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**“ASSESSMENT OF NUTRITIONAL STATUS OF  
ELDERLY POPULATION OF RURAL AREAS:  
A COMMUNITY BASED CROSS SECTIONAL STUDY”**

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**Submitted by  
REG. NO. BD0119007**

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JAWAHARLAL NEHRU MEDICAL COLLEGE, KAHER,  
BELAGAVI – 590010, KARNATAKA, INDIA**

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**Dr. SHIVASWAMY M. S. MD**  
Professor and Head,  
Department of Community Medicine,  
J. N. Medical College, KAHER,  
Belagavi – 590010,  
Karnataka, India.

Place: Belagavi  
Date:

**Dr. (Mrs.) N. S. MAHANTSHETTI MD**  
Principal,  
J. N. Medical College, KAHER,  
Belagavi – 590010,  
Karnataka, India.

Place: Belagavi  
Date:

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**(Reg. No: BD0119007)**

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Accredited 'A' Grade by NAAC (2<sup>nd</sup> Cycle)

Placed in Category 'A' by MHRD (Govt)

Nehru Nagar, Belagavi- 590 010, Karnataka, INDIA

☎ 0831 - 2471350



☎ 0831 - 2470759



www.jnmc.edu



principal@jnmc.edu

Ref No: MDC/PG/

Date: 28-10-2021.

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*Ashwini A Bellad*  
(Dr. Ashwini A Bellad)  
Guide.



*N.S. Mahantashetti*  
Dr. (Mrs.) N.S. Mahantashetti,  
Chairperson-Antiplagiarism Committee &  
Principal,  
J. N. Medical College, Belagavi.

To,  
Reg. No. **BD0119007**.  
Postgraduate Student,  
2019-20 Batch,  
Department of Community Medicine,  
J. N. Medical College, Belagavi.

## LIST OF ABBREVIATIONS USED

1	WHO	World Health Organization
2	MNA	Mini- Nutritional Assessment
3	RDA	Recommended Dietary Allowances
4	W/H Ratio	Waist / Hip Ratio
5	MAC	Mid - Arm Circumference
6	CC	Calf Circumference
7	HB	Hemoglobin
8	RBS	Random Blood Sugar
9	SPSS	Statistical Package for Social Science
10	CPI	Consumer Price Index
11	PUC	Pre University Course
12	NGO	Non-Governmental Organization
13	PR	Pulse Rate
14	BP	Blood Pressure
15	RR	Respiratory Rate
16	BMI	Body Mass Index
17	ANM	Auxiliary Nurse Midwife
18	ASHA	Accredited Social Health Activist
19	ADA	American Diabetes Association
20	kg	Kilogram
21	cm	Centimeter
22	<b>g</b>	Effect size

## **ABSTRACT**

**Title: Assessment of nutritional status of elderly population of rural areas: A community based cross sectional study**

### **Introduction:**

Ageing is an inevitable and irreversible biological process that commences with birth, continues throughout life and ends in death. As per the United Nations, the cutoff age is 60 years and above for older age population. Globally the elderly population in 2020 was 727 million. In the coming three decades, the global population of older persons is predicted to increase by two fold, thus by 2050 the number will reach over 1.5 billion. The increase in the segment of older population will be witnessed by all the regions between 2020 and 2050. Globally, the older population forms 9.3 per cent of the total population in 2020 and is expected to rise to 16.0 per cent by 2050.

A great proportion, 61% of elderly population are from developing country, but by 2025 the proportion will increase to approximately 70%. The 2011 census reports that India is the second most populated country in the world. The portion of the elderly population of India and Karnataka is 8.6% and 7.7% respectively. In India, the elderly population is predicted to rise to 19% that is 323 million people by 2050, and majority of them living in rural parts of India. The elderly dependency ratio will also increase from 0.12 to 0.31 because of decreased fertility rate and elongated life expectancy.

To nurture good nutritional status and avoid the occurrence of malnutrition, frequent monitoring of the nutritional status in older people plays an important and key role.

The nutritional status estimation forms important part in creating the database which can be used in formulation of important nutritional programs and policies.

The elderly population is increasing with rapid rate but still this segment of population is often neglected and not many national programmes and policy are designed for elderly population. Hence the study was conducted with the aim to detect the nutritional status and analogue factors of elderly population living in rural areas with the help of MNA tool

### **Objectives :**

1. To assess the nutritional status of elderly people residing in the rural field practice area .
2. To study the factors related to nutritional status.

### **Materials and Methods:**

**SOURCE OF DATA:** Elderly population residing in the rural field practice area of PHC Kinaye in Belagavi district of Karnataka state, India.

**STUDY DESIGN:** A community based cross-sectional study

**STUDY PERIOD:** 1<sup>st</sup> January 2020 to 31<sup>st</sup> December 2020 (12 months)

**SAMPLE SIZE:** Calculated by taking prevalence of 15 (600)

**SAMPLING METHOD:** Systematic random sampling method.

**Inclusion Criteria:** Subjects above 60 years of age and residing in the area for a period of >6months and who gave consent for the study.

**Exclusion criteria :**

1. Critically ill patients for example cancer, end stage renal disease, receiving artificial enteral or parenteral nutrition.
2. Elderly people suffering from neuropsychiatric illness.
3. Bed ridden elderly patients.

**Data collection:**

According to the sampling frame, house to house visit was done and data was collected from elderly people after taking a informed written consent. Data was collected using a pre designed and pre tested questionnaire by a validated tool called Mini Nutritional Assessment (MNA) tool by personal interview method. A 24hr dietary recall method was used to assess the calorie intake of the elderly.

Random blood sugar testing was done using a glucometer and Hemoglobin level was estimated using a Hemoglobinometer. Subjects were weighed with a floor weighing scale to the nearest 0.1kg and height, mid-arm circumference and calf circumference were measured to the nearest 0.1cm.

The MNA tool comprised of 18 questions based on the following 4 components-

1. Anthropometric measurements
2. Dietary intake
3. Global health and social assessment
4. Subjective assessment of nutrition and health.

Interpretation of the score was done as follows:

Score <17: Malnourished

Score 17- 23.5: At risk of Malnutrition

Score >23.5: Well Nourished

### **Results:**

The study shows that, 36.5% were in the age group of 60 - 64 years and 34.8% were in 65 - 69 years age group. More than half (53.3%) were male participants and majority (86.17%) were Hindus. More than one third (34%) had completed primary school and 32.7% were illiterate, 33.3% were farmers by occupation and 33.8% were home makers. Majority of the participants (85.5%) were married and 14.2% were widowed. Nearly half of the participants (49%) belonged to class IV according to Modified B.G. Prasad classification. More than three - fourth (78.5%) were living in joint type family.

Almost one third (23%) were diabetic and 15.2% were hypertensive. Majority of the participants (64.7%) consumed vegetarian diet and nearly half of them (47.7%) did not consume adequate calories. Majority of the elderly population (93.2%) did not have any history of substance abuse. Among the male participants, majority of them (60.9%) were non-anemic and among female participants, more than half (62.9%) were anemic. When RBS of the participants was tested, majority (74.8%) were in pre-diabetic stage. The W/H ratio was high in 69.3% and 55.45% of the male and female participants respectively. Nearly half of the participants (45.8%) had BMI >23, followed by 27.7% had BMI 21 to < 23. According to the MNA score, the prevalence of the malnutrition was found to be 17% , 41.5% were at risk of malnutrition and 41.5% were well nourished.

Various socio-demographic factors had impact over nutritional status of the elderly individuals. Significant association was established between older age( p value - <0.001), female gender ( p value - 0.001), low educational status ( p value - <0.001), lower SES ( p value - <0.001), marital status ( p value - <0.001), type of family ( p value - <0.001), 24-hrs dietary intake ( p value - <0.001), history of substance abuse ( p value - <0.047), BMI ( p value - <0.001) and past history of chronic illness ( p value - <0.004) with nutritional status.

### **Conclusion:**

This study showed that the prevalence of malnutrition among elderly population was 17% and there was a high prevalence of both at risk of malnutrition 249 (41.5%) and normal nutritional status was seen in 249 (41.5%).

The prevalence of malnutrition was significantly associated with the various factors like older age, female gender, lower educational status, lower socio - economic status, type of family, marital status, lower Body Mass Index, those who had inadequate calorie intake, who were suffering from chronic illness and those who had history of substance abuse.

**Keywords:** Malnutrition, MNA tool, elderly population, Nutritional status, rural population

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## **INTRODUCTION**

Ageing is an inevitable and irreversible biological process that commences with birth, continues throughout life and ends in death. As per the United Nations, the cutoff age is 60 years and above for older age population. Globally the elderly population in 2020 was 727 million. In the coming three decades, the global population of older persons is predicted to increase by two fold, thus by 2050 the number will reach over 1.5 billion. The increase in the segment of older population will be witnessed by all the regions between 2020 and 2050. Globally the older population forms 9.3 % of the total population in 2020 and is expected to rise to 16.0 % by 2050. <sup>(1)</sup>

A great proportion, 61% of elderly population are from developing country, but by 2025 the proportion will increase to approximately 70%. The proportion of the elderly population of India and Karnataka is 8.6% and 7.7% respectively. In India the elderly population is predicted to rise to 19% that is 323 million people by 2050, and majority of them living in rural parts of India. The elderly dependency ratio will also increase from 0.12 to 0.31 because of decreased fertility rate and elongated life expectancy. <sup>(2,3)</sup>

Such a boom in the population of elderly people will apparently lead to several hellacious difficulties. The repercussions of aging are several, complex and often go unrecognized. With the advancing age, the physical and biological function/s will also slowly decline in their functional capacities. The elderly population not only encounter health problems but also other challenges like psychological and social problems. Malnutrition is one of the difficult circumstance noticed in elderly age group but often due attention is not given. <sup>(4)</sup>

Providing adequate nutrition for older persons has many practical issues involved because of which they become more susceptible to malnutrition. With advancing age, energy requirement is reduced because of decline in both lean body mass and basal metabolic rate, the call rises for other vital nutrients. Hence appropriate care should be taken to include all class of food in diet. The nutrition of the elderly not only affects immunity but functional ability too, hence it is an important element of elderly care that requires further notice. <sup>(5,6)</sup>

The vulnerability to malnutrition in elderly population has many reasons like the functional and physiological changes that manifest with advancing age, difficulty in feeding , less mobility, psychological stress, loss of spouse, illiteracy, poverty, lack of access to services like health and social services ,lack of financial support and poor access to food. The ability to perform their day to day activities including preparation of food and food consumption is defined as functional status of the elderly, thus affects nutritional status. In India, the health problem of the older population is the summation of poor nutrition , medical issues, which includes both non communicable and communicable diseases. A vicious cycle is formed between malnutrition and morbidity. <sup>(7,8)</sup>

Often the health and nutrition component of the elderly are ignored. The estimation of malnutrition in elderly people in India is understated. A few studies conducted earlier have stated that underweight is seen in more than half of the older population and about 90% had an energy consumption lesser than the recommended allowance. <sup>(9)</sup>

The nutritional status can be determined in elderly population, using the Mini-Nutritional Assessment (MNA) which is an acknowledged screening instrument and used all over the world. Its first publication was in 1996, since then it has high validation of specificity, sensitivity and reliability. It is an easy and efficient way to identify malnourished people or those who are at risk of malnutrition. It has great uses in evaluation of outcome, physical intervention programs, educational programs in nutrition and nutritional intervention in elderly adults. <sup>(9)</sup>

To nurture good nutritional status and avoid the occurrence of malnutrition, frequent monitoring of the nutritional status in older people plays an important and key role.

