants had a medium dietary diversity score, 5 dependents of Aurepalle had a high dietary diversity.

Table 4.19. Distribution of elderly in dietary diversity score among economic status

Dietary Diversity	Aurepalle n=(60)				Dokur n=(60)			
	LIG	MIG	HIG	Depen-dents	LIG	MIG	HIG	Depen-dents
LDD (≤3)	0	0	0	0	0	0	0	0
MDD (4-5)	29 (85)	1(100)	0	20 (80)	27(100)	4 (100)	1(50)	26(96)
HDD (≥ 6)	5 (15)	0	0	5(20)	0	0	1(50)	1(4)
Total	34(100)	1 (100)	0	25 (100)	27(100)	4 (100)	2(100)	27(100)

Figures in the parenthesis indicate per cent elderly

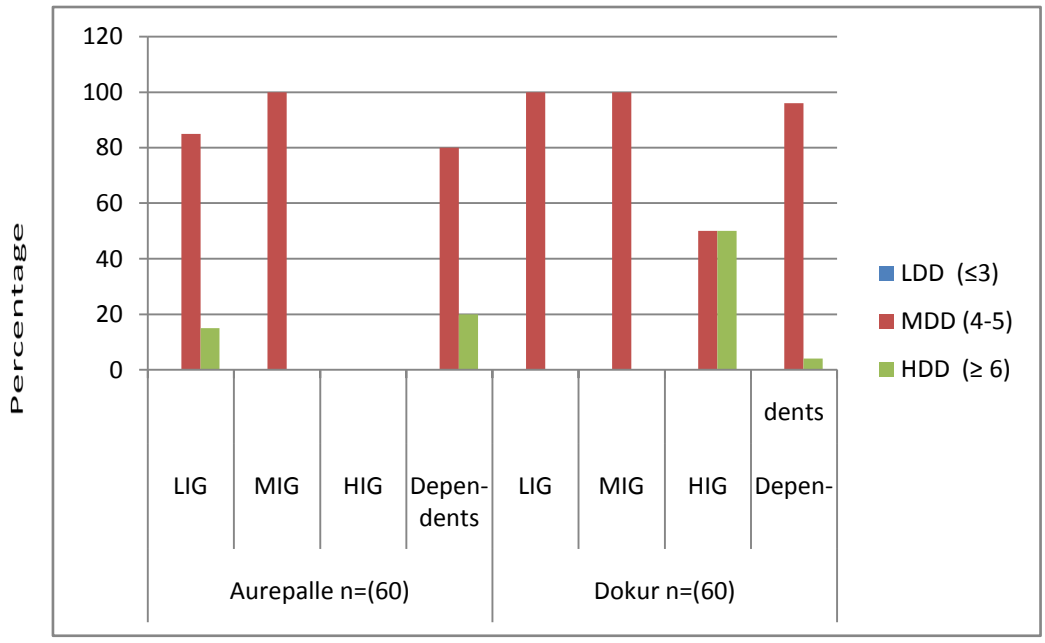

Fig. 4.25. Distribution of elderly based on economic status and DD scores.

4.2.3.2 Food Weighment Method

Diet survey method for dietary assessment was done on a sub sample of 15 elderly from each of the two villages, Aurepalle and Dokur by food weighment method, in which raw/cooked foods were weighed and recorded. Cooked food quantity was converted to raw ingredients and their quantities were recorded. The mean food intake details of elderly are given in table 4.20.

Table 4.20. Food intake by the elderly from different food groups

S. No	Foods (g)	Aurepalle (n=15)	Dokur (n=15)	t- value
1	Cereals	413 ± 93	363 ± 63	0.33 NS
2	Pulses	67 ± 68	76 ± 77	1.07 NS
3	Fats and oils	52 ± 10	45 ± 7	1.13 NS
4	Green leafy vegetables	13 ± 51	14 ± 51	2.13**
5	Roots and Other vegetables	330 ± 58	373 ± 87	2.26**
6	Milk & milk products	63 ± 87	77 ± 71	2.89**
7	Meat & meat products	76 ± 155	55 ± 140	3.59**
8	Fruits	0	0	0
9	Sugars	19 ± 37	36 ± 31	0.17 NS

Values are mean ± S.Ds.

The food intake data of a single day indicated that all were in the habit of eating rice and no other cereal or millet. Use of vegetables was commonly seen. Intake of pulses, milk products, meat, and sugar was seen only in some elderly on the days of weighment. The quantity of meat, pulse and sugar consumed by one or two subjects in both the groups made the S.Ds too high. Overall the mean intake of cereal was 413 ± 93 and 363 ± 63g, pulses was 67 ± 68 and 76 ± 77g and that of fats and oils was 52 ± 10 and 45 ± 7g in the respective villages, Aurepalle and Dokur, without any significant difference between the groups. Generally, the cereal intake was slightly lower in elderly of Dokur compared to recommended intakes, but pulse and fat intake were quite high.

Intake of leafy vegetables was very low at 13 ± 51g and 14 ± 51g and roots and other vegetable intake was good with 330 ± 58g and 373 ± 87g in Aurepalle and Dokur respectively, with elderly of Dokur taking significantly higher quantities ($P<0.01$). Consumption of milk was 63 ± 87 and 77 ± 71g and meat was 76 ± 155 and 55 ± 140g among elderly of Aurepalle and Dokur respectively, with significant difference ($P<0.01$) between the groups, with vegetables and milk intake high in Dokur and meat intake high

in Aurepalle. Fruit intake was nil in both the villages. Sugar intake was mostly restricted to tea, with a mean intake of 19 ± 37 and 36 ± 31g in Aurepalle and Dokur respectively, without any significant difference.

Conversion of food intake into the nutrient intake was done using nutritive value tables (Gopalan *et al*., 1991) and the is presented in table 4.21. The mean energy intake was 2418 ± 595 and 2342 ± 451k.cals and protein intake was 54 ± 18 and 52 ± 16g among elderly of Aurepalle and Dokur respectively. No significant difference was observed between the two groups.

4.21. Nutrient intake of elderly and per cent adequacy compared to RDA

Nutrients	**RDA/day**	**Aurepalle (n=15)**	Ade-quacy %	**Dokur (n=15)**	Ade-quacy %	**t- value**
		Mean ± SD		Mean ± SD		
Energy (kcal)	2176	2418 ± 595	110	2342 ± 451	100	0.69 NS
Protein (gm)	60	54 ± 18	90	52 ± 16	87	1.44 NS
Fat (gm)	20	50 ± 18	254	53 ± 33	266	2.26**
Calcium(mg)	600	530 ± 500	88	698 ± 901	116	2.79**
Iron(mg)	30	12 ±15	43	6.3 ± 2.9	16	2.88**
Beta Carotene(µg)	2400	2330 ± 2138	90	1741±1885	53	3.31**
Riboflavin(mg)	1.4	0.7 ± 0.17	53	0.54 ± 0.26	38	3.34**
Vitamin-C(mg)	150	95 ±101	63	52± 43	34	3.48**

Figures indicate ± standard deviation NS - Not Significant ** - 1% Level * - 5% Level
Source: Nutrient requirements and recommended dietary allowances for Indians, 2000.

Intake of fat was around 50 ± 18 and 53 ± 33g, calcium was 530 ± 500 and 698 ± 901mg, iron was 12 ±15 and 6.3 ± 2.9mg respectively among elderly of Aurepalle and Dokur, with significant difference ($P<0.01$) between the groups. Intake of beta-carotene was 2330 ± 2138 and 1741±1885µg, riboflavin was 0.7 ± 0.17 and 0.54 ± 0.26mg and that of vitamin C was 95 ±101 and 52± 43mg per day among elderly of Aurepalle and Dokur respectively, with significant difference ($P<0.01$) between the groups. While intake of fat and calcium was more in elderly of Dokur, iron, beta-carotene, riboflavin and vitamin C were more in elderly of Aurepalle, indicating greater protection from antioxidant nutrients.

The nutrient intake data was compared against the RDAs of elderly and it was found that energy was adequate in both the groups, protein was deficient by 10-13%, and intake of oil was $2^{1/2}$ times greater than requirement. Calcium intake was adequate in elderly of Dokur, but meeting only 88% RDA in case Aurepalle. Per cent adequacy of

beta-carotene was 90 and 53, and that of riboflavin was 53 and 38 and of vitamin C was 63 and 34 respectively among elderly of Aurepalle and Dokur. In general both the groups had low intakes of these vitamins, with elderly of Dokur having less intake compared to elderly of Aurepalle.

Poor intake of protective foods among elderly could be attributed to lack of purchasing power, lowered capacity to prepare food for themselves, inability to chew food, lack of knowledge and negligence of self care. The high incidence of bone pain complaints was due to inadequate calcium intake and anaemia due to poor intake of iron rich leafy vegetables and occasional meat consumption.

Niharika and Vibha (2013) reported that the diet of the elderly people in comparison to the balanced diet was substantially inadequate. Cereals and pulses were the two foods consumed by all the people.

Suzana Shahar *et al., (*2007) showed that the mean energy intake for men (1412 ± 461kcal/d) and women (1201 ± 392 kcal/d) were below the Recommended Nutrient Intake (RNI) for Malaysia, Moreover, 52.5% of men and 47.5% of women might have underreported their food intake. Dietary micronutrients most likely to be deficient were thiamin, riboflavin and calcium.

Kimaya and Sharma (2013) reported that 74% elderly females and 73% males were found to be consuming 4-5 meals in a day. Ninety two per cent and 91% of elderly females and males were consuming meals regularly. The mean intake of pulses ($z = 2.07$ $p<0.05$), other vegetables ($z = 2.03$ $p<0.05$), fruits ($z = 2.04$ $p<0.05$) and fat ($z = 2.53$ $p<0.05$) was found to be significantly higher in elderly males of 60-70 years than 70-80 years. However, the dietary intake amongst the elderly females of 60-70 years and 70-80 years did not show any significant difference. The macronutrient intake in the elderly showed a significant negative correlation with age and positive correlation with number of meals consumed.

A study conducted by Sachdeva *et al.* (2006) on "Efficacy of nutrition counseling on the nutritional and hematological profile of elderly males of urban and rural areas" reported that there was significant improvement in the nutrient intake and hematological profile of the subjects after nutrition counseling, but it did not meet the recommendations. The poor status could be due to low income, illiteracy, ignorance, low availability of foods, loneliness, depression etc. There should be multi pronged nutrition and health

education programme, keeping in view the cost benefit analysis and severe financial constraints.