The nutritional status estimation forms important part in creating the database which can be used in formulation of important nutritional programs and policies. <sup>(9)</sup>

The elderly population is increasing with rapid rate but still this segment of population is often neglected and not many national programmes and policy are designed for elderly population. Hence this study was conducted to evaluate the nutritional status and analogue factors of elderly population living in rural areas with the help of MNA tool.

## **OBJECTIVES**

1. To assess the nutritional status of elderly people residing in the rural field practise area.
2. To study the factors related to nutritional status.

## **REVIEW OF LITERATURE**

A cross sectional study was done on 360 elderly population residing in Kamrup district, Assam to assess the nutritional status using MNA tool and 24-hr dietary recall method from July 2012 to August 2013. The study revealed that 15% of 360 were malnourished, at risk of malnutrition were 55% and 30% were well nourished. Inadequate calorie intake was found in 52.7% elderly study population and the main reasons for 59.5% was chewing and swallowing problems, 54.2% had loss of appetite and 48.4% could not afford. The study also showed significant association between gender, socio demographic status and age with the status of nutrition in elderly population and was found out that malnutrition was not uncommon in elderly age group. <sup>(7)</sup>

Among elderly people, cross sectional study was done for the nutritional assessment using MNA tool in rural area of Belagavi district between January 2016 to June 2017. The study comprised of 545 participants out of which 245 (45%) were males and 300 (55%) females. The study showed that 23.5% were malnourished , at risk of malnutrition were 49% and 27.5% were found to have normal nutritional status. Association between advanced age and lower MNA score was significant but association between malnutrition and gender was not significant. The study also highlighted the need of regular screening of nutritional status of elderly in rural areas and the implementation of nutritional programs for elderly population. <sup>(4)</sup>

Among elderly population residing in Buttramatti village, Belagavi district, cross sectional study was done to know nutritional status using MNA tool in the year 2014. Totally 190 participants were enrolled in the study, out of which 71 were males and 119 were females, 33.15% were in 60-69 years of age group. Socio demographic

details showed that majority of them were Hindu by religion and 46.31% were illiterate. It revealed that 31 males and 52 females were at risk of malnutrition and malnutrition was found in 24.4% males and 21% females, but association between nutritional status and gender was statistically not significant. <sup>(10)</sup>

In Bangalore a community based cross sectional study was done for the assessment of nutritional status in 91 elderly population using MNA tool for a period of 3 months in the year 2016. The results showed that the mean age was  $67.69 \pm 8.76$  among study participants and gender distribution revealed that 42 were males and 49 were females. The nutritional status according to MNA score showed that at risk of malnutrition was seen in 51 participants and 28 elderly were malnourished. Also the statistical significance between age and nutritional status of the study subjects was established. <sup>(11)</sup>

To assess the nutritional status in 102 urban and 102 rural elderly population residing in the Dharwad district, cross sectional study was done for 4 months from December 2014 to March 2015 and MNA tool was used. Most of the study participants were Hindu by religion and were in the age group of 60-69 years. Statistical significance was established between nutritional status and other variables like advanced age and literacy level. The association between gender, marital status, type of family and religion with nutritional status was not significant. It also revealed that the prevalence of malnutrition in elderly was high in rural area than urban area. <sup>(9)</sup>

A cross sectional study was conducted in 2016 to know the prevalence of malnutrition using MNA tool in rural area of Puducherry among elderly population. Totally 279 participated in this study, out of which 68.1% were females. BMI score showed that underweight was seen in 15.1% and 32.6% were found to be obese.

Study showed statistical significance between nutritional status with advancing age, gender, occupation and education. According to MNA score 58.7% were at risk of malnutrition and malnourishment was found in 17.9% of the participants. This study highlighted the need of opportunistic screening of elderly population at grass root level. <sup>(12)</sup>

A study was conducted in 2013 to assess nutritional status of elderly population in the rural parts of South India . Totally 181 elders were included in this study out of which 58% were females and 42% were males. Illiteracy was found in 78% of the subjects. Malnutrition was found in 3% , where as at risk of malnutrition was seen in 44% among the subjects .The status of nutrition with advancing age and prevalence of chronic co morbidities among elderly population was found to be statistically significant. <sup>(13)</sup>

A cross sectional study was done in 2020 with an objective to assess the nutritional status of the elderly population in the rural areas of Thiruvanthapuram District. Totally 249 participants were enrolled, out of which 42.9% were males and 57.1% were females. Almost half 49.4% of them were in the age group of 60-69 years, 62.5% were in upper-lower socioeconomic class, 58.8% were currently married,47.8% consumed all 3 meals per day. The malnutrition was observed in 14.3%, 44.1% were at risk of malnutrition and 41.6% were well nourished. Factors like age, substance abuse were associated with malnutrition. The study suggested for the routine screening of the elderly as it helps for the early intervention. <sup>(14)</sup>

A cross sectional study was conducted to know the nutritional status among older population in the year 2014 in rural areas of Nainital. Total of 440 elderly were interviewed about their socio economic details, dietary patterns and BMI was

calculated. More than half of them belonged to 60-69 years of age group. 60% of them were illiterate and 59.09% were in social class III. Non vegetarian consumption was seen in 51.36%. BMI scores showed 25.68% were undernourished and only 4.32% were obese. Decreasing trend of BMI was seen with increasing age and was found to be statistically significant. <sup>(15)</sup>

A community based cross sectional study was done in the rural area of Manipur to assess the elderly population nutrition status using MNA tool in 2017. Totally 250 eligible participants were enrolled for the study. The malnutrition and at risk of malnutrition was observed in 20.8% and 49.2% respectively. Co-morbidity was seen in 3/5<sup>th</sup> of the participants, hypertension was seen in 58.6% and diabetes in 21.4%. 25% participants were smokers and 7.2% had frequent consumption of alcohol. <sup>(16)</sup>

A study was done to assess nutritional status and diet in elderly population residing in rural parts of India using a cross sectional study design and the study was done in 9 states by National Nutrition Monitoring Bureau (NNMB) in 2006. Anthropometry and dietary assessment was done on 3871 and 2138 elderly population respectively. Majority of them consumed food of all types but below RDA by both male and female participants. The main diet of rural population was cereals and millets. In terms of BMI, underweight in elderly men was found to be 44.8% and 40.9% in females. The study suggested for periodic assessment of elderly population by anthropometric and dietary methods to know early malnutritional status. <sup>(17)</sup>

A cross sectional study was conducted using MNA tool to know the nutritional status and associated co-morbidities in elderly adults in rural area of Dehradun for 3 months period in 2014. A total of 192 adults were interviewed among

which males comprised 48.4% and females 51.6%. Risk of malnutrition was seen in 43.7% and 20.83% were malnourished according to MNA score. Statistical significance was seen between low MNA score and presence of co-morbidities and advancing age. The study highlighted the malnutrition's multidimensional background and the need of establishment of Geriatric clinic at PHC level for regular survey of nutrition status in elderly population. <sup>(18)</sup>

The Nutritional status and associated factors were studied in 339 elderly population of rural areas of Nepal by conducting cross sectional study using MNA tool in 2018. Malnutrition was seen in 24.8%, at risk of malnutrition was detected in 49.6% and 24.8% had normal nutritional status. Statistical significance between malnutrition and presence of co-morbidities was established. Participants who were taking Polypharmacy had 3.01 times more chance of falling in malnutrition score. <sup>(19)</sup>

A cross sectional study was done to assess 242 elderly population's nutritional status using MNA tool in rural areas of Nepal in 2016. The study revealed that 111 were male and 131 female participants. The socio economic and demographic details revealed that 72% were illiterate and 75% were Hindu by religion. 56% had smoking habits and 21% consumed alcohol. Normal nutritional status was seen in 11%, 65% were at risk range, and malnourished range was seen in 24%. The Study highlighted the accuracy level of MNA tool in detection of early malnutritional status in elderly population and also the importance of dietary intervention to reverse the problem. <sup>(20)</sup>

A cohort study conducted in rural and urban elderly population of France for the detection of nutritional status using MNA tool in 2007 revealed that the participants were mainly males and had low socio economic level. Polypharmacy was seen in 58% of 961 subjects. The poor nutritional status was statistically significant

with factors like low education level, gender, low socio economic level, lower BMI and poly-pharmacy. <sup>(21)</sup>

The nutritional status and dietary intake was assessed using MNA tool by conducting cross sectional study on 162 elderly participants residing in the region of Southern Ireland . Among the participants, 91 were female and 71 were males. At risk of malnutrition was found in 21% and malnutrition was seen in 1.2% of the study population. Majority of them did not meet the RDA. The prevalence of dietary insufficiency was high and the insufficient intake in energy, iron and fiber was 54.9%,54.9% and 82.7% respectively. <sup>(22)</sup>

The nutritional status was assessed in elderly population in rural area in 2014 on 247 subjects with a cross sectional approach. 55.8% of the study participants were males and 44.2% were females, 68.3% were illiterate, 71.2% participants consumed energy less than RDA. The prevalence of chronic energy deficiency was detected in 45.8% . Socio economic status and BMI value was directly proportional and relationship between them was statistically significant. <sup>(23)</sup>

Assessment of nutritional status in elderly population of rural area of Bikaner was done using MNA tool in 2011 using a cross sectional approach on a total of 500 subjects. Among which 315 were males and 115 were females. 46% of the total fell in at risk of malnutrition and 42.4% fell in well nourished category . The relationship between prevalence of malnutrition and gender distribution and other socio economic variable like literacy, occupation, socioeconomic class was seen to be statistically significant. The relationship between BMI and malnutrition risk was found to be inversely proportional. This study also highlighted that the prevalence of malnutrition in elderly population was more in rural areas than compared to urban areas. <sup>(24)</sup>

In Pune city, a descriptive study was conducted in 2017 to analyze the nutritional status of elderly population in old age home on 150 elderly adults, out of which 73 were females and 58 were males. Socio demographic profile revealed that the mean age of females and males was 71.7 and 72.59 year respectively. 24hr dietary recall method was done to assess their diet pattern and it revealed that majority of the respondents did not meet the RDA criteria for the calorie consumption. In females 8.3% were underweight and in males 15.5% . The susceptibility to malnutrition among both the gender was not statistically significant. The study also highlighted in particular about the low intake of protein in both the gender and also drew special attention for the need of funds for geriatric health development. <sup>(25)</sup>

A cross sectional study was done on elderly population for a period of one year in 2012 on 105 participants living in old age home in Davangere district using MNA tool to assess the nutritional status. Gender distribution revealed that 65% were females and 37 were males. Malnourishment was seen in 24% and at risk of malnourishment was established in 61% of the participants. The relationship between advancing age , educational status , rural background and the nutritional status was statistically significant. <sup>(26)</sup>

A study was conducted in 2021 in rural areas of Tamil Nadu with an aim to assess the nutritional status and its related factors of elderly population using MNA tool. Totally 440 subjects were enrolled for the study. Of the total participants, 56.4% were males and 43.5% were females. Majority (72%) were of the age group 60-75 years, only 3.1% were >85 years age group, 54.4% were illiterate and 7.5% were degree holders. The prevalence of malnutrition was 17.6%, at risk of malnutrition was seen in 48.7% and 33.6% were well nourished. Statistical significance was present

between the nutritional status and factors like illiteracy, female gender and age >75 years. The study highlighted the need of multidimensional approach to educate the community. <sup>(27)</sup>

In Udipi taluka, a cross sectional study was executed on elderly population to study their nutritional status using MNA tool in 2017 on 570 subjects. The study group was formed of 38% females and 62% males. The normal nutrition and at risk of malnutrition was found almost equal in the group that is 44% of the total and malnutrition was predominantly found in 11.22%. The statistical connection between nutritional status and advancing age, female gender and low calorie intake was found to be significant. The predominant reasons for low calorie intake was discovered to be problems in chewing and swallowing and loss of appetite. The study suggest that the geriatric health should be addressed on national health care agenda. <sup>(28)</sup>

A cross sectional study was conducted in 2011 in rural areas of Tamil Nadu to estimate the prevalence of nutritional status and NCD in 571 elderly population .Gender distribution revealed that 52.1% were males and 47.9% were females. Undernourishment (BMI<18.5) was seen in almost 50% of the group and it revealed that the prevalence was seen more in females ( 44.1%) than males(38.7% ) and it increased with advancing age and presence of co morbidities. The vitamin deficiency was seen higher in females (70.7%) compared to males (29.3%). The prevalence of anemia was found to be statistically significant with female gender. Among the co morbidities , the prevalence of diabetes and hypertension was found to be more common than other diseases. <sup>(29)</sup>

A study was done in the year 2017 on elderly population using cross sectional method in 3 Hong Kong district to assess nutritional status using MNA tool . Survey

was done on 613 people, with 54% females and 36% male participants. Majority of them scored >24 in MNA tool and classified under well nourished, MNA score <17 was observed in 1.1% and 28.1% were at risk of malnutrition. RDA adherence was less than 80% in most of the study participants. The lack of appetite and skipping of meal was significantly linked with malnutrition status in elderly population. The study suggested to open geriatric canteen and also to increase social support for geriatric population for their overall health development. <sup>(30)</sup>

The nutritional status of elderly population residing in rural areas of Bangladesh was studied by conducting a cross sectional study on 125 subjects using MNA tool in 2020. The education status revealed that there was no formal education in 53.6% of the people. Malnutrition was noticed in 22% males and 28.8% females. The statistical significance between the advancing age, low literacy and female gender with malnutritional status was established. <sup>(31)</sup>

## MATERIALS AND METHODS

### METHODOLOGY:

**A.SOURCE OF DATA:** The present study was conducted among the elderly population residing in Peeranwadi, Kinaye rural field practice area, Rural Health Center of Department of Community Medicine, J. N. Medical College, KAHER, Belagavi.

**B. STUDY DESIGN:** A community based cross-sectional study.

**C. STUDY PERIOD:** Data collection was done from 1<sup>st</sup> January 2020 to 31<sup>st</sup> December 2020.

### D. SAMPLE SIZE CALCULATION :

Sample size calculation:  $n = \frac{4pq}{d^2}$

Prevalence of malnutrition in elderly was taken as 15%. <sup>(7)</sup>

Where n = sample size

p is prevalence, taken as 15%

q = 100-p = 85

d = absolute error, taken as 3%

$n = \frac{4 \times 15 \times 85}{3 \times 3} = 566$

Estimated Sample size is = 600.

**E.SAMPLING FRAME:**

Systematic random sampling method was used in the present study

Under kinaye Rural health centre, we have 9 subcenters, Randomly we selected - Peeranwadi subcenter.

With the help of the Household register available at the Kinaye Rural Health Centre we got the following information,

Total population of Peeranwadi -12,532

Elderly population -1,127

Total number of households -1850

So by **Systematic random sampling :**

$$k = \frac{\text{total no of households}}{\text{sample size}} = \frac{1850}{600} = 3$$

By chit method number 2 was selected ,

so every 2<sup>nd</sup>, 5<sup>th</sup> ... house was visited till we got our sample size (600).

**INCLUSION CRITERIA:** Subjects above 60years of age and residing in the area for a period of >6months and who gave consent for the study.

**EXCLUSION CRITERIA:**

1. Critically ill patients for example cancer, end stage renal disease, receiving artificial enteral or parenteral nutrition.
2. Elderly people suffering from neuropsychiatric illness
3. Bed ridden elderly patients

**PILOT STUDY :** The pilot study was performed in urban area of Belagavi (Ashok Nagar), the questionnaire was validated and all necessary changes were made. The results of the pilot study has not been included in the present study for data analysis.

**ETHICAL CLEARANCE :** The clearance has been obtained by the Institutional Ethical Committee, J. N. Medical College, KAHER, Belagavi. The ethical clearance letter has been attached to the present study.

Written informed consent was obtained from the study participants, the consent forms had simple words and was in local language.

**DATA COLLECTION:** The geographic blueprint was obtained from ASHA's of the Peeranwadi subcenter and according to the sampling frame house to house visit was done. Informed written consent was obtained from all the participants before commencing the study. All the General information, Socio - demographic data was collected using a pre designed and pre tested questionnaire by face to face interview by the researcher.

**MATERIALS :** A validated tool which is specific to elderly nutritional status assessment called Mini Nutritional Assessment (MNA) tool was used to assess the prevalence of malnutrition .The MNA tool comprised of 18 questions based on the following 4 components-

1. Anthropometric measurements
2. Dietary intake
3. Global health and social assessment
4. Subjective assessment of nutrition and health .

Interpretation of the score was done as follows:

Score <17 : Malnourished

Score 17- 23.5 : At risk of Malnutrition

Score >23.5 : Well Nourished. <sup>(32)</sup>

**ANTHROPOMETRY:** <sup>(33)</sup>

**A) WEIGHT :** Subjects were weighed with a weighing scale to the nearest 0.1kg and after every recording the scale was adjusted to zero.

**B) HEIGHT :** The participants were asked to stand without footwear with heels, back touching to the wall and arms hanging by the side and was measured from head to heel. Height was recorded to nearest 0.1cm using simple stadiometers .

**C) MID-ARM CIRCUMFERENCE (MAC):** With the help of the measuring tape, MAC was recorded to nearest 0.1 cm. The participants were asked to flex their left upper arm and the mid point between the end of shoulder and the tip of the elbow was marked. The measuring tape was snugged around the arm at the midpoint and the MAC was recorded.

**D) CALF CIRCUMFERENCE (CC):** The measuring tape was placed around the most bulk part of the calf and the measurement was recorded to nearest 0.1cm.

**E) WAIST AND HIP CIRCUMFERENCE (WC and HC ):** The participants were in the standing position and for WC the measurement was taken around the abdomen (just above the umbilicus) and for HC the measurement was taken at the widest part of the hip with the help of the measuring tape. Both HC and WC was recorded nearest 0.1cm.

**F) BODY MASS INDEX (BMI) :** The BMI was calculated using the formula :

BMI - weight (in kg) /Height (Meter<sup>2</sup>) .

BMI was classified according to MNA tool. <sup>(32)</sup>

**24HR DIETARY RECALL METHOD :** It was used to assess the calories intake in the elderly population and to check if the calorie requirement was adequate according to recommended dietary allowances (RDA) 2010 guideline as per the individuals weight. <sup>(34)</sup>

**LABORATORY INVESTIGATIONS:**

**RANDOM BLOOD SUGAR:** Random blood sugar level testing was done using glucometer and according to ADA guidelines

79-140mg/dl- Normal range

140-200mg/dl- Pre diabetes

>200 – Diabetes. <sup>(35)</sup>

**HEMOGLOBIN:** Hemoglobin was estimated using Hemoglobinometer and according to WHO, Women with Hb level <12g/dl and Men with Hb level <13g/dl were considered anemic. <sup>(36)</sup>

**STATISTICAL ANALYSIS:** The collected data was entered and managed using Microsoft Excel sheet. For the analysis of the data SPSS (statistical package for social science) software version-20 was used. The data was analyzed using percentages, chi square test and multivariate logistic regression. To check association between nutritional status and their risk factors, chi - square test was used. A probability value

(p value) of less than 0.05 was considered as statistically significant. Univariate linear regression analysis was performed to identify possible risk factors associated with poor nutritional status and factors associated with low MNA score ( $p < 0.15$ ) were included in multivariate regression model to identify their independent effect on the outcome.

**STUDY VARIABLES:**

**Age:** Age was recorded to the nearest completed years.

**Religion:** The study participant's religion were grouped under "Hindus", "Muslims" and Christians.

**Type of family** <sup>(37)</sup>

1. Nuclear: The household consisting of married couple along with their dependent children who live in the same house.
2. Joint: Households where many married couples and their children live in the same house, where all the males are blood relatives.
3. Problem family: The standards of life are below the accepted standards and the physical and emotional needs of the children are unmet.
4. Broken family: Either of the spouse are separated or died.
5. Three generation family: The household where all the representatives of the three generation live together in the same house.

**EDUCATIONAL QUALIFICATION:**<sup>(38)</sup> (as per the Census of India criteria, 2011).

1. Illiterate: person who is not capable to read and write.
2. Primary: person with completion of one to five years of schooling.
3. Secondary: person with completion of six to ten years of schooling.
4. PUC: person who has completed PUC.
5. Degree: those who obtained any degree.

**OCCUPATION:** The beneficiaries self reported their source of income which would earn their livelihood.

1. Farmer: those who works in farm fields.
2. labourer- those who make their living based on their daily wages.
3. Business/self-employed: a person either owner or executive engaged in commercial or industrial business
4. Government employee: person who works in any government agencies on either permanent or contract basis.
5. Private employee: person who is a permanent or contract worker in any private company or factory or NGO.
6. Retired/pensioner: beneficiary who is currently not working but receiving pension.
7. Unemployed: person who is currently not working or not getting any kinds of benefits.
8. Home maker: beneficiary who looks after the home, children on day to day basis.