Maria Nyberg1 *et al.* (2015) reported that the nutritional status in the elderly was found to be negatively influenced by motoric eating difficulties including problems with manipulating food on the plate and transporting food to the mouth.

Sumon Kumar Das *et al.* (2012) reported that the mean body mass index (BMI), hemoglobin, alanine transaminase (ALT), albumin, vitamin B12, and fasting blood sugar (FBS) were significantly lower and serum creatinine, vitamin D and folate were significantly higher among elderly compared to that of middle aged population.

Neelam Yadav *et al. (*2012) showed that the intake of all the nutrients were significantly less in malnourished group in comparison to well nourished group. Half of the elderly subjects consumed more calories than the RDA.

4.3 NUTRITIONAL AND LIFESTYLE PROBLEMS OF ELDERLY

During the process of aging, elderly develop certain physical problems like difficulty in hearing; failing eye sight, loss of appetite etc. From table 4.22 it was observed that the difficulty in hearing, seeing, loss of appetite and loss of teeth, general weakness, and joint pains, back pain are some of the problems faced by the elderly in rural areas.

The health problems of the elderly are complicated by social, economic and psychological interactions to a greater degree than younger people. Moreover, these problems are usually multiple and are often masked by sensory and cognitive impairments' so that special skills are required to detect them. These factors contribute to a worsening of morbidity and mortality.

Table 4.22. Physical, nutritional and health related problems of the elderly

Nutritional health problems	Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
Loss of sensation	9 (15)	6 (5)	15 (13)
Loss of balance	0 (0)	2 (1)	2 (2)
Memory impairment	10 (17)	6 (5)	16 (13)
Hearing impairment	15 (25)	11 (9)	26 (22)
Vision impairment	13 (22)	9 (7)	22 (18)

Loss of appetite	12 (20)	15 (13)	27 (23)
Loss of control in urine and stool	5 (8)	4 (3)	9 (8)
Constipation	7 (12)	11 (9)	18 (15)
Digestion problems	3 (5)	10 (8)	13 (11)
Diabetes	6 (10)	7 (6)	13 (11)
Chest pain	4 (7)	1 (1)	5 (4)
Obesity	4 (7)	2 (1)	6 (5)
Anemia	0 (0)	6 (5)	6 (5)
Osteoarthritis	10 (17)	8 (7)	18 (15)

Figures in the parenthesis indicate per cent elderly.

Physical, nutritional and other health problems are quite prominent among the elderly in both Aurepalle and Dokur villages. Around 13% of elderly expressed loss of sensation. Nearly 2% of elderly had physical imbalance and 13% had memory impairment. Vision impairment was seen in 18% elderly; while 22% showed hearing loss. Nearly 23% of elderly had loss of appetite. While 8% elderly complained of loss of control in urine and stool, 15% suffered constipation. Nearly 4% of elderly were suffering frequent chest pain and 11% of elderly had diabetes. Fifteen percent were suffering from osteoarthritis and nearly 11% of elderly were suffering from indigestion problem. Five per cent of elderly were obese, 5% were anemic. These results indicate mild to moderate degrees of nutritional health problems in elderly.

Normal ageing includes physiological changes such as a less acute sense of taste, a fall in basal metabolic rate, decline in muscle mass and tone, and impaired swallowing. Physical factors affecting the nutritional status of the elderly would start with illness. Dentition then becomes a major cause for elderly nutrition problems. Functional disabilities, compounded with arthritis, stroke, visual impairment or dementia may interfere with cooking and other activities. Senses of taste and smell decline and food becomes too bland for seniors. Nausea, indigestion, heartburn, and a reduction of vitamin B12 absorption are all typical gastrointestinal problems stemming from the aging process.

Functional disabilities, compounded with arthritis, stroke, visual impairment, or dementia may interfere with shopping and cooking. Senses of taste and smell have declined and food becomes too bland for seniors.

Prabhavathy Devi (2011) reported that the major health problems were anemic and cataract. Bio-chemical profile showed that serum Hb level was lower.

Balamurugan and Ramathirtham (2012) reported that the most common health problems aged people face include eye sight, hearing, joint pains, nervous disorders, weakness, heart complaints, asthma, tuberculosis, skin diseases, urinary problems and others. More health problems were reported by women compared to men.

Shraddha *et al.* (2012) showed that the disorders of oral cavity were more prevalent among aged males (40.6%), while diseases of skin were more prevalent among aged females (10.0%). Most common disorder reported among elderly were diseases of the eye (51.7%) followed by endocrine, nutritional and metabolic diseases (38.4%).

Renutyagi and Satwanti Kapoor (2010) reported that there was a significant association between the indices of adiposity, lung functions, muscular strength and blood pressure among the elderly.

Correa *et al.* (2001) reported that more than 30 percent of the men and 48 per cent of the women had some kind of cognitive deficit. The healthy diet indicator ranged from 1 to 7 among both genders, with the mean score being higher in the subjects with normal cognitive function.

According to statistical projections of the World Health Organization, Ana *et al.,* (2009) during the period between 1950 and 2050, the group of elderly in Brazil will have increased 15 times. Chronic-degenerative diseases are the illnesses that most affect the elderly population, directly related to the growing demand for Enteral Nutrition Therapy.

Hennie Janssen *et al.* (2002) reported that the vitamin D supplementation in vitamin D–deficient, elderly people improved muscle strength, walking distance and functional ability and resulted in a reduction in falls and non vertebral fractures. In healthy elderly people, muscle strength declined with age and was not prevented by vitamin D supplementation.

Smitesh Gutta *et al.* (2013) found that 45% of the elderly had a repeat fall after the age of 60 years owing mainly to poor vision, osteoporosis, anemia or the use of more than 3 chronic medications. It was also found that both elderly and the caregivers were found to have poor knowledge regarding prevention of falls, health education (OR 0.418; 95% CI: .176-.991).

Syed Qadri *et al*. (2013) reported that an overwhelming majority (68.2%) of elderly enjoyed a good quality of life, while those having a fair/poor quality of life were ≤ 15%. Quality of life was better in males in physical, psychological, social and environmental domains. Majority of the subjects were anemic (64.5%), suffering from

dental problems (62.2%) and joint pains (51.4%). Maximum numbers of subjects (92.7%) were utilizing non-government health care facility due to long distance from their houses (33.3%).

Some of the life style practices of elderly are compiled in table 4.23, which included their habits as to smoking, alcoholism etc. Information as to whether elderly live or with spouse or in a joint family was also elicited because these factors have bearing on elderly heat and nutritional status. Three fourths of the elderly (71%) were found to be living alone or with their spouse, while the rest were in joint family system. Only 10% of elderly were able to be with children / grand children and dine together with children. Forty two per cent of elderly had the habit of tobacco chewing; nearly 68% of elderly take alcohol every day. Thirty six per cent of elderly had the habit of smoking. Only 2% of elderly were found to be walking for health, while 2% were completely inactive and the rest of the majority were found be attending to their normal household and personal chores, limiting their activities in and around their houses.

Table 4.23. Life style practices of elderly

Life style practices	Aurepalle n=60	Dokur n=60	Grand Total n=120
Living alone/living with spouse	45 (75)	40 (67)	85 (71)
Dining along with children	5 (8)	7 (12)	12 (10)
Habit of tobacco chewing	19 (32)	31 (52)	50 (42)
Habit of taking alcohol	35 (58)	47 (78)	82 (68)
Habit of smoking	19 (32)	24 (40)	43 (36)
Walking for health	1 (1)	2 (3)	3 (2)
No activation	1 (1)	2 (3)	3 (2)

Figures in the parenthesis indicate per cent elderly.

Komal Chauhan *et al.* (2009) reported that about 88% of the elderly females were living with their spouse in young elderly group. In old elderly group 44% of females were living alone.

Suzana *et al. (*2007) showed that majority of the elderly (87.2%) were fully independent in performing daily tasks, with men having a significantly higher score compared to women ($p<0.001$).

Komal Chauhan *et al.* (2009) reported that elderly female respondents spent more time in idle activities (9 hrs) followed by sleep (7.4 hrs), leisure activities (2.2 hrs) and exercise (30-40 minutes). This showed their sedentary lifestyle.

Rashmi and Lalita (2005) reported that exercise reduced the risk of falling by 10%, and balance training programs reduced the risk by nearly 20%.

Anku Moni Saikia and Neelakshi Mahanta (2013) reported that no significant relationship could be elicited between living status and nutritional status.

4.4. INCIDENCE OF MORBIDITY AMONG ELDERLY

Morbidity among elderly people has an important influence on their physical functioning and psychological well-being. Many elderly have several disorders at a time. The incidence of diseases increases with age.

Morbidity among elderly people has an important influence on their physical functioning and psychological well-being. Many elderly have several disorders at the same time. The following intrinsic risk factors have been described: previous history of falls, very old age, arthritis of knees, stroke, Parkinson's disease, postural hypotension (>20 mm Hg), limitations in physical function, weak hand grip strength, motor weakness(e.g., difficulty in standing up from a chair), poor balance while standing, turning, changing position or walking, poor tandem gait, gait impairment, cognitive impairment, depressive symptoms, poor vision, the use of hypnotic, anti-depressants or tranquillizers' and the use of 4 or more prescribed drugs.

Incidences of morbidity among elderly were quite prominent among the Aurepalle and Dokur villages as shown in table (4.24). On the day of interview twenty per cent of elderly reported that they were sick in the last 7 days, and 7.5% of elderly had symptoms like fever, cough, cold or body pains and the sickness lasted for 2-5 days in 8% of elderly. Nearly 8% of elderly had gone to either government hospital or RMP doctor for treatment, while another 8% took medicines over the counter. Nearly 6% of elderly were unable to carry out their usual activity. Around 16.7% of elderly were sick in the last 15 days and 11% of elderly had symptoms like stomach pain, fever, joint pains and in 6% of elderly symptoms lasted for 7 days and eight percent of elderly had gone for treatment to the nurses, or medical shops. Eight per cent of elderly were unable to carry out their usual activity.

Table 4.24. Incidence of morbidity among elderly in the last one week and in a fortnight

S.No	Morbidity and No. of Sick days	Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
1	Sickness /disability in the last 7 days	13 (21.6)	11(18.3)	24 (20)
2	Suffered from fever/ cough/ cold/ body pains.	2 (3.3)	7 (11.6)	9 (7.5)
3	No. of days, symptom have lasted (2-5 days)	2 (3.3)	8 (13.3)	10 (8.3)
4	Visited Govt. hospital/ RMP doctor for treatment	6 (10)	4 (6.6)	10 (8.3)
5	Inability to carry out usual activity for (3-4)	4 (6.6)	3 (5)	7 (5.8)
6	Sickness in the last fortnight / disability	11 (18.3)	9 (15)	20(16.6)
7	Suffered from stomach pain, fever, joint pains	8 (13.3)	5 (8.3)	13(10.8)
8	No. of days the symptom lasted (4,5,7)	5 (8.3)	2 (3.3)	7 (5.8)
9	Treatment over the counter of medical shop	4 (6.6)	6 (10)	10 (8.3)
10	Inability to do usual activities for 5-8 days	5 (8.3)	5 (8.3)	10 (8.3)
	Total	60 (100)	60 (100)	120 (100)

Figures in the parenthesis indicate per cent elderly.

The incidence of diseases increased with age. The importance of early surveillance of the health needs of elderly people has been emphasized, Knowledge of the situation and circumstances of the elderly population is essential to the provision of cost-effective services and the planning of strategies for intervention and care. Little is known about the health needs of elderly population. Assessment of the morbidity profile will help in the application of interventions, to improve the health status and the quality of life of the elderly (Ibrahim *et al*., 2000).

Lisette *et al.* (2004) reported that inactivity, smoking, and to a lesser extent a low-quality diet, increased mortality risk. A combined effect of multiple unhealthy lifestyle factors was also observed. And the study showed that a healthy lifestyle at older age is related to a delay in the deterioration of health status and a reduced mortality risk.

Ajitha Katta *et al*. (2011) reported that the morbidities were associated with musculoskeletal system (38.8%) predominantly as arthritis, lumbar pain etc. Patients reporting communicable diseases were found to be low (1.7%).

Kamble *et al.* (2012) reported that the commonest morbidity observed among the elderly people was depression (31.4%) followed by musculoskeletal disorder (25.5%), hypertension (24.1%), gastrointestinal problems (11.5%), diabetes mellitus (5.9%), & neurological problems (4.7%).

Strandhangen *et al.* (2000) reported that when smoking, cholesterol and hypertension were taken into account, there was significantly a lower mortality among men with a high fruit consumption during 16 years follow up study until the age of 70 years (P=0.042).

4.5 NUTRITIONAL KNOWLEDGE AND BELIEFS OF ELDERLY

The World Health Organization (WHO) has acknowledged that ageing and nutrition is a growing global challenge. Modifying lifestyle factors such as diet can prevent, slow or reverse the onset of many of the chronic diseases associated with ageing. "The Food Habits in Later Life" project of the International Union of Nutritional Sciences highlighted the value of rapid assessment procedures for developing food-based dietary guidelines for their aged members. A healthy and nutritious diet can prevent disease and improve health conditions leading to an improved quality of life for older people. Some dietary restrictions may be due to culture and some due to physiological states. In addition, poor dental health may cause elders to avoid eating foods with tough texture, and high-fiber. High-cholesterol foods are avoided due to suggestions from medical practitioners and dietitians based on modern medical science. Nutrition knowledge presumably influences attitudes and eating behavior. But food restriction behavior and its relationship with nutrition knowledge and attitudes has not been well studied.

The elderly of Aurepalle and Dokur villages were interviewed to assess their Nutritional Knowledge and associated beliefs using a structured questionnaire with probable responses listed under each statement. The details are given in table 4.25. The statements were related to the nutritional requirements and healthy practices pertaining to gastro intestinal tract, bones, blood and cardiovascular system. But majority of the elderly in both the villagers respondents saying, they do not know' and that is how respondents to the statements were only from a very few elderly and the same were converted to per cent figures.

Table 4.25. Nutrition knowledge and beliefs of elderly

Statements of nutrition knowledge and beliefs		Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
1. Quantity of food should change with age?	a. Should increase	0 (0)	0 (0)	0 (0)
	b. Should decrease	5 (4)	0 (0)	5(4)
	c. No change required	4 (3)	3 (2)	7 (6)
	d. No answer	58 (97)	50 (84)	108 (90)
2. Aging causes bone loss?	a. Yes	7 (6)	2 (1)	9 (8)
	b. No	0 (0)	0 (0)	0 (0)
	c. Donot know	53 (88)	58 (97)	111 (92)
3. To improve bone strength aged persons should take these.	a. Milk	10(8)	2 (2)	12 (10)
	b. Meat	5 (5)	4 (3)	9(8)
	c. Expose to sun light for some time	2 (1)	0 (0)	2 (1)
	d. Green leafy vegetables	3 (2)	2 (1)	5 (4)
	e. Only supplements	0 (0)	0 (0)	0 (0)
	f. Normal food	0 (0)	4 (3)	4 (3)
4.Maintaining good blood is important in old age	a. Yes	2 (1)	3 (2)	5 (4)
	b. No	56 (93)	57 (95)	113 (95)
	c. Donot know	0 (0)	2 (1)	2 (1)
5. Foods that provide good blood composition	a. Fruits	5 (4)	2 (1)	7(6)
	b. Meat	6 (5)	4 (3)	10 (9)
	c. Milk	0 (0)	0 (0)	0 (0)
	d. Iron tablets	0 (0)	0 (0)	0 (0)
	e. Normal food	0 (0)	3 (2)	3 (2)
	f. Green leafy vegetables	2 (1)	0 (0)	2 (1)
	g. Cereals	0 (0)	0 (0)	0 (0)
	h. Pulses	0 (0)	0 (0)	0 (0)
	i. Sour fruits	0 (0)	0 (0)	0 (0)
6.Quality of food should change with age	a. Yes	48 (80)	57 (95)	105 (88)
	b. No	4 (2)	7(7)	11 (9)
	c. Don't know	0 (0)	4 (3)	4 (3)
7.It is better to have higher bodyweight to delay aging	a. Yes	0 (0)	0 (0)	0 (0)
	b. No	4 (3)	2 (1)	6 (5)
	c. Don't know	60 (100)	54 (90)	114 (95)
8.More oil/fat intake prevents aging	a. Yes	0 (0)	0 (0)	0 (0)
	b. No	48 (80)	50 (83)	98 (81)
	c. Don't know	13 (11)	9 (8)	22 (19)

9. Plenty of water should be taken during old age to prevent dehydration	a. Yes	5 (4)	2 (2)	7 (6)
	b. No	35 (58)	25 (42)	60 (50)
	c. Don't know	52 (87)	1 (1)	53 (44)
10. Excess intake of egg/meat/fish is necessary to prevent loss muscle	a. Yes	5 (4)	2 (2)	7 (6)
	b. No	58 (97)	50 (84)	108 (90)
	c. Don't know	2 (2)	3 (3)	5 (4)
11. It's natural that every old person suffers from	a. Blood pressure	6 (5)	4 (3)	10 (9)
	b. Diabetes	0 (0)	0 (0)	0 (0)
	c. Heart diseases	0 (0)	0 (0)	0 (0)
	d. Osteoporosis	2 (2)	3 (3)	5 (4)
	e. Obesity	0 (0)	0 (0)	0 (0)
	f. Constipation	4 (3)	3 (3)	7 (6)
	g. Any other	44 (73)	54 (90)	98 (81)
12. Dietary fiber is present in	a. Meat	0 (0)	0 (0)	0 (0)
	b. Been vegetables	4 (3)	0 (0)	4 (3)
	c. Rice	0 (0)	1 (1)	1 (1)
	d. Egg	0 (0)	0 (0)	0 (0)
	e. Millets	0 (0)	0 (0)	0 (0)
	f. Spices	0 (0)	2 (3)	2 (3)
	g. Fruits	1 (1)	1 (1)	2(2)
	h. Root vegetables	0 (0)	2 (3)	2 (3)
	i. Dals	0 (0)	0 (0)	0 (0)
13.Quantity of fiber intake	a. More than normal	0 (0)	0 (0)	0 (0)
	b. Less than normal	0 (0)	0 (0)	0 (0)
	c. No change	4 (3)	3 (3)	7 (6)
14. Fiber in food	a. Causes in digestion	0 (0)	2 (1)	2 (1)
	b. Helps in digestion	4 (3)	2 (2)	6 (5)
	c. Prevents constipation	2 (1)	0 (0)	2 (1)
	d. Protects heart	0 (0)	0 (0)	0 (0)
	e. Prevents cancer	0 (0)	0 (0)	0 (0)
15.Diseases that can be controlled by diet without taking medicine	a. Anemia	0 (0)	0 (0)	0 (0)
	b. Cardio vascular dieseases	0 (0)	0 (0)	0 (0)
	c. Diarrhea	3 (3)	0 (0)	3 (3)
	d. Hypertension	0 (0)	2 (2)	2 (2)
	e. Hyper lipidimia	0 (0)	0 (0)	0 (0)
	f. Obesity	0 (0)	0 (0)	0 (0)
	g. Gastric/duodenal problems	0 (0)	1 (1)	1 (1)

16. Hypertension/BP can be controlled by	a. Only by tablets	0 (0)	0 (0)	0 (0)
	b. By reduced intake of pickles	3 (3)	0 (0)	3 (3)
	c. By reduced intake of salty foods like papads.	0 (0)	0 (0)	0 (0)
	d. Reduced oil intake	0 (0)	0 (0)	0 (0)
	e. Increase total food intake	0 (0)	3 ()	3 ()
	f. Increasing fiber	0 (0)	0 (0)	0 (0)
17. Is supplementation a must during old age?	a. Yes	3 (3)	1 (1)	4 (3)
	b. No	54 (90)	58 (48)	112 (94)
	c. Don't know	2(2)	2 (2)	4 (3)
18. Are there any foods that old people should avoid, if yes what are they?	a. Yes	3 (3)	1 (1)	4(3)
	b. No	51 (85)	50 (100)	111 (93)
	c. Don't know	2 (2)	3 (3)	5 (4)
If yes, what are those foods?		0 (0)	0 (0)	0 (0)
Total		120 (100)	120 (100)	120 (100)

Figures in the parenthesis indicate per cent elderly.

Majority of the questions were not answered by the respondents. Seven per cent of elderly respondents had the knowledge on that the consumption of water, dietary fiber during old age is necessary to prevent dehydration and constipation. Six per cent of the elderly respondents had knowledge on conscious intake of oil to prevent metabolic diseases and plenty of milk and milk products as the bone strength decreases during aging. The remaining questions were not much answered by the respondents.