**SOCIOECONOMIC CLASS**

Modified B. G. Prasad’s classification was used to classify socio- economic status which was based on per capita income (in Rupees/month) and the scale was developed in 1961. The BG Prasad’s classification was formed on the basis of Consumer Price Index (CPI) for 1960 which was 100, later it got modified in 1982 and 2001 with the introduction of linking factors to convert CPI (1982). All India average Consumer Price index (for Industrial workers) for the year January 2020 (2001=100) = 330. <sup>(39)</sup>

Multiplication factor = Current index value (330)/Base index value in 2001 (100) = 3.3.

Thus New income value is given by = multiplication factor × old income value × 4.63 × 4.93. <sup>(40)</sup>

Here 4.63 and 4.93 are the linking factors obtained by the Labour Bureau of India

So, once the values are substituted we got the new scale as given below,

<b>Socioeconomic status: class</b>	<b>B. G. Prasad’s classification of 1961 (monthly income in rupees)</b>	<b>Revised B. G. Prasad’s classification for 2020 (monthly income in rupees) <sup>(40)</sup></b>
I	100 and above	7533 and above
II	50 to 99	3766-7532
III	30 to 49	2260-3765
IV	15 to 29	1130-2259
V	Below 15	1129 and below

## **RESULTS**

The present study was a community based cross sectional study conducted among 600 elderly population in the rural field practice area of Rural Health Centre, Kinaye, under the Department of Community Medicine, J. N. Medical College, KAHER, Belagavi. This study was conducted from 1<sup>st</sup> January 2020 to 31<sup>st</sup> December 2020.

The obtained data was tabulated and analyzed under following contents:

### **I. Socio-demographic profile**

### **II. Personal information**

### **III. Hematological and Biochemical analysis**

### **IV. General Physical Examination**

### **V. Mini-Nutritional Assessment**

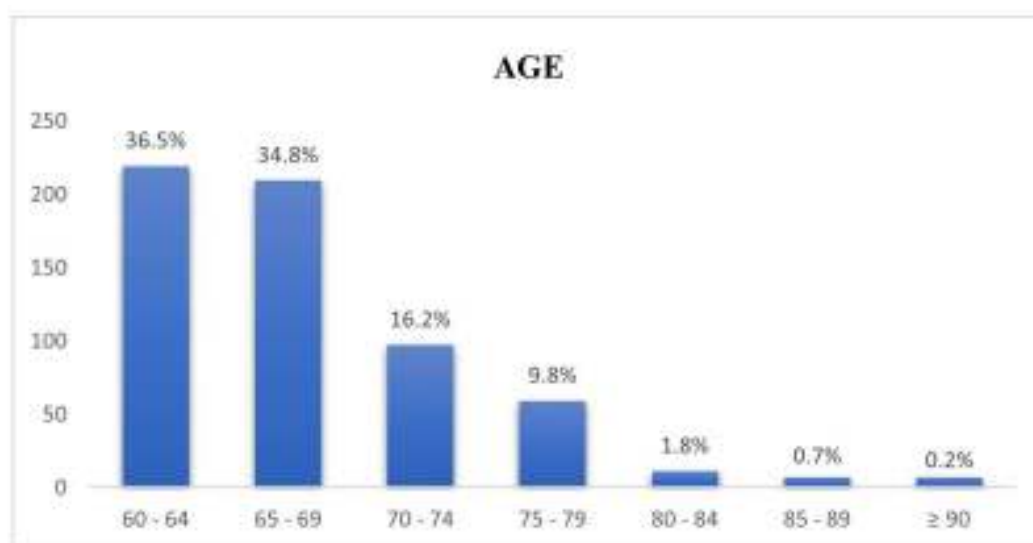
## I. Socio-demographic profile :

### A. Age:

**Table 1: Distribution of the study participants according to Age(N=600)**

Age (years)	Number (n)	Percentage (%)
60 - 64	219	36.50
65 - 69	209	34.80
70 - 74	97	16.20
75 - 79	59	9.80
80 - 84	11	1.80
85 - 89	4	0.70
≥ 90	1	0.20
Total	600	100

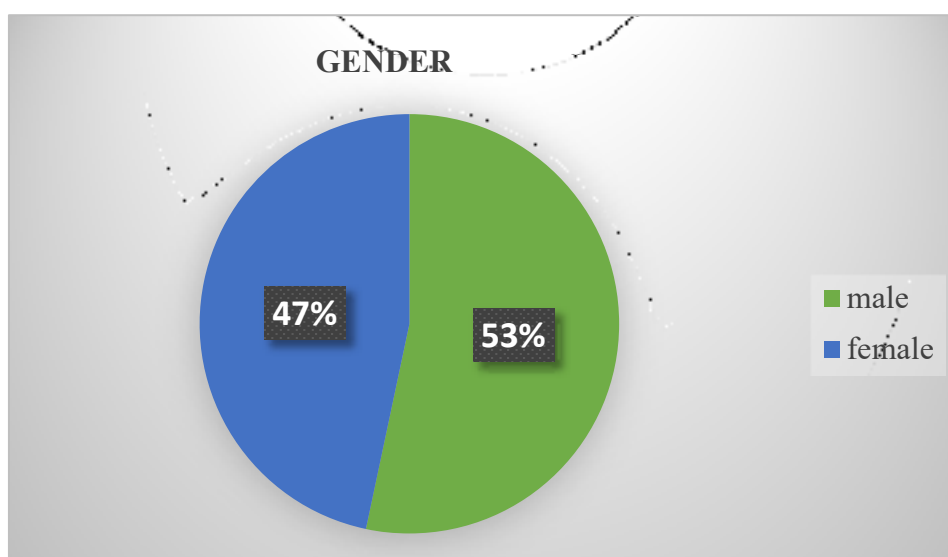
**Graph 1.**



In the present study, 219(36.5%) were in the age group of 60 - 64 years , 209(34.8%) were in 65 - 69 years age group ,97(16.2%) were in 70 -74 years age group , 59(9.8%) were in 75 - 79 years age group , 11(1.8%) were in 80 - 84 years age group, 4 (0.7%) were in 85 - 89 years age group and only 1( 0.7%) was above 90 years .

**B. Gender:****Table 2: Distribution of the study participants according to Gender (N=600)**

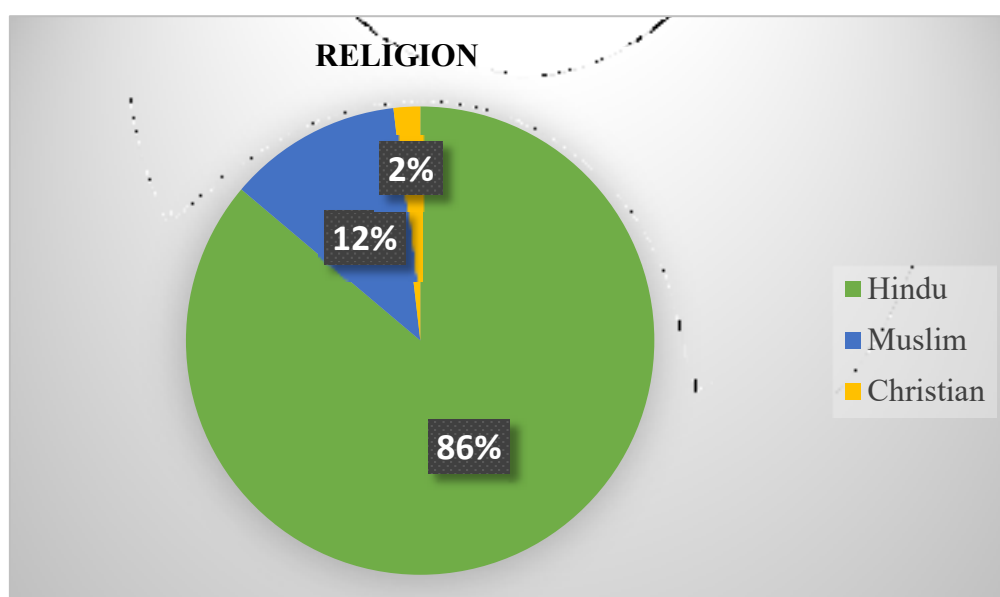
Gender	Number (n)	Percentage (%)
Male	320	53.30
Female	280	46.70
Total	600	100

**Graph 2.**

In the present study, 320(53.3%) were males and 280(46.7%) were female participants.

**C. Religion:****Table 3: Distribution of the study participants according to Religion(N=600)**

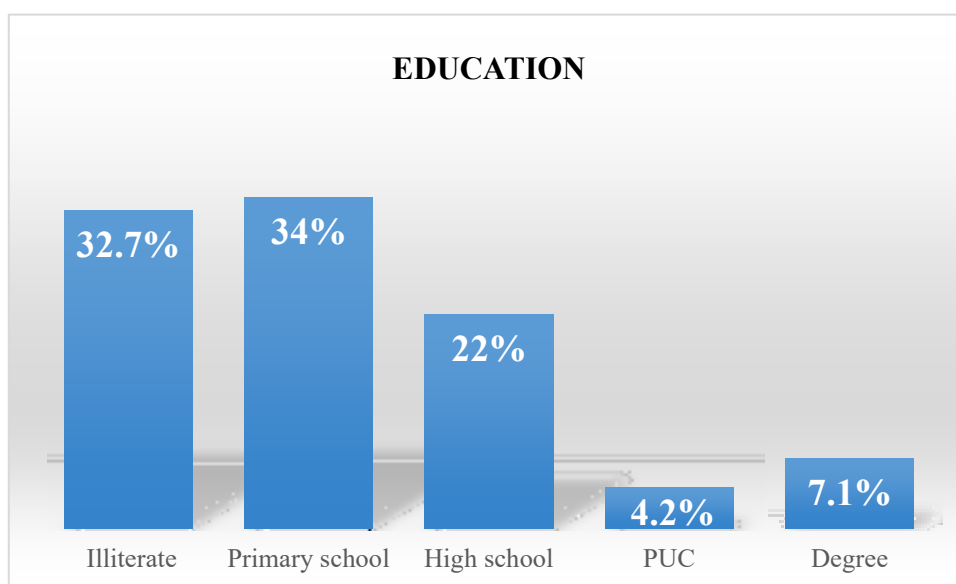
Religion	Number (n)	Percentage (%)
Hindu	517	86.17
Muslim	72	12.00
Christian	11	1.83
Others	0	0.00
Total	600	100

**Graph 3.**

In the present study majority of the study participants, 517 (86.17%) were Hindus, followed by 72 (12%) were Muslims and 11 (1.83%) were Christian.

**D. Education:****Table 4: Distribution of the study participants according to education (N=600)**

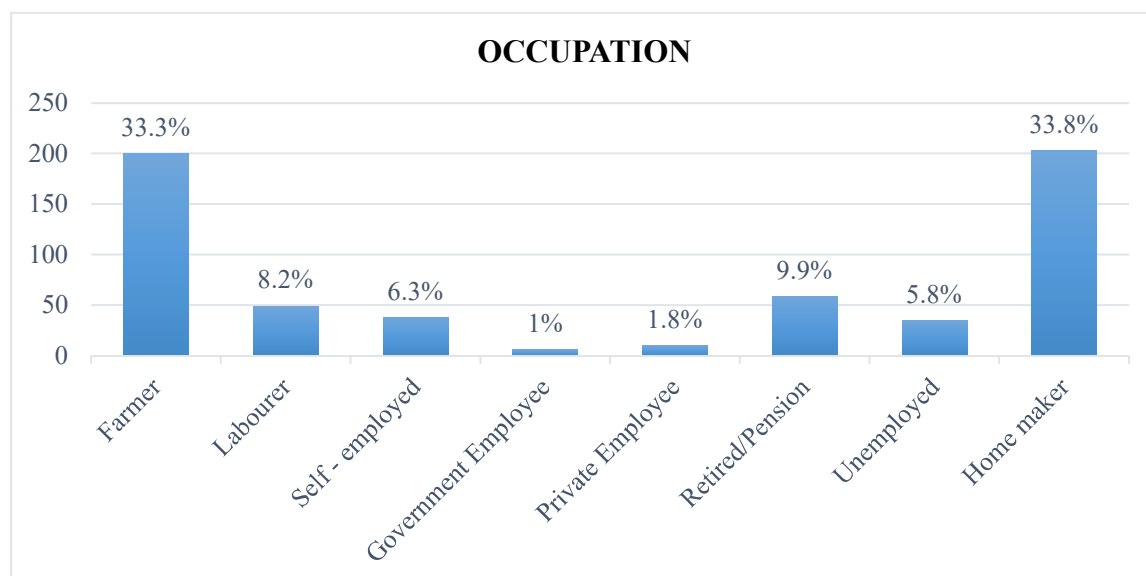
Education	Number (n)	Percentage (%)
Illiterate	196	32.70
Primary school	204	34.00
High school	132	22.00
PUC	25	4.20
Degree	43	7.10
Total	600	100

**Graph 4.**

In this study, majority of the study participants 204 (34%) studied up to primary school, 132 (22%) completed high school, 25(4.2%) completed PUC, 43(7.1%) were Degree holders and 196(32.7%) were illiterate.

**E. Occupation:****Table 5: Distribution of the study participants according to Occupation (N=600)**

Occupation	Number (n)	Percentage (%)
Farmer	200	33.30
Labourer	49	8.20
Self - employed	38	6.30
Government Employee	6	1.00
Private Employee	10	1.80
Retired/Pension	59	9.90
Unemployed	35	5.80
Home maker	203	33.80
Total	600	100

**Graph 5.**

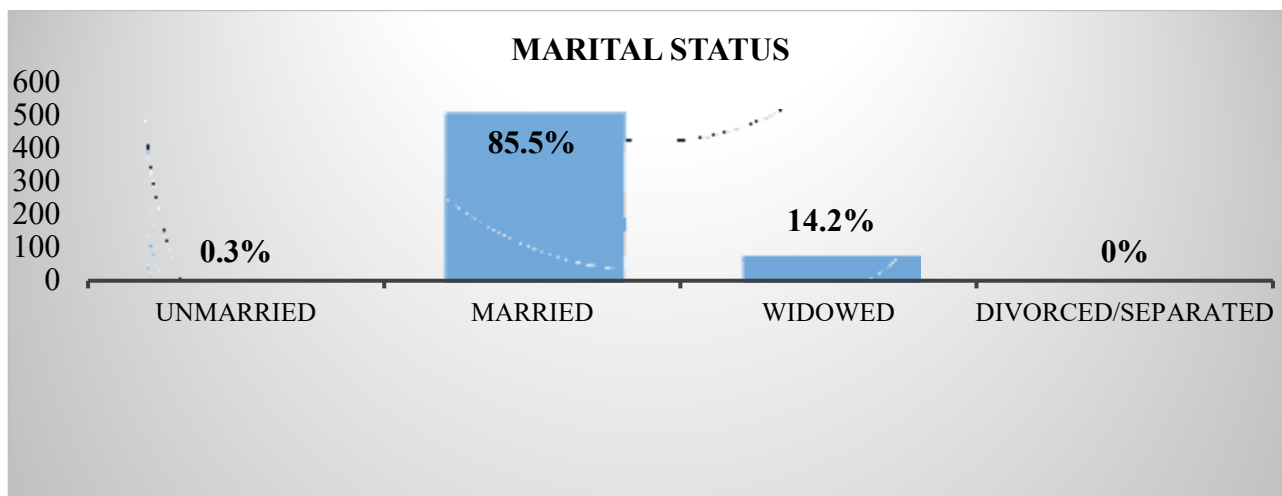
In the present study, 203(33.8%) were homemakers, 200(33.3%) were Agriculturist, 59 (9.9%) were retired, 49 (8.2%) were labourers, 35 (5.8%) were unemployed, 10(1.85%) were Private employee and 6(1%) were Government employee.

**F. Marital status:**

**Table 6: Distribution of the study participants according to Marital status (N=600)**

Marital status	Number (n)	Percentage (%)
Unmarried	2	0.30
Married	513	85.50
Widowed	85	14.20
Divorced/Separated	0	0.00
Total	600	100

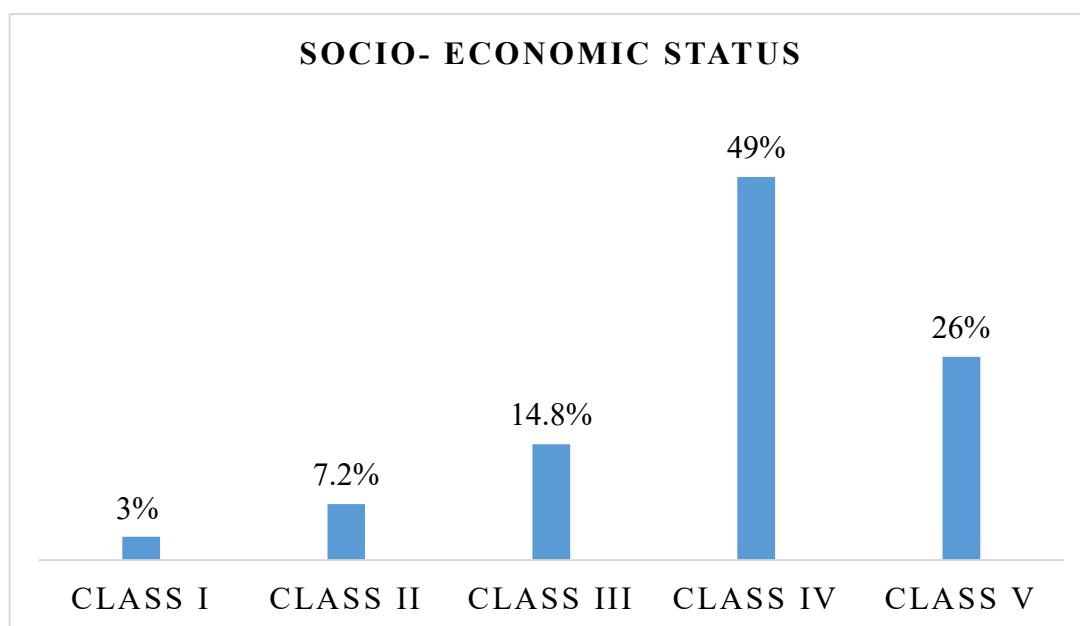
**Graph 6.**



In the present study, majority 513(85.5%) were married, 85 (14.2%) were widowed and 2 (0.3%) were unmarried.

**G. Socio - economic status:****Table 7: Distribution of the study participants according to Socio - economic status (Modified B.G.Prasad Classification)(N=600)**

Socio -Economic status	Number (n)	Percentage (%)
Class I	18	3.00
Class II	43	7.20
Class III	89	14.80
Class IV	294	49.00
Class V	156	26.00
Total	600	100

**Graph 7.**

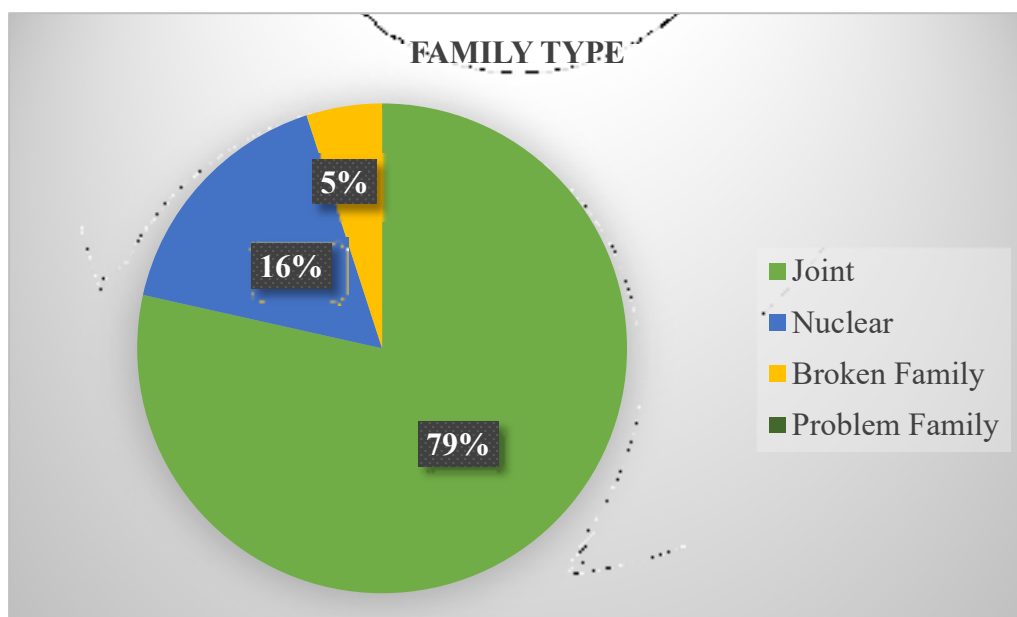
In the present study, according to modified B.G.Prasad classification, majority of the study participants 294(49%) belonged to class IV, followed by 156 (26%) to class V, 89 (14.8%) to class III, 43 (7.2%) to class II and only 18 (3%) to class I.

### H. Type of Family:

**Table 8: Distribution of the study participants according to the type of family(N=600)**

Type of Family	Number (n)	Percentage (%)
Joint	471	78.50
Nuclear	99	16.50
Broken Family	30	5.00
Problem Family	0	0.00
Total	600	100

**Graph 8.**



In the present study , large number of study participants 471 (78.5%) were living in joint family,99 (16.5%) were in nuclear family and 30 ( 5%) were living in broken family.