Wei Lin and Ya-Wen Lee (2005) reported that the elderly had poor nutrition knowledge, especially about the relationship between nutrition and disease.

Olayiwola *et al*. (2013) found that the knowledge of undergraduate toward the nutrition of elderly illustrated that those with Food Science and Nutrition background had a good score (99%), while those without nutrition background (62% had a poor score. A correlation existed between knowledge of ageing and elderly nutrition ($r = 0.23$; $p<0.05$).

Riyami *et al. (*2009) found that elderly had the poor knowledge of nutrition plus some nutritional imbalances and low levels of physical activity. Significant sex differences existed in elderly peoples' nutritional knowledge, consumption of fluids, milk and sweets, use of dietary regimens and experience of appetite change.

Vani Bhushanam *et al.* (2013) found that the awareness levels of elderly in nutrition knowledge revealed a mean 36%.

Niharika and Vibha (2013) reported that the prevalence of anemia was higher in low socio-economic (53.3%) group as compared to 46.6% elderly in high and middle socio-economic status.

Table 4.26. Food beliefs and taboos among elderly

Food Beliefs and taboos	Reasons	Aurepalle	Dokur	Total
Foods avoided /To be avoided				
1. Brinjal	Skin allergies	40 (67)	38(63)	78(65)
2. Potato	Joint pains	47(78)	36(60)	83(69)
3.Gogu	Body pains/ joint pains	53(88)	41(68)	94(78)
4.Snake gourd	Do not like	45(75)	34(57)	79(66)
Foods Good for health				
1.GLV	Good for eyes and intestines	16(27)	4(7)	20(17)
2.Milk	Gives energy	21(35)	14(23)	35(29)
3.Potato	Causes leg pains	47(78)	40(67)	87(73)
4.Pachipulusu, onion, chillies (Tamarind in jaggary,water)	Cools the body and protects from heat	10(17)	15(25)	25(21)
Foods promoted				
1.Milk and milk products	Provides strength, helps in speedy recovery from sickness	14(23)	17(28)	31(26)
2.Bread	Gives energy and for speedy recovery	23(38)	27(45)	50(42)
3.Coconut water	Cools the body, protects from sun stroke	21(35)	17(28)	38(32)
4.Dhal	Gives strength	6(10)	4(7)	10(8)

Figures in the parenthesis indicate per cent elderly.

Food beliefs and taboos are quite prominent among the elderly in both Aurepalle and Dokur villages. Nearly 78% of elderly said foods like potato; brinjal, puntikura (gogu) and snake gourd have to be avoided by elderly. Around 55% of elderly in the belief that milk and green leafy vegetables are good for health. And 81% of elderly had foods promoted food like milk, bread and to be good for elderly.

Some elderly avoids brinjal and potato because it causes leg pains, gogu causes body pains or joint pains and most of the elderly donot like snake gourd.

Green leafy vegetables elderly good for eyes and intestines, milk gives energy for elderly, Pachipulusu,onion, chillies (Tamarind in jaggary,water) Cools the body and protects from heat. Foods promoted for elderly milk and milk products Provides strength, helps in speedy recovery from sickness, bread Gives energy and for speedy recovery, coconut water Cools the body, protects from sun stroke, dhal gives energy for elderly people.

Wei Lin and Ya-Wen Lee (2005) reported that 67% of participants usually avoided eating foods that are irritating (acidic, spicy, etc.), 59.3% usually avoided foods with a tough texture, 53.5% usually avoided cold foods, 50.9% usually avoided 'heating' foods, 45.8% usually avoided 'cooling' foods, 41.5% usually avoided hot foods and 40.8% usually avoided rough foods.

4.6 MINI NUTRITIONAL ASSESSMENT OF ELDERLY

The Mini Nutritional Assessment (MNA) of Vellas *et al.,* 2006 has been increasingly used worldwide but its efficacy has been assessed only in few countries. The Mini Nutritional Assessment (MNA) has been increasingly employed, worldwide, for the brief evaluation of older person's nutritional status as per the guidelines of ICRISAT. This MNA is composed of an anthropometric assessment, a brief questionnaire about diet characteristics, global health and environment and a self evaluation of health and nutritional status. The format is basically divided into two sections; screening and assessment, with statements marked A to H for screening and I to R for assessment.

4.6.1 SELF ASSESSMENT OF ELDERLY USING MNA FORMAT

The MNA format with the responses and conditions of elderly is given in table 4.27. The screening test had questions pertaining to food intake, weight loss, mobility, BMI, stress and psychological problems. From the responses of MNA test it could be assessed that there was no decrease in the food intake of 74% and 55% of elderly, but a moderate decrease in food intake was expressed by 26% and 45% elderly in the respective villages of Aurepalle and Dokur. Self assessment of weight loss in the last 3 months indicated that an overall 11% of elderly do not know, but 45% (55% and 37% in Aurepalle and Dokur respectively) expressed a loss of 1to 3kg. No weight loss in the last 3 months was reported by 44% (33% and 53% from Aurepalle and Dokur respectively).

All elderly in both villages reported that they can go out, without restricting to bed or chair, and suffered no psychological stress or acute disease in the past 3 months and 99% of the elderly had no neuropsychological problems except one person in Aurepalle, who complained of severe dementia/ depression. The BMI of elderly calculated from weight and height measurements of elderly when divided into categories of nutritional status indicated that 32% were less than 19, 18% were in 19-21, 15% were in 21-23, and 35% were ≥ 23 BMI. Nearly equal per cent of elderly were under weight (32%), normal (33%) and overweight or obese (35%). As many underweight elderly were in Aurepalle (47%), that many elderly were overweight or obese (47%) in Dokur village.

All the above criteria was taken into consideration for screening the elderly into normal, at risk of malnourishment and malnourished by giving scores to the responses to each of the statements.

Table 4.27. Responses to self assessment of elderly using Mini Nutritional Assessment

Assessment	Aurepalle n=60	Dokur n=60	Total n=120
Screening:			
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	0	0	0
1=moderate decrease in food intake	16 (26)	27(45)	43 (36)
2=no decrease in food intake	44 (74)	33 (55)	77 (64)
B. Weight loss during the last 3 months			
0=weight loss greater than 3kg	0	0	0
1=does not know	7 (12)	6 (10)	13 (11)
2=weight loss between 1 and 3kg	33 (55)	22 (37)	55 (45)
3=no weight loss	20 (33)	32(53)	52 (44)
C. Mobility			
0=bed or chair bound	0	0	0
1=able to get out of bed/chair but does not go out	0	0	0
2=goes out	60 (100)	60 (100)	120 (100)
D. Has suffered psychological stress or acute disease in the past 3 months			
0=yes	0	0	0
2=no	60 (100)	60 (100)	120 (100)

E. Neurolopsychological problems			
0=severe dementia or depression	1(2)	0	1 (1)
1=mild dementia	0	0	0
2=no psychological problems	59 (98)	60 (100)	119 (99)
F. Body mass index (BMI) (weight in kg)/ (height in m^2)			
0=BMI less than 19	28 (47)	11 (18)	39 (32)
1=BMI less than 19 to less than 21	12 (20)	9 (15)	21 (18)
2=BMI 21 to less than 23	6 (10)	12 (20)	18 (15)
3=BMI 23 or greater	14 (23)	28 (47)	42 (35)

Figures in the parenthesis indicate per cent elderly.

Table 4.27(cont.). Responses to self assessment of elderly using MNA

Assessment	Aurepalle n=60	Dokur n=60	Total n=120
Assessment:			
G. Lives independently (not in nursing home or hospital)			
1=yes	60 (100)	60 (100)	60 (100)
0=no	0	0	0
H. Takes more than 3 prescription per day			
0=yes	4 (7)	5 (8)	9 (8)
1=no	56 (93)	55 (92)	111 (93)
I. Pressure sores or skin ulcers			
0=yes	1(2)	3 (5)	4 (3)
1=no	59 (98)	57 (95)	116 (97)
J. How many full meals does the patient eat daily?			
0=1meal	3 (5)	0	3 (3)
1=2 meal	20 (33)	4 (7)	24 (20)
2=3 meal	37 (62)	56 (93)	93 (77)
K. Selected consumption on markets for protein intake			
*At least one serving of dairy products (milk, cheese, yogurt) per day			
*Two or more servings of legumes or eggs per week.			
Meat, fish, or poultry every day			
0.0=if 0 or 1 yes	25 (42)	19 (32)	44 (37)
0.5=if 2 yes	35(58)	41(68)	76 (63)
1.0=if 3 yes	0	0	0
L. Consumes two or more servings of fruit or vegetables per day?			
0=no	4 (7)	0	4 (4)
1=yes	56 (93)	60 (100)	116 (96)

M. How much fluid (water, juice, coffee, tea, milk..) is consumed per day?			
0.0=less than 3 cups	0	0	0
0.5=3 to 5 cups	9 (15)	2 (3)	11 (10)
1.0=more than 5 cups	51 (85)	58 (97)	109 (90)
N. Mode of feeding			
0=unable to eat without assistance	0	0	0
1=self-fed with some difficulty	7 (12)	4 (7)	11 (9)
2=self-fed without any problem	53 (88)	56 (93)	109 (91)

Figures in the parenthesis indicate per cent elderly.

Table 4.27(cont.). Responses to self assessment of elderly using MNA

Assessment	Aurepalle n=60	Dokur n=60	Total n=120
O. Self view of nutritional status			
0=views self as being malnourished	9 (15)	6 (10)	15 (13)
1=is uncertain of nutritional state	41 (68)	26 (43)	67 (55)
2=views self as having no nutritional problem	10 (17)	28 (47)	38(32)
P. In comparison with other people of the same age, how does the patient consider his/her health status?			
0.0=not as good	0	0	0
0.5=does not know	0	0	0
1.0=as good	31 (52)	25 (42)	56 (46)
2.0=better	29 (48)	35 (58)	64 (54)
Q. Mid-arm circumference (MAC) in cm			
0.0=MAC less than 21	17 (28)	12 (20)	29 (24)
0.5=MAC21to22	10 (17)	7 (12)	17 (14)
1.0=MAC 22 or greater	33 (55)	41 (68)	74 (62)
R. Calf circumference (CC) in cm			
0=CC less than 31	53 (88)	57 (95)	110 (92)
1=CC 31 or greater	7 (12)	3 (5)	10 (8)

Figures in the parenthesis indicate per cent elderly.