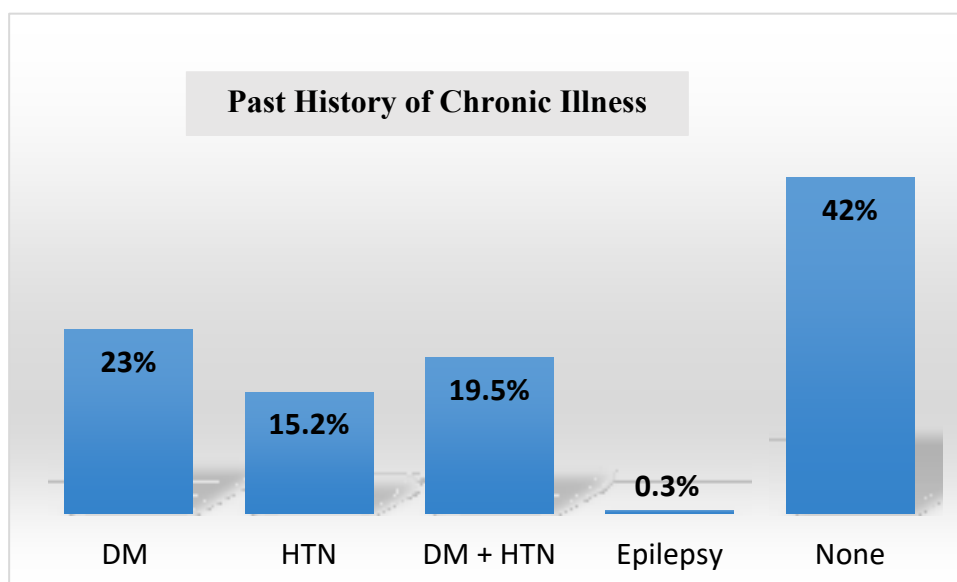
## II. Personal information:

### A. Past History:

**Table 9 : Distribution of the study participants based on their past history of chronic illness (N=600)**

Past history of chronic illness	Number (n)	Percentage (%)
DM	138	23.00
HTN	91	15.20
DM + HTN	117	19.50
Epilepsy	2	0.30
None	252	42.00
Total	600	100

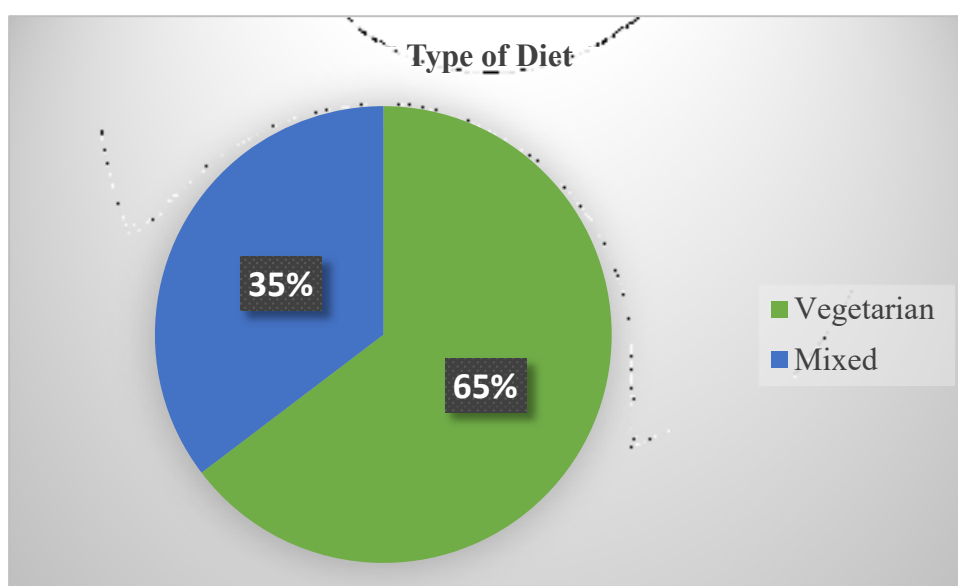
**Graph 9.**



In the present study, majority of the participants 252(42%) did not have any past history of chronic illness, followed by 138(23%) were Diabetic, 91(15.2%) were Hypertensive, 117(19.5%) were Diabetic and Hypertensive and only 2(0.3) had Epilepsy.

**B.Type of Diet:****Table 10: Distribution of the study participants depending on their type of diet intake (N=600)**

Type of Diet	Number (n)	Percentage (%)
Vegetarian	388	64.70
Mixed	212	35.30
Total	600	100

**Graph 10.**

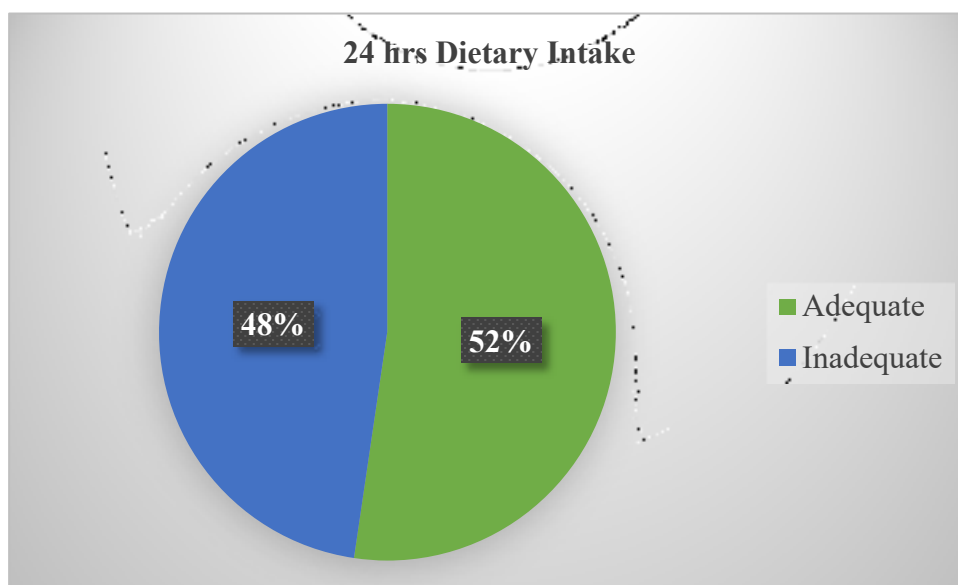
Among the total participants, 388(64.7%) were vegetarian and 212(35.3%) consumed mixed diet.

**C. 24hrs Dietary intake:**

**Table 11: Distribution of study participants according to their 24hr dietary intake(N=600)**

24hrs dietary recall	Number (n)	Percentage (%)
Adequate	314	52.30
Inadequate	286	47.70
Total	600	100

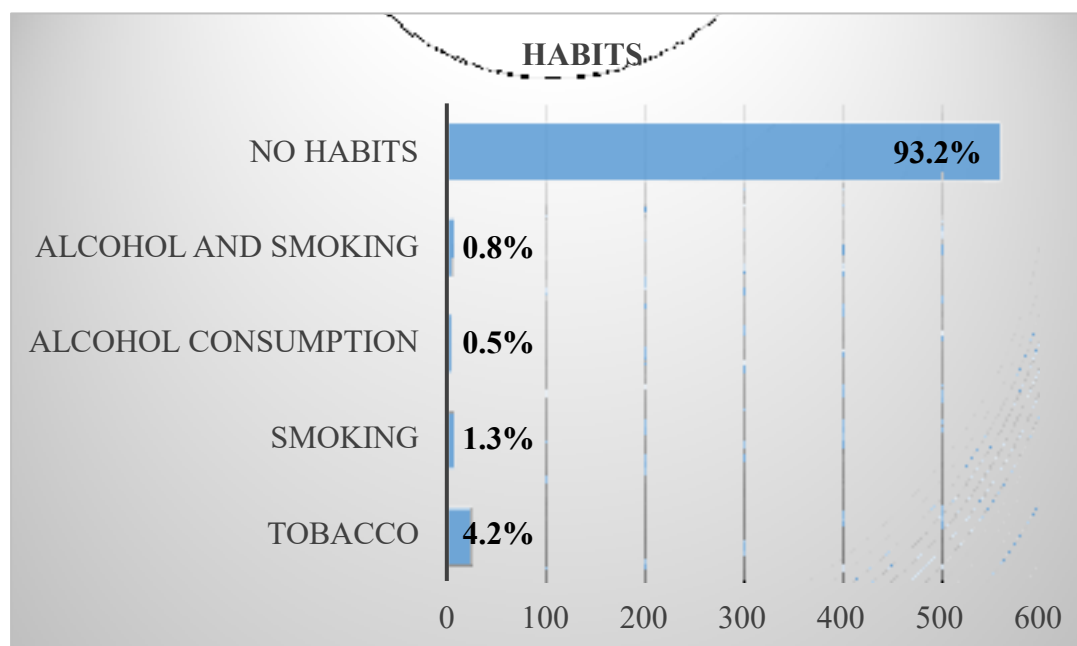
**Graph 11.**



In our study, majority of the participants 314 (52%) consumed adequate calorie and 286(48%) had inadequate calorie intake.

**D. Habits:****Table 12: Distribution of the study participants according to their habits(N=600)**

Habits	Number (n)	Percentage (%)
Tobacco	25	4.20
Smoking	8	1.30
Alcohol consumption	3	0.50
Alcohol and smoking	5	0.80
No habits	559	93.20
Total	600	100

**Graph 12.**

Among the study participants, majority 559(93.2%) did not have any habits, followed by 25(4.2%) used to chew tobacco, 8 ( 1.3%) used to smoke, only 3(0.5%) consumed alcohol. Five participants (0.8%) had a habit of consuming both alcohol and tobacco.

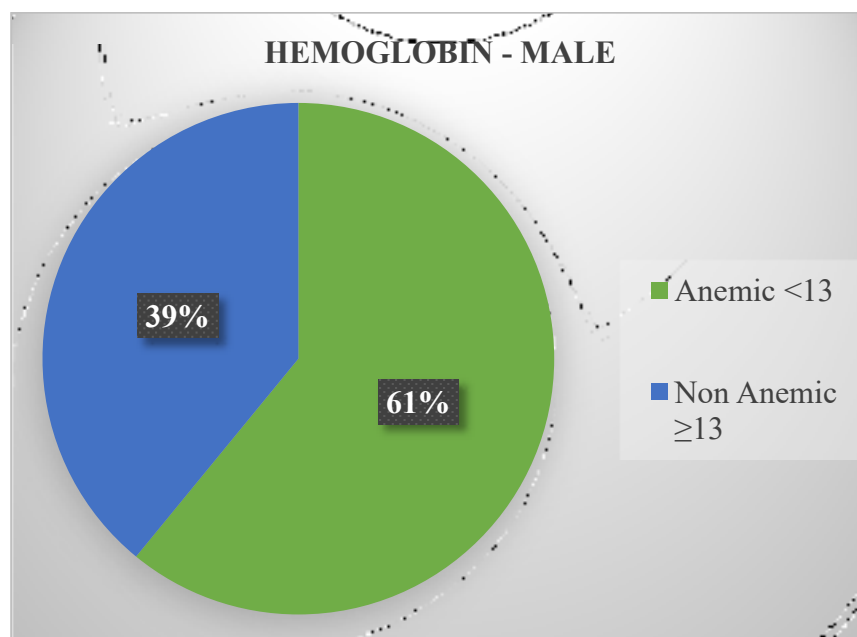
### III. Hematological and Biochemical profile.

#### A. Hemoglobin (Hb):

**Table 13: Distribution of the study participants according to their hemoglobin level. (N=600)**

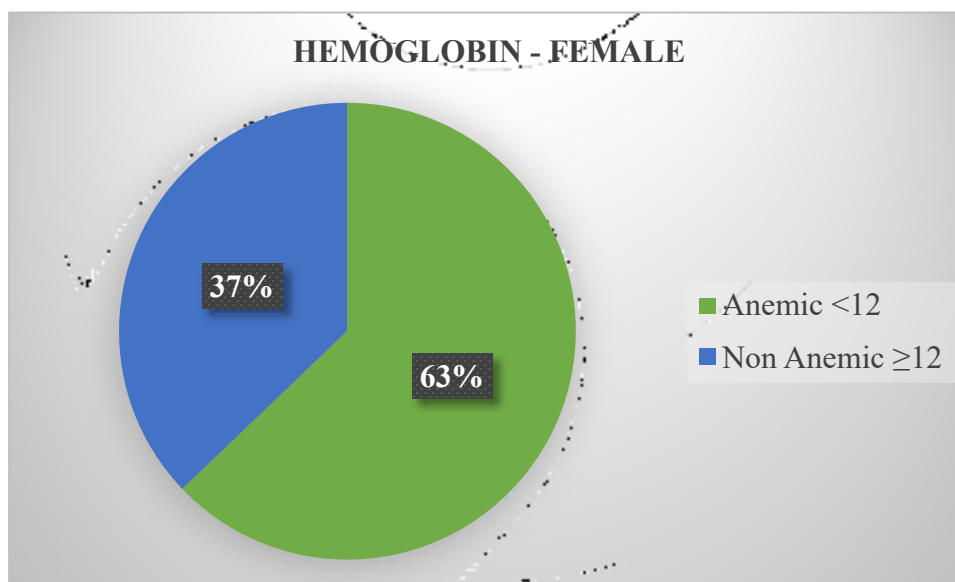
Hemoglobin	Number (n)	Percentage (%)
Male		
Anemic <13	195	60.90
Non Anemic $\geq$ 13	125	39.10
Total	320	100
Female		
Anemic <12	176	62.90
Non Anemic $\geq$ 12	104	37.10
Total	280	100

Graph 13a.



In the present study , among the total male participants, 195(61%) were anemic and 125(39%) were non anemic.

Graph 13b.



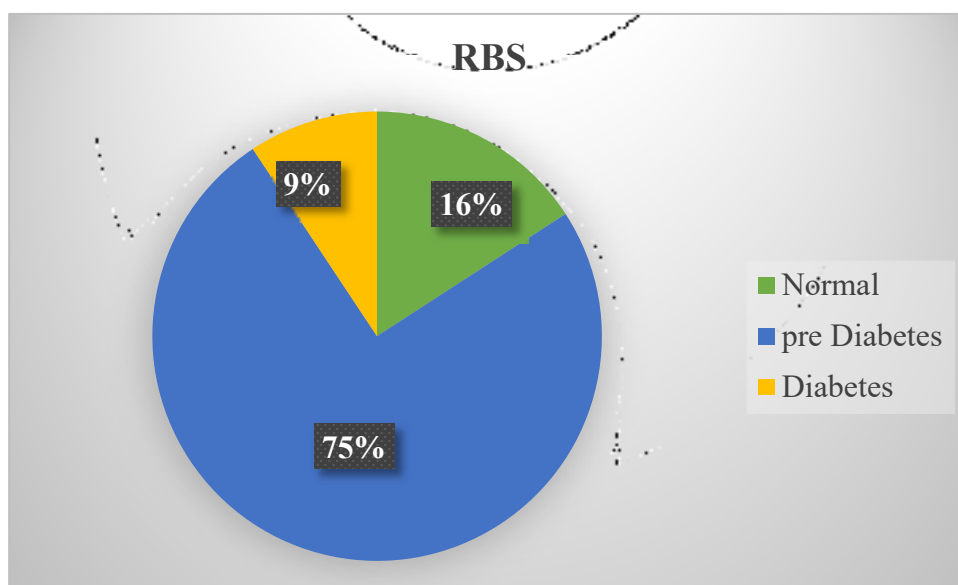
In the present study, among the total female participants, 176(63%) were anemic and 104(37%) were non anemic.

**B. Random blood sugar:**

**Table 14: Distribution of the study participants according to their Random blood sugar level (RBS) (N=600)**

RBS	Number (n)	Percentage(%)
Normal	95	15.80
Pre Diabetic	449	74.80
Diabetic	56	9.40
Total	600	100

**Graph 14.**



Among the total participants, majority 449(75%) were in pre - diabetic stage, 56(9.4%) were diabetic and 95(16%) were non-diabetic.

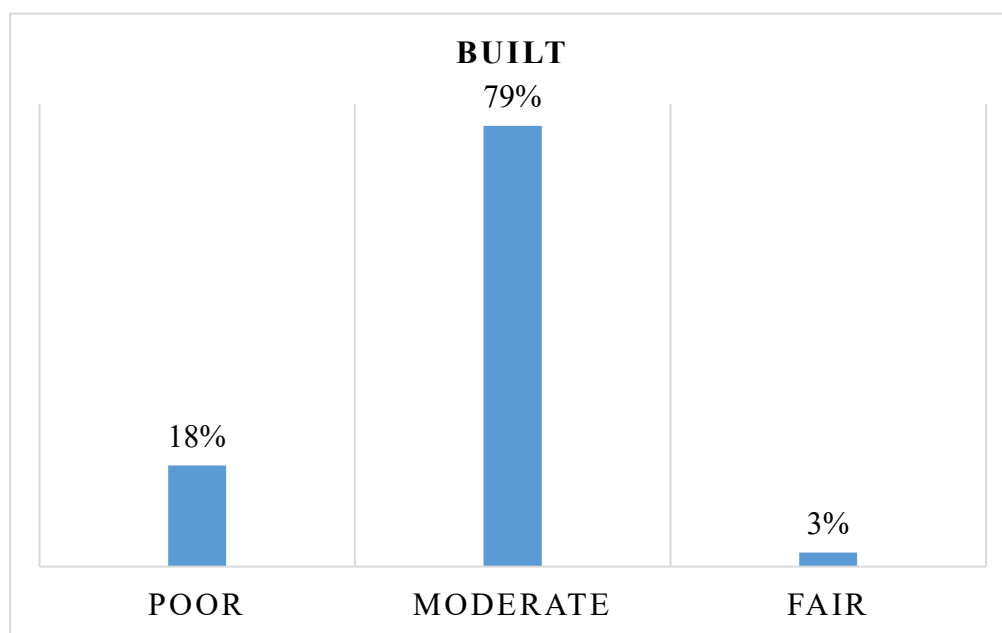
#### IV. General physical examination.

##### A. Built and Nourishment :

**Table 15: Distribution of the study participants according to their built and nourishment (N=600)**

Built and Nourishment	Number (n)	Percentage(%)
Poor	109	18.20
Moderate	476	79.30
Fair	15	2.50
Total	600	100

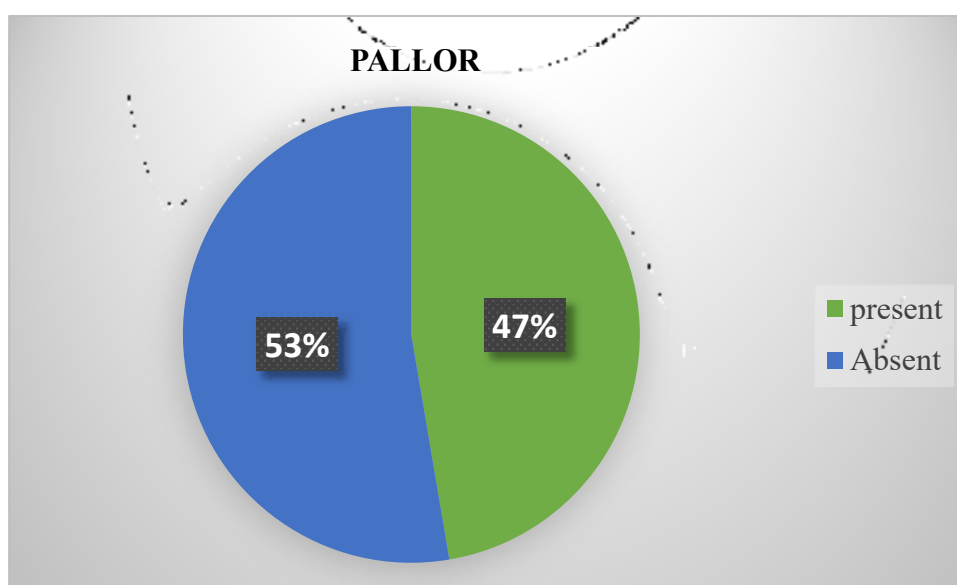
**Graph 15.**



Among the study participants, 476(79%) were moderately built and nourished, 109(18%) were poorly built and nourished and only 15(3%) were fairly built and nourished.

**B. Pallor:****Table 16: Distribution of the study participants according to the presence of pallor(N=600)**

Pallor	Number (n)	Percentage (%)
Present	284	47.30
Absent	316	52.70
Total	600	100

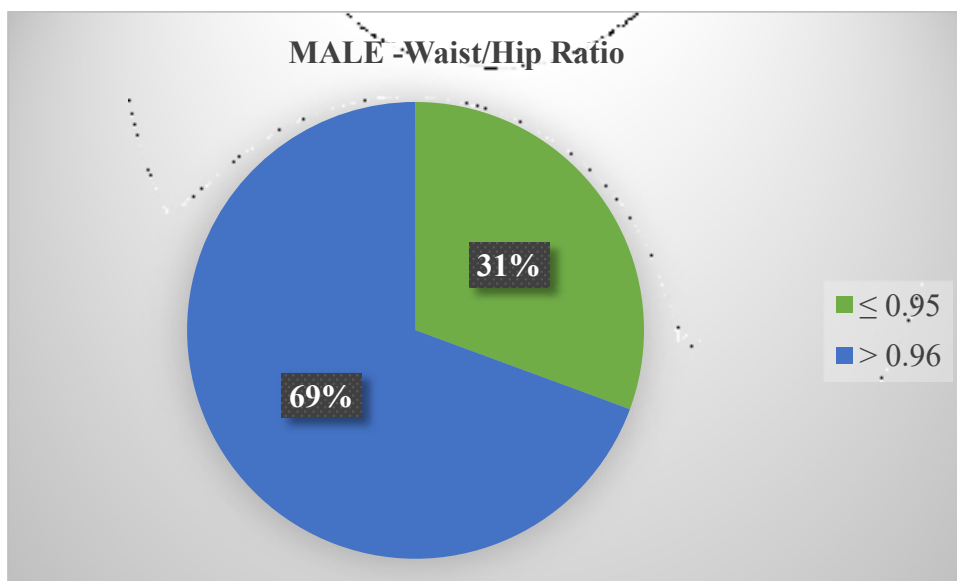
**Graph 16.**

Among the study participants, 316(53%) had pallor on examination and remaining 284(47%) did not have pallor.