The statements of MNA pertaining to assessment (G to R) of elderly were related to their living conditions, intake of medicines, food, supplements, fruits, fluid, mode of feeding, skin ulcers, self assessment, and actual measurements of arm and calf muscle circumferences. Distribution of elderly as per the responses for assessment statement s is given in table 4.27. Hundred per cent of the elderly in both the villages live independently in their houses, but not in nursing home or hospital.

A meager, 8% of elderly take more than 3 prescriptions per day and 93% do not take any medicine. A small number of elderly (3%) suffered pressure sores or skin ulcers.

While 77% elderly (62% in Aurepalle and 93% in Dokur) eat three full meals a day, 20% had 2 meals per day and 3% took only one meal in a day. Intake of selected consumption of markets for protein intake revealed that 37% (42% in Aurepalle and 32% in Dokur) had only one or no protein food from dairy/ legume/egg/meat. An overall 63% elderly (58% in Aurepalle and 68% in Dokur) consumed at least two of the protein foods per day. Consumption of two or more servings of vegetable and fruit was 96% overall, but it could only be vegetable, as fruit consumption was found be relatively nil in 3 day dietary diversity. Fluid intake was found to be more than5 cups among 90% of elderly, while 10% had 3-5 cups per day in the form of water, tea, juices, milk etc. More than 90% fed themselves without any help, while 9% of the elderly also self-fed, but with some difficulty.

The self viewing of elderly as being malnourished was expressed by 13% (15% in Aurepalle and 10% in Dokur), and as having no nutritional problem was the feeling of 32% elderly (17% in Aurepalle and 47% in Dokur). Uncertainty of their nutritional state was expressed by 55% (68% in Aurepalle and 43% in Dokur). In comparison with other people of the same age, 46% of elderly (52% in Aurepalle and 42% in Dokur) considered their health as good and 54% (48% in Aurepalle and 58% in Dokur) felt that they were better than others.

In the assessment test mid arm and calf circumferences were measured and reported in table 4.27. MAC was greater with ≥22cm in 62% elderly, moderate in with 21-22cm in 14% and <21 in 24% elderly. Calf circumference was <31cm among 92% and ≥31cm in 8% elderly.

Costa Bruna *et al.* (2012) reported that there was high prevalence of overweight (46.1%) among subjects, according to body mass index. According to the Mini Nutritional Assessment 67.3% were at risk of malnutrition and inadequate intake of nutrients.

Neelam yadav *et al.* (2012) showed that 38.90% elderly were ‘well nourished’ and 37.09% were ‘at risk’ while 24.97% were ‘malnourished’. On MNA score According to BMI, maximum subjects (48.46%) were normal, whereas 36.92% were obese, 14.61% were found to be under weight.

4.6.2 NUTRITIONAL STATUS OF ELDERLY USING SCREENING SCORES OF MNA

The screening statements of MNA test had six questions on food intake, weight loss, mobility, BMI, stress and psychological problems and the same were scored as given in table 4.27. The scores were totaled for each subject and elderly were classified into three categories of nutritional status and the same are given in table 4.28.

Table 4.28. Nutritional status of elderly as per screening score of MNA

Screening score (Subtotal Max.14 points)	Description	Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
12-14 points	Normal nutritional status	13 (27)	35 (58)	48 (40)
8-11 points	At risk of malnutrition	45 (75)	25 (42)	70 (58)
0-7 points	Malnourished	2 (3)	0 (0)	2 (2)
	Total	60 (100)	60 (100)	120 (100)

Figures in the parenthesis indicate per cent elderly.

The screening scores of MNA of elderly shows that a greater per cent of elderly of Aurepalle (75%) and 42% from Dokur were at risk of malnutrition, while 3% elderly, only from Aurepalle were malnourished. Forty per cent of total elderly (27% in Aurepalle and 58% in Dokur) were in normal nutritional status. The data indicates that elderly of Dokur were healthier than Aurepalle, which confirms the results of anthropometric nutritional assessment.

Malnutrition indication score envisages that 25% of elderly are in normal nutritional status, and nearly 66.7% of elderly had risk of malnutrition. Nearly 8.3% percent of elderly were identified as malnourished.

Kirtana Pai (2011) reported a high risk of malnutrition ($p<0.05$) in the old age home residents, and confirmed the need for increased surveillance of nutritional status among residents of old age homes.

Ozge Kucukerdonmez (2005) reported that the MNA results (<17 points) indicated that 6.5% of the male and 8.8% of the female participants had inadequate nutrition. According to NSIC, 34.3% of males and 36.9% of females were classified as having a high risk of nutritional deficiency.

4.6.3 NUTRITIONAL STATUS OF ELDERLY USING SCREENING AND ASSESSMENT SCORES OF MNA

The elderly were assessed for their present conditions and abilities using 11 criteria, and each one was scored as given in table 4.27. Based on the total scores of screening and assessment, the elderly were classified into different groups of nutritional status and the results are given in table 4.29.

Table 4.29. Nutritional status of elderly according to MNA total assessment score

Nutritional status indicator score (Screening Score 14 points + Assessment Score Score 16 points)		**Aurepalle (n=60)**	**Dokur (n=60)**	**Total (n=120)**
24 to30 points	Normal nutritional status	5 (8)	25 (42)	30 (25)
17 to 23.5 points	At risk of malnutrition	45 (75)	35 (58)	80 (67)
Less than 17 points	Malnourished	10 (17)	0 (0)	10 (8)
	Total	60 (100)	60 (100)	120 (100)

Figures in the parenthesis indicate per cent elderly.

Nutritional status of elderly using screening and assessment scores of MNA shows that 25% (8% in Aurepalle and 42% in Dokur) had normal nutritional status, with higher percent of elderly from Dokur and very less from Aurepalle. Elderly at risk of malnutrition were 67% overall but within the villages, 75% in Aurepalle and 58% in Dokur were in at risk category. The per cent elderly at risk was less (58%) only with screening, but it has increased (67%) by additional 7%, when both screening and assessment criteria were taken into consideration, indicating that multiple parameters have to be taken into consideration while evaluating nutritional status of elderly. Similar to an increase in at risk elderly, the per cent malnourished elderly has also increased from 2 to 8% on the whole.

Kirtana Pai (2011) reported a high risk of malnutrition ($p<0.05$) in the old age home residents, and confirmed the need for increased surveillance of nutritional status among residents of old age homes.

Ozge Kucukerdonmez (2005) reported that the MNA results (<17 points) indicated that 6.5% of the male and 8.8% of the female participants had inadequate nutrition. According to NSIC, 34.3% of males and 36.9% of females were classified as having a high risk of nutritional deficiency.

Suzana *et al.* (2007) showed that majority of the elderly subjects (87.2%) were fully independent in performing daily tasks, with men having a significantly higher score compared to women ($p<0.001$). However, men were less likely to be able to perform a flexibility test (50.7%) than women (27.0%) ($p<0.05$).

Maria *et al.* (2009) reported that 33.8% elderly were classified as adequate regarding nutritional Status; 37.1% were classified as being at risk of malnutrition and 29.1% were classified as malnourished. Among the variables, eating partial (42.9%) or complete (12.9%) dependence was found in more than half of the malnourished elderly, in 13.4% of those at risk of malnutrition and in 2.5% of those without malnutrition.

Zarina *et al*. (2006) reported that BMI was 18.5 - 22, indicating chronic energy deficiency, was found in 50% of the population. MNA revealed a prevalence of 26% for protein–energy malnutrition and 62% for risk of malnutrition.

Olayiwola and Deji (2013) reported that the mean nutritional vulnerability score was higher for women than men ($p<0.05$).

Shilpa Jose and Kumari (2014) reported that the study MNA demonstrated a sensitivity of 90.2% per cent and specificity of 96.4% per cent in identifying well nourished and malnourished elderly, which is excellent. Use of BMI as a 'gold standard' also showed that MNA had excellent sensitivity (95.4%) and specificity (93.9%) in identifying malnutrition.

Olayiwola and Ketiku (2006) reported that based on BM), more than half of the respondents had an acceptable nutritional status with a BMI between 18-25 (63% male; 58% female) whilst 15% of the males and 14% of the females were under weight with BMIs below 18 and 3% of the males had severe malnutrition (BMI below 15). The majority were either moderately vulnerable or (50% male; 50% female) or highly vulnerable (39% male and 46% female).

4.7 COMPARISON OF PRESENT WITH PAST NUTRITIONAL STATUS OF ELDERLY

In recent years, there has been a sharp increase in the number of older persons worldwide and many old people are alive now a day than at any time in history. Traditional perceptions of old age have been challenged during the past few years and it is important that elderly people are not taken as a burden on society, but rather as an asset. Nutrition is an important determinant of health in persons over the age of 60 and above. Nutritional status can be affected by social factors also. Education plays a key role in the positive levels of nutrient intakes by older people.

In this context, comparison of the present nutritional status in both the villages were studied and compared and the pooled data of two villages of present BMI was compared with previous BMI.

4.7.1 Comparison of BMI of elderly between the two villages

The present body mass indices of elderly of both the villages were compared and tested statistically in table 4.30. The mean BMI of elderly of Aurepalle was 19.7 ± 3.7 and that Dokur village was 19.19 ± 3.2.

Table 4.30. Difference in the BMI of elderly between Aurepalle and Dokur in 2014

Village	Mean±S.D	t- value	Probability
Aurepalle (n=60)	19.72±3.71	0.4992*	0.4406
Dokur (n=60)	19.19±3.26		

Values are mean ± standard deviation.

Though elderly of both the villages maintained a BMI of normal category, elderly of Aurepalle maintained slightly better BMI than elderly of Dokur. There is a significant difference between BMI of the elderly of the two villages, Aurepalle and Dokur at 5% level of significance. The difference between BMI could be attributed to better food habits of Aurepalle elderly compared to Dokur elderly.

4.7.2 Comparison of BMI of elderly between 2012 and 2013

The mean BMI of elderly in the SAT villages during the years 2012 (18.20 ± 3.1) and 2013 (18.08 ± 4.45) were given in table 4.31. The pooled data of elderly of both villages shows that there was a slight decrease in the BMI of elderly in 2013 compared to 2012, with a significant difference ($P<0.5$)

Table 4.31. Difference in the BMI of elderly for the year of 2012 – 2013

Year	Mean±S.D	t- value	Probability
2012	18.20 ± 3.1	1.8443*	0.0295*
2013	18.08 ± 4.45		

Values are mean ± standard deviation.

Difference in the mean BMI of elderly in the years 2013 and 2014 as shown in table 4.32 indicates that the mean BMI of elderly in 2013 was 18 ± 4.45 and that of elderly in 2014 was 19.42 ±3.24.

Table 4.32. Differences in the BMI of elderly

Year	Mean±S.D	t- value	Probability
2013	18.07±4.45	0.7328*	0.4576
2014	19.42±3.24		

Values are mean ± standard deviation.

Though elderly in both the years maintained a BMI of normal category, elderly of 2014 had a better BMI than elderly of 2013, which is a significant improved range ($p<0.01$) in 2014.

The BMI of elderly in 2012 and 2014 years was compared and tested statistically and is given in table 4.33. The mean BMI of elderly of 2012 was 18 .2 ± 3.1 and that of elderly of 2014 was 19.4 ±3.2. Which shows a significant improvement in 2014 ($p<0.01$).

Table 4.33. Difference in the Body Mass Index of elderly

Year	Mean±S.D	t- value	Probability
2012	18.2±3.1	3.1513**	0.0031**
2014	19.4±3.2		

Values are mean ± standard deviation.

Over a period 3 years there was a slight decrease in the BMI of elderly between 2012 and 2013, but later the BMI improved between 2013-14, owing to improvement in food intake or due to healthy environment without the incidence of morbidity.

4.7. 3 Comparison of past height of elderly of Aurepalle and Dokur

The height of the villagers for the past years was obtained as pooled data for both the villages. Hence the height of the combined villages of respective villages was compared statistically. The 2010 and 2011 years height of elderly of both the years were compared and tested statistically and are given in table 4.33 The mean height of elderly of 2010 was 144.81 ± 25.87cm and that of elderly of 2011 was 144.10 ± 25.93.cm

Table 4.34. Difference in the height of elderly

Year	Mean±S.D	t- value	probability
2010	144.81±25.87	0.0697	0.0264*
2011	144.10±25.93		

Values are mean ± standard deviation.

Though elderly of both the villages maintained a height of normal category, elderly of 2011 maintained slightly better height than elderly of 2010. There is a significant difference between Aurapalle and Dokur villages with respective height at 5% level.

Table 4.35. Differences in the height of elderly

Year	Mean±S.D	t- value	probability
2011	144.10±25.93	0.4135	0.2679
2012	143.36±26.38		

Values are mean ± standard deviation.

The height of elderly in 2011 and 2012 of years were compared and tested statistically and are given in Table 4.34. The mean height of elderly of 2011 was 145 ± 25.9 cm and that of elderly of 2012 was 143.3 ± 26.3cm.

Though elderly of both the villages maintained a height of normal category, elderly of 2011 maintained slightly better height than that during 2012. There is no significant difference between 2011 and 2012 with respective height.

Table 4.36. Difference in the height of elderly

Year	Mean±S.D	t- value	Probability
2013	144.85±18.96	2.0004	0.0193*
2014	143.28±26.38		

Values are mean ± standard deviation.

During 2013 and 2014 height of elderly were compared and tested statistically and are given in table 4.35. The mean height of elderly in 2013 was 144.8 ± 18.9cm and that of elderly of 2014 was 143.2 ± 26.3cm. There was a reduction in the height of elderly from 2013 to 2014 which is quite natural with aging.

4.7.4 Comparison of past weight of elderly of Aurepalle and Dokur

Table 4.37. Difference in the weight of elderly

Year	Mean ± S.D	t- value	Probability
2010	41.4221±15.2992	0.1371	0.0951
2011	41.7597±15.2710		

Values are mean ± standard deviation.

The weight of the villagers for the past years was obtained as pooled data for both the villages. Hence, the weight of the combined villagers of respective villages was compared statistically.

The 2010 and 2011 year's weight of elderly of both the years were compared and tested statistically and are given in Table 4.36. The mean weight of elderly of 2010 was 41.4 ± 15.3 and that of elderly of 20141was 41.8 ± 15.3.

Though elderly of both the years maintained a weight of normal category, elderly of 2011 maintained had slightly better height than elderly of 2010. There is no significant difference between 2010 and 2011 with respective weight at 5% level of significance and t calculated value was 0.1371 with the probability of 0.0951.

Table 4.38. Differences in the weight of elderly

Year	Mean±S.D	t- value	probability
2011	41.76±15.27	0.2402	0.5250
2012	41.14±16.51		

Values are mean ± standard deviation.

The weight of elderly in 2011 and 2012 years were compared and tested statistically and are given in Table 4.37. The mean weight of elderly of 2011 was 41.8 ± 15.3 and that of elderly of 2012 was 41.2 ± 16.5. Though elderly of both the years maintained a weight of normal category, elderly of 2011 maintained slightly better height than elderly of 2012. There is no significant difference between 2011 and 2012 with respective weight at 5% level of significance and t calculated value was 0.2402 with the probability of 0.5250.

Table 4.39. Difference in the weight of elderly

Year	**Mean±S.D**	**t- value**	**Probability**
2013	41.11±15.29	2.1223	0.0127*
2014	41.15±15.51		

Values are mean ± standard deviation.

The weight of elderly 2013 and 2014of both the years were compared and tested statistically and are given in Table 4.38. The mean weight of elderly of 2013 was 41.2 ± 15.3 and that of elderly of 2014 was 41.2 ± 10.5.

Though elderly of both the years maintained a weight of normal category, elderly of 2014 slightly had better height than elderly of 2013. There is a significant difference between 2013 and 2014.

Comparison of present BMI with previous BMI (Body mass indices) status shows normal and same for the previous past five years. The weight of the elderly was significantly increased from the previous nutritional status to present nutritional status, and height of the elderly reduced from the previous status to present status, which is natural with aging.

SUMMARY AND CONCLUSION

Chapter V

SUMMARY AND CONCLUSIONS

The study was conducted in collaboration with Research Program on Markets, Institutions and Policies (RP-MIP) of ICRISAT at Aurepalle and Dokur villages of Mahaboob Nagar district in Telangana state, India. Since it is a part of ICRISAT Research project, "Women's Empowerment in Rural South Asia: Micro-level Evidences on Labor Participation, Institutions and Food Security", the data analysis and comparison with the previous research data will be done at ICRISAT, Patancheru. Sixty households with elderly population from each of the two villages, Aurepalle and Dokur were selected for the study. A detailed interview schedule was developed to collect information from the elderly respondents.

Elderly people above 65 years were selected from Mahaboob Nagar district by purposeful sampling procedure. Total sample of 120 were divided into two groups, sixty elderly people in Aurepalle and sixty elderly people in Dokur villages of Mahaboob Nagar district.

Interview schedule was prepared with questions related to factors related nutritional profile of elderly in the following broad heads i.e., socio-economic status which includes caste, religion, sources of income, housing details, education and health, and nutritional knowledge of elderly and morbidity among elderly in the past 14 days.

The information about elderly living in rural areas include various aspects like age, sex, caste, religion, educational qualification, and economic status was collected. The situations from a pooled data of both the villages indicate that not more than 20% are surviving after the age of 76 years, while there was a very small gap between male and female ratio in Aurepalle indicating relatively similar longevity; in Dokur village, the number of female elderly outweigh the number of males. Women were more than double the percentage of males in Dokur suggesting that there could have been a higher mortality among older men compared to older women of Dokur and less longevity among men of Dokur compared to Aurepalle.

Majority of the subjects belonged to Hindu religion in both Aurepalle and Dokur with 98% elderly in each village, while 2% in each village belonged to Muslim religion. The area was predominantly a Hindu residential place and there is a likelihood of

similarities in culture, food habits, nutritional and health conditions. The differences in cultural practices of the three communities might have an influence on the nutritional and health status of elderly.

Literacy level was very poor in Dokur village with highest per cent of illiterates, with a meager per cent elderly, who studied up to primary or upper primary education and none reaching high school education. Comparatively in Aurepalle, 25% of the elderly had education up to either primary or upper primary or high school level and above. Educational back ground of elderly has an influence on the status of the elderly in the family and in neighborhood. Education will also impact the health and nutritional status of elderly.

A group of 33% elderly in Aurepalle and 35% from Dokur do not have income of their own, they are dependent on children. Most of the elderly live together with their spouses. This type of situation was mostly seen in Aurepalle. Majority of the elderly were comfortable within their own housing facilities.

Contrary to the synchrony in height and weight measurements in men, women showed a different picture with lower mean weight (45.0 kg) for tall women (147 cm) of Aurepalle, and high mean weight of 51.0 kg for shorter women (144 cm) of Dokur. Thus, shorter the women the heavier the weight; taller the men, heavier their weight. Women with short stature and reduced activity seem to be gaining more weight. The results indicate mild to moderate degrees of nutritional deficiencies in elderly.

In general, the diets constituted cereals with vegetables cooked with some oil on regular basis; with occasional intake of meat or eggs is the typical food intake pattern of Aurepalle and Dokur. Milk consumption was seen among 42-45% in Aurepalle against 10-12% in Dokur. The dietary diversity indicates more of a carbohydrate diet with limited intake of protein consumption of protective foods (milk) but some amount of vegetable is taken every day. Majority of elderly belonging to BC and SC category has medium dietary diversity score from Aurepalle village A good no. of BC's had high dietary diversity score indicating BC community been in the habit of good dietary diversity. Majority of the elderly in both the villages were either dependents or belonged to middle income group and they had a medium dietary diversity score, the low income (4) dependents (5) elderly of Aurepalle had a high dietary diversity score.

Regarding dietary diversity high literacy per cent and economic status made the rural elderly more diet conscious as indicated by the consumption of higher amounts of

fruits and milk and milk products than those illiteracy elderly people living in rural areas. On the other hand, the rural elderly were more dependent on the locally available foods such as cereals, and pulses which might have caused a high protein intake status for them. The gender also had noticeable difference in nutrient uptake. Many of the elderly were found to be ignoring about the importance of nutrients in maintaining their health status that made the intake of all nutrients low compared to RDA. Energy was adequate in both the groups, protein was deficient by 10-13%, and intake of oil was $2^{1/2}$ times greater than requirement. Calcium intake was adequate in elderly of Dokur, but meeting only 88% RDA in case Aurepalle. Per cent adequacy of beta-carotene was 90 and 53, and that of riboflavin was 53 and 38 and of vitamin C was 63 and 34 respectively among elderly of Aurepalle and Dokur. In general both the groups had low intakes of these vitamins, with elderly of Dokur having less intake compared to elderly of Aurepalle.

Poor intake of protective foods among elderly could be attributed to lack of purchasing power, lowered capacity to prepare food for themselves, inability to chew food, lack of knowledge and negligence of self care. The high incidences of bone pain complaints were due to inadequate calcium intake and anaemia due to poor intake of iron rich leafy vegetables and occasional meat consumption.

All elderly in both villages reported that they can go out, without restricting to bed or chair, and suffered no psychological stress or acute disease in the past 3 months and 99% of the elderly had no neuropsychological problems except one person in Aurepalle, who complained of severe dementia/ depression. The BMI of elderly calculated from weight and height measurements of elderly when divided into categories of nutritional status indicated that 32% were less than 19, 18% were in 19-21, 15% were in 21-23, and 35% were $\geq$ 23 BMI. Nearly equal per cent of elderly were under weight (32%), normal (33%) and overweight or obese (35%). As many underweight elderly were in Aurepalle (47%), that many elderly were overweight or obese (47%) in Dokur village.

The statements of MNA pertaining to assessment (G to R) of elderly were related to their living conditions, intake of medicines, food, supplements, fruits, fluid, mode of feeding, skin ulcers, self assessment, and actual measurements of arm and calf muscle circumferences. Distribution of elderly as per the responses for assessment statement s is given in table 4.27. Hundred per cent of the elderly in both the villages live independently in their houses, but not in nursing home or hospital. A meager, 8% of elderly take more

than 3 prescriptions per day and 93% do not take any medicine. A small number of elderly (3%) suffered pressure sores or skin ulcers.

While 77% elderly (62% in Aurepalle and 93% in Dokur) eat three full meals a day, 20% had 2 meals per day and 3% took only one meal in a day. Intake of selected consumption of markets for protein intake revealed that 37% (42% in Aurepalle and 32% in Dokur) had only one or no protein food from dairy/ legume/egg/meat. An overall 63% elderly (58% in Aurepalle and 68% in Dokur) consumed at least two of the protein foods per day. Consumption of two or more servings of vegetable and fruit was 96% overall, but it could only be vegetable, as fruit consumption was found be relatively nil in 3 day dietary diversity. Fluid intake was found to be more than5 cups among 90% of elderly, while 10% had 3-5 cups per day in the form of water, tea, juices, milk etc. More than 90% fed themselves without any help, while 9% of the elderly also self-fed, but with some difficulty.

The self viewing of elderly as being malnourished was expressed by 13% (15% in Aurepalle and 10% in Dokur), and as having no nutritional problem was the feeling of 32% elderly (17% in Aurepalle and 47% in Dokur). Uncertainty of their nutritional state was expressed by 55% (68% in Aurepalle and 43% in Dokur). In comparison with other people of the same age, 46% of elderly (52% in Aurepalle and 42% in Dokur) considered their health as good and 54% (48% in Aurepalle and 58% in Dokur) felt that they were better than others.

In the assessment test mid arm and calf circumferences were measured and reported in table 4.27. MAC was greater with ≥22cm in 62% elderly, moderate in with 21-22cm in 14% and <21 in 24% elderly. Calf circumference was <31cm among 92% and ≥31cm in 8% elderly.

Nutritional status of elderly using screening and assessment scores of MNA shows that 25% (8% in Aurepalle and 42% in Dokur) had normal nutritional status, with higher percent of elderly from Dokur and very less from Aurepalle. Elderly at risk of malnutrition were 67% overall but within the villages, 75% in Aurepalle and 58% in Dokur were in at risk category. The per cent elderly at risk was less (58%) only with screening, but it has increased (67%) by additional 7%, when both screening and assessment criteria were taken into consideration, indicating that multiple parameters have to be taken into consideration while evaluating nutritional status of elderly. Similar to an

increase in at risk elderly, the per cent malnourished elderly has also increased from 2 to 8% on the whole.

It was observed that the most predominant diseases found in the elderly were arthritis, blood pressure, constipation, obesity, diabetes, and anemia. In Aurepalle, elderly most predominant disease condition observed was digestibility (31.2); diabetes (27.6); vision loss (14.4) ;obesity (16.8); memory loss (16.8); loss of control in urine and stool (14.4); In Dokur. Elderly, most predominant disease condition observed was loss of sensation (32.4); digestibility (30.6); diabetes (25.8); memory loss (15.6); and hearing loss (12.6); it was observed that elderly people irrespective of sex and area suffered with problems like cold and cough, fever, vomiting and sore throat frequently. Thus, the result of the study reveals that the socio-economic conditions and living habits play a major role in the nutritional status of the elderly.

The elderly suffered from many physical problems and diseases. The deficient intake of food, irregular feeding habit and lack of balanced diet caused most of these health problems, which made them more vulnerable and susceptible towards the diseases. The present study identifies the risk factors like isolation, unsatisfactory family relations, spouse loss, decreased mobility and anorexia due to psychological and physical illness, which need to be taken care. Irrespective of their nutritional status, majority of the elderly preferred to lead a happy and peaceful life. Hence, it can be concluded that apart from providing nutrition and palatable diet, the family members should provide to the elderly a healthy environment to promote their social interaction. Hence, it is very important to take care of their health as they are vulnerable and susceptible towards disease, due to lack of proper diet and knowledge. Hence, youngsters should step forward to provide a peaceful life for elderly, who once represented the healthy part of the society.

The need to promote healthy eating habits is essential in order to provide a healthy diet with adequate intake of nutrients specific to the elderly, as well as an appropriate focus on the social issues involved. Health education and promotion should be instituted for the elderly. Healthy traditions and values of Indian culture should be protected and promoted by developing good intra-familial and social relationships. Hypertension, joint pain and visual impairment are the most common problems in elderly rural population which cause the more dependency among the elderly population.

Elderly people are sometimes left alone to find for themselves for maintaining their health. In such a situation, proper nutrition and health care is necessary for them to

lead a normal life. Proper intervention programs are required for the elderly people to live healthy life.

Nutrition plays an important role in maintaining health at all ages but for the elderly the impact may be directly related to the length and quality of life. Recommendations to decrease the prevalence of malnutrition in elderly include improving the eating environment, looking for early signs of under nutrition, screening for treatable causes of poor intake (e.g. depression, dental problems) and then modifying the diet appropriately and controlling infection. This requires an emphasis on nutrition education and an increasingly important role of nutrition as a scientific discipline in public health and medicine.

Finally it is concluded that Nutritional knowledge, frequent health checkups to minimize or to prevent chronic diseases among elderly is essential. As the poor economic status prevailing in the villages is hindering them from consuming protective foods like green leafy vegetables, egg, protein rich foods and fruits etc, the government can take an initiative in providing protective foods for vulnerable groups. The counseling sessions on Nutritional Health Education for elderly must be conducted frequently by health, women and child welfare departments. Intervention programs are required for the elderly men and women, to take care of their health and nutritional needs.

During 2013 and 2014 height of elderly were compared and tested statistically and are given in table 4.35. The mean height of elderly in 2013 was 144.8 ± 18.9cm and that of elderly of 2014 was 143.2 ± 26.3. There was a reduction in the height of elderly from 2013 to 2014 which is quite natural with aging.

Though elderly of both the years maintained a weight of normal category, elderly of 2014 slightly had better height than elderly of 2013. There is a significant difference between 2013 and 2014.

Comparison of present BMI with previous BMI (Body mass indices) status shows normal and same for the previous past five years. The weight of the elderly was significantly increased from the previous nutritional status to present nutritional status, and height of the elderly reduced from the previous status to present status, which is natural with aging.

Over a period 3 years there was a slight decrease in the BMI of elderly between 2012 and 2013, but later the BMI improved between 2013-14, owing to improvement in food intake or due to healthy environment without the incidence of morbidity.

Scope of future research:

- A similar detailed study can be conducted in other locations at in different places i.e. different districts of Andhra Pradesh and Telangana comparing male and female elderly.
- A comparative study on health and nutritional status, prevalence of diseases of elderly living with families and living alone can be done.
- Such studies will help the nutritionists for enrichment of essential nutrients in food supplements to enhance the serum nutrient profile.
- Imparting nutrition education for the management personnel and inmates and its impact on nutritional status of the inmates can be studied.

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APPENDICES

APPENDICES

NUTRITIONAL PROFILE OF THE ELDERLY IN THE SEMI ARID TROPICS (SAT) VILLAGES

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APPENDIX -A

GENERAL DETAILS:

1. Name of the head of the household (including surname):
2. Name of the respondent:
3. Religion : Hindu, Muslim, Christian, others
4. Caste category : SC/ST/BC/FC/OBC/NT/VJ
5. Type of family : Joint/Nuclear/Extended nuclear family
6. Type of house : Building/Tiled roof house/Hut
7. Land holding (acres):
8. Whether the head/any family members belong to the VLS survey conducted by ICRISAT? Y/N.

   If yes, household identification No: ……..
9. Start time of interview : End time of interview :

FAMILY COMPOSITION:

S.No.	NAME	AGE	SEX	EDUCATION	OCCUPATION	HEIGHT (cms)	WEIGHT (kgs)	BMI	ANNUAL INCOME (Rs)
1									
2									
3									
4									

APPENDIX - B

CLINICAL ASSESSMENT:

Deficiency	**1= Present 2=Not Present**	**Deficiency**	**1= Present 2=Not Present**
Protein energy malnutrition		Pale eyes, tongue, lips, and face skin	
Kwashiorkor		Tiredness/lack of energy	
Marasmus		Edema of feet	
Weakness, lack of energy		Spoon shaped nails	
Loss of subcutaneous fat/muscle wasting		**Riboflavin**	
Copper color hair		Cheilosis	
Thin easily pluckable hair		Angular stomata is	
Pale skin		Atrophic papillae	
Moon face		**Thiamine**	
Low birth weight		Loss of ankle and knee jerks	
Spoon shaped nails		Edema of body parts	
Edema		Tenderness of calf muscles	
Vitamin-A		Loss of sensation	
Night blindness		Loss of muscle function	
Dryness of skin		**Niacin**	
Bitot spots		Pellagrous skin	
Xeropthalmia (Dry eyes)		Majenta red tongue	
Dissolved of cornea		Swollen papillae of mouth	
Follicular hyperkeratosis		Fissures on tongue	
Conjunctival xerosis		**Iodine deficiency**	
Corneal xerosis		Thyroid gland swelling	
Vitamin-C		Deafness	
Swollen bleeding gums		Growth retardation	
Lack of blood clotting		**Florosis**	
Vitamin-D		Motted teeth	
Bowed legs		Dental cavities	
Knock knees		Protruding eyes	
Pigeon chest		**Any others**	
Iron deficiency anemia			
Paleness of inner side of eye lids			

APPENDIX - C

MAJOR NUTRITIONAL PROBLEMS DURING OLDAGE

Ask these questions to the respondent*: Do you / are you experiencing any of the following given below.*

DEFICIENCIES	**Response: Yes / No**	**DEFICIENCIES**	**Response: Yes / No**
Loss of sensation		Anemia	
Loss of balance		Constipation	
Memory loss		Loss of apatite	
Hearing loss		Loss of control in urine and stool	
Diabetic retinopathy (Vision loss)		(Any others (specify)	
Diabetes			
Chest pain			
Osteoarthritis (Joint pains)			
Digestibility			
Obesity			

LIFE STYLE PROBLEMS FOR ELDERLY PEOPLE

Life style problems	**Aurapalle (n=60)**	**Dokur (n=60)**	**Total (n=120)**
Living alone			
Do you eat along with children			
Habit of tobacco chewing			
Habit of taking alcohol			
Habit of smoking			
Spending some time in walking			
Inactivation			

MORBIDITY QUESTIONS

1. Were you sick or disabled* in the last 7 days Yes=1; No=2. If yes, please ask question no
2. If no, please ask question no 3.

3. What were the symptoms /diseases (list in the order of severity)?

Sl.No	Symptom	No of days the symptom lasted	Where did you go for treatment
1			
2			
3			
4			
5			
How many days were you unable to carry out your usual activity?			

4. Were you sick or disabled in the last 14 days Yes=1; No=2, If yes please fill in question

5. What were the symptoms /diseases (list in the order of severity)?

Sl.No	Symptom	No of days the symptom lasted	Where did you go for treatment
1			
2			
3			
4			
5			
How many days were you unable to carry out your usual activity?			

APPENDIX - D

DIETARY ASSESSMENT THROUGH DIETARY DIVERSITY

Ask these questions to the respondent*: Please think carefully about the foods and drinks that you have consumed during the* ***past 3 days*** *and list them down. Start with yesterday and go backwards. If the respondent is not able to answer, then please ask the caretaker of the respondent.*

Day/Date	Breakfast	Snacks	Lunch	Snacks	Dinner	Others
Yesterday-Date						

APPENDIX - E

WEIGHMENT METHOD:

Meal **List items prepared**	**Name of the ingredient**	**Weight of raw ingredients (gm)**	**Weight of cooked food (gm)**
Breakfast			
Mid-morning			
Lunch			

Meal **List items prepared**	**Name of the ingredient**	**Weight of raw ingredients (gm)**	**Weight of cooked food (gm)**
Snacks			
Dinner			

APPENDIX - F

FOOD BELIEFS AND TABOOS OF ELDERLY

FOOD ITEM	REASONS
FOODS AVOIDED	
1	
2	
3	
4	
5	
FOOD BELIEFS	
1	
2	
3	
4	
5	
6	
FOODS PROMOTED FOR ELDERLY	
1	
2	
3	
4	

APPENDIX – G

KNOWLEDGE OF HEALTH AND NUTRITION

knowledge of health and nutrition		Aurepalle (n=60)	Dokur (n=60)	Total (n=120)
1. Quantity of food should change with age?	a. Should increase			
	b. Should decrease			
	c. No change requires			
2. Aging causes bone loss?	a. Yes			
	b. No			
	c. Don't know			
3. To improve bone strength aged persons should take these.	a. Milk			
	b. Meat			
	c. Sit in sunlight for some time			
	d. GLV			
	e. Only supplements			
	f. Normal food			
4.Maintaining good blood is important in old age	a. Yes			
	b. No			
	c. Don't know			
5. Foods that provide good blood composition	a. Fruits			
	b. Meat			
	c. Milk			
	d. Iron tablets			
	e. Normal food			
	f. GLV			
	g. Cereals			
	h. Pulses			
	i. Sour fruits			
6. Quality of food should change with age	a. Yes			
	b. No			
	c. Don't know			
7. It is better to have higher bodyweight to delay aging	a. Yes			
	b. No			
	c. Don't know			
8. More oil/fat intake prevents aging	a. Yes			
	b. No			
	c. Don't know			
9. Plenty of water should be taken during old age to prevent dehydration	a. Yes			
	b. No			

	c. Don't know			
10. Excess intake of egg/meat/fish is necessary to prevent loss muscle	a. Yes			
	b. No			
	c. Don't know			
11. It’s natural that every old person suffers from	a. Blood pressure			
	b. Diabetes			
	c. Heart diseases			
	d. Osteoporosis			
	e. Obesity			
	f. Constipation			
	g. Any other			
12. Dietary fiber is present in	a. Meat			
	b. Been vegetables c.GLV			
	d. Rice.			
	e. Egg			
	e. Millets			
	g. Spices			
	h. Fruits			
	i. Root vegetables			
	j. Dals			
13. Quantity of fiber intake	a. More than normal			
	b. Less than normal			
	c. No change			
14. Fiber in food	a. Causes digestion			
	b. Helps indigestion			
	c. Prevents constipation			
	d. Protects heart			
	e. Prevents cancer			
15. Diseases that can be controlled by diet without taking medicine	a. Anemia			
	b. CVD			
	c. Diarrhea			
	d. Hypertension			
	e. Hyper lipidimia			
	f. Obesity			
	g. Gastric/duodenal problems			
16. Hypertension/B.P can be controlled	a. Only by tablets			
	b. By reduced intake of pickles			
	c. By reduced intake of salty foods like papads.			
	d. Reduced oil intake			
	e. Increase total food intake			

	f. Increasing fiber			
17. Is supplementation a must during old age	a. Yes			
	b. No			
	c. Don't know			
18. Are there any foods that old people should not take?	a. Yes			
	b. No			
	c. Don't know			
19. If yes, what are those foods?				

APPENDIX - H

12 FOOD GROUPS CHART

Question number	Food group	Examples	YES=1 NO=0
1	CEREALS	Corn/maize, rice, wheat, sorghum, millet, or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products)+ insert local foods e.g. ugali, nshima, porridge or pastes or other locally available grains	1 (millet porridge and rice)
2	VITAMIN A RICH VEGETABLES AND TUBERS	Pumpkin, carrots, squash, pr sweet potatoes that are orange inside+ other locally available vitamin A rich vegetables (e.g. red sweet pepper)	1 (pumpkin)
3	WHITE ROOTS AND TUBERS	White potatoes, white yams, white cassava, or other foods made from roots	0
4	DARK GREEN LEAFY VEGETABLES	Dark green/leafy vegetables, including wild ones+ locally available vitamin A rich leaves such as amaranth, cassava leaves, kale, spinach etc.	1 (cassava leaves)
5	OTHER VEGETABLES	Other vegetables (e.g. tomato, onion, eggplant), including wild vegetables	1 (onion and tomato)
6	VITAMIN A RICH FRUITS	Ripe mangoes, cantaloupe, apricots (fresh or dried), ripe papaya, dried peaches+ other locally available vitamin A rich fruits	1 (mango)
7	OTHER FRUITS	Other fruits, including wild fruits	0
8	ORGAN MEAT	Liver, kidney, heart or other	0

		organ meats or blood-based foods	
9	FLESH MEATS	Beef, pork, lamb, goat, rabbit, wild game, chicken, duck, or other birds	0
10	EGGS	Chicken, duck, guinea fowl or any other egg	0
11	FISH	Fresh or dried fish or shellfish	0
12	LEGUMES, NUTS AND SEEDS	Beans, peas, lentils, nuts, seeds or foods made from these	1 (groundnuts)
13	MILK AND MILK PRODUCTS	Milk, cheese, yogurt or other milk products	0
14	OILS AND FATS	Oil, fats or butter added to food or used for cooking	1 (oil in sauce from lunch and dinner)
15	SWEETS	Sugar, honey, sweetened soda, sweetened juice or sugary foods such as chocolates, candies, cookies and cakes	1 (sugar in tea)
16	SPICES, CONDIMENTS, BEVERAGES	Spices (black pepper, salt), condiments (soya sauce, hot sauce), coffee, tea, alcoholic beverages or local examples	1 (fish powder and tea)
Household level only	Did you or anyone in your household eat anything (meal or snack) OUTSIDE the home yesterday?		
Individual level only	Did you eat anything (meal or snack) OUTSIDE the home yesterday?		No

Mini Nutritional Assessment
MNA®

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

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 ☐

Screening score (subtotal max. 14 points) ☐☐
12-14 points: Normal nutritional status
8-11 points: At risk of malnutrition
0-7 points: Malnourished
For a more in-depth assessment, continue with questions G-R

Assessment

G Lives independently (not in nursing home or hospital)
1 = yes 0 = no ☐

H Takes more than 3 prescription drugs per day
0 = yes 1 = no ☐

I Pressure sores or skin ulcers
0 = yes 1 = no ☐

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals ☐

K 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 ☐.☐

L Consumes two or more servings of fruit or vegetables per day?
0 = no 1 = yes ☐

M 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 ☐.☐

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem ☐

O 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 ☐

P 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 ☐.☐

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC 22 or greater ☐.☐

R Calf circumference (CC) in cm
0 = CC less than 31
1 = CC 31 or greater ☐

Assessment (max. 16 points) ☐☐.☐
Screening score ☐☐.☐
Total Assessment (max. 30 points) ☐☐.☐

Malnutrition Indicator Score

24 to 30 points	☐	Normal nutritional status
17 to 23.5 points	☐	At risk of malnutrition
Less than 17 points	☐	Malnourished

References
1. Vellas B, Villars H, Abellan G, *et al.* Overview of the MNA® - Its History and Challenges. *J Nutr Health Aging.* 2006; **10**:456-465.
2. Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF). *J. Geront.* 2001; **56A**: M366-377
3. Guigoz Y. The Mini-Nutritional Assessment (MNA®) Review of the Literature - What does it tell us? *J Nutr Health Aging.* 2006; **10**:466-487.

For more information: www.mna-elderly.com