**C . Waist : Hip Ratio:****Table 17: Distribution of the study participants according to their Waist : Hip Ratio (W/H Ratio) (N=600)**

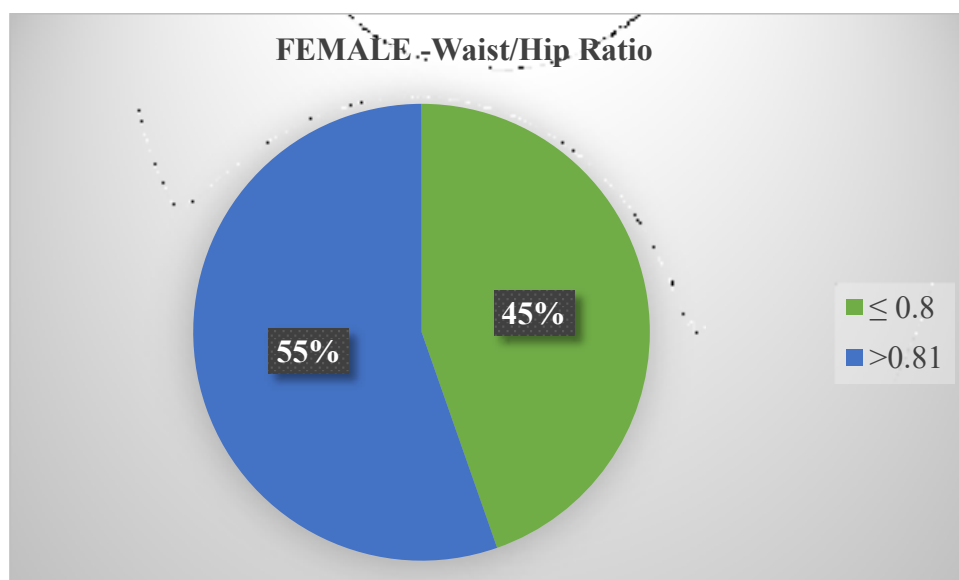
W/H Ratio	Number(n)	Percentage (%)
Male		
≤ 0.95	98	30.70
> 0.96	222	69.30
Total	320	100
Female	Number(n)	Percentage (%)
≤ 0.80	125	44.60
>0.81	155	55.40
Total	280	100

Graph 17a.



Among the male participants, more than half 222(69%) had waist/hip ratio  $>0.96$  and remaining 98(31%) had waist/hip  $\leq 0.95$ .

Graph 17b.



Among the female participants, more than half 155(55%) had waist/hip ratio  $>0.81$  and 125(45%) had waist/hip  $\leq 0.80$ .

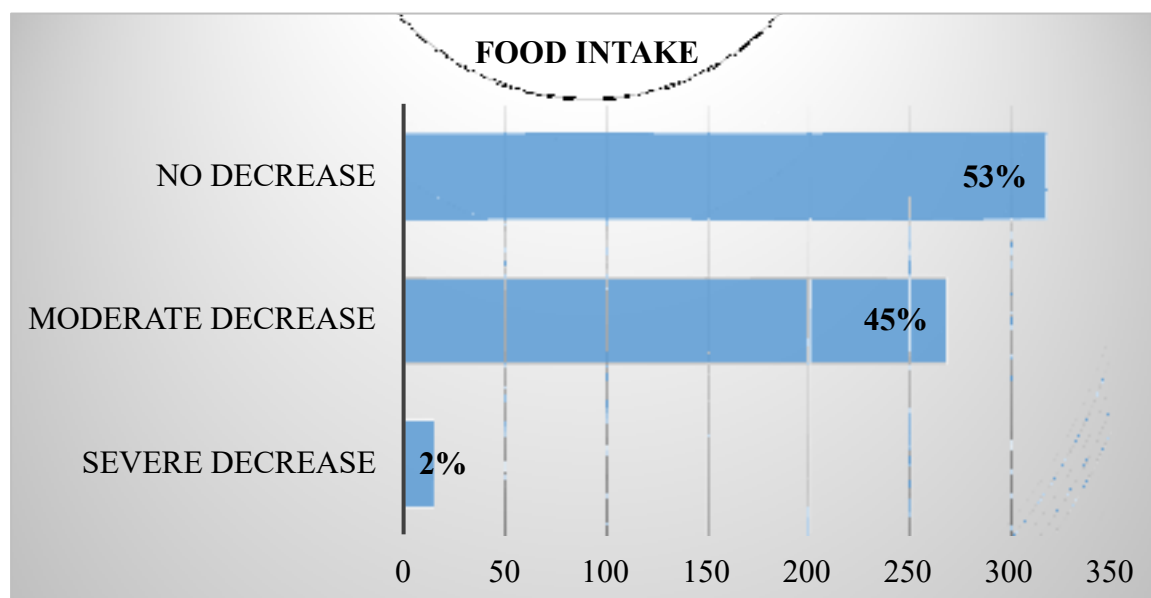
## V. Mini Nutritional Assessment. (MNA)

### A. Food Intake:

**Table 18: Distribution of the study participants according to their food intake in the past 3 months (N=600)**

Food Intake	Number(n)	Percentage (%)
Severe decrease	15	2.50
Moderate decrease	268	44.70
No decrease	317	52.80
Total	600	100

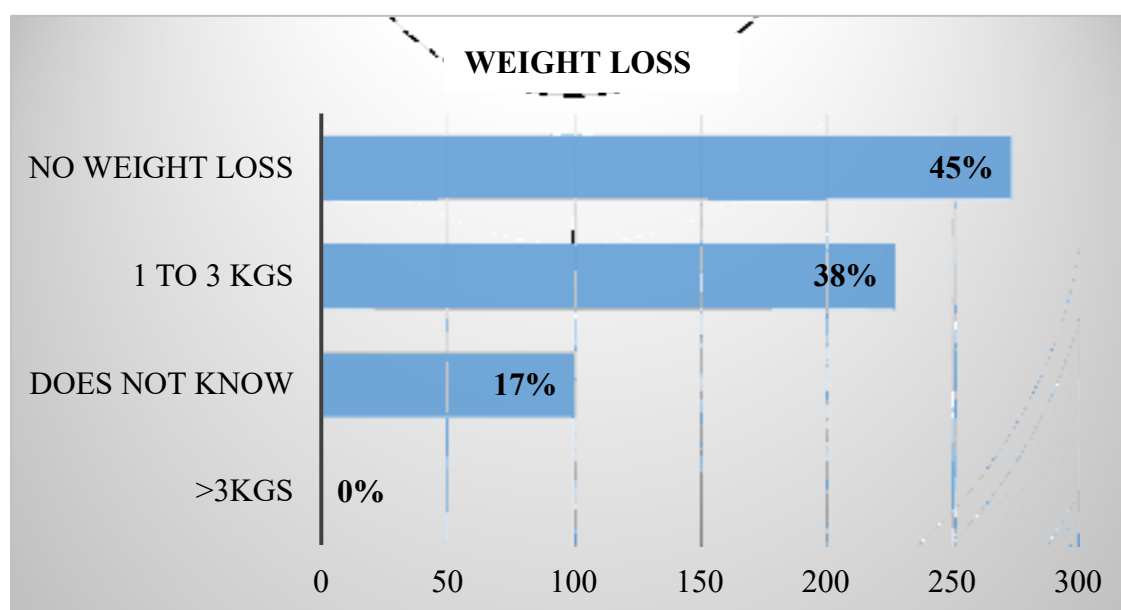
**Graph 18.**



In the present study, more than half of the participants 317(53%) had no decrease in food intake, 268(45%) had moderate decrease in food intake and only 15(2%) had severe decrease in food intake.

**B. Weight loss:****Table 19: Distribution of the participants according to their weight loss history in the past 3 months (N=600)**

Weight loss	Number(n)	Percentage(%)
>3kgs	0	0.00
Does not know	100	16.70
1 to 3 kgs	227	37.80
No weight loss	273	45.50
Total	600	100

**Graph 19.**

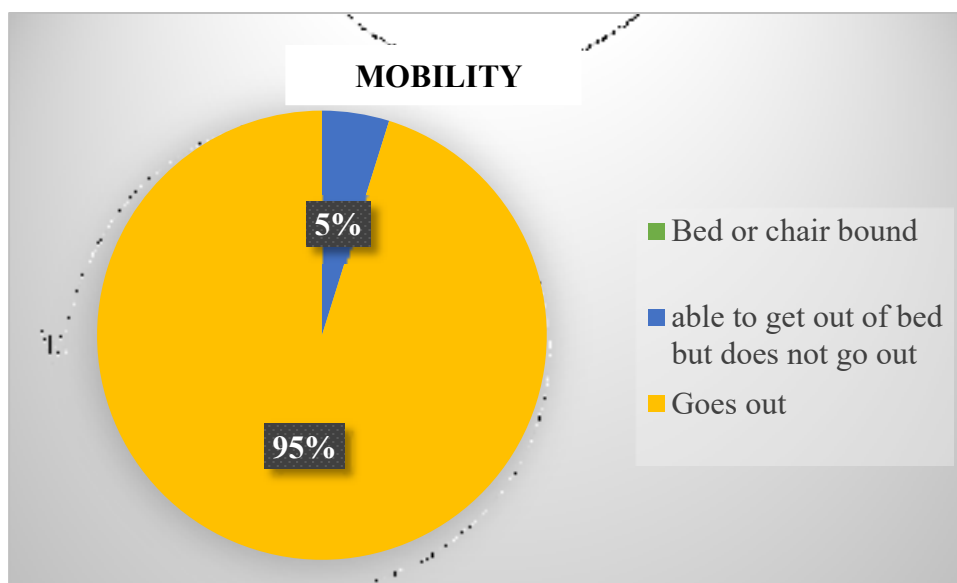
In the present study, nearly half of the participants 273(45%) had no weight loss history in the past 3 months, followed by 227(38%) had weight loss of about 1-3kgs and 100(17%) did not know about their weight changes.

C. Mobility:

**Table 20: Distribution of the study participants according to their Mobility (N=600)**

Mobility	Number (n)	Percentage (%)
Bed or chair bound	0	0.00
Able to get out of bed but does not go out	29	4.80
Goes out	571	95.20
Total	600	100

**Graph 20.**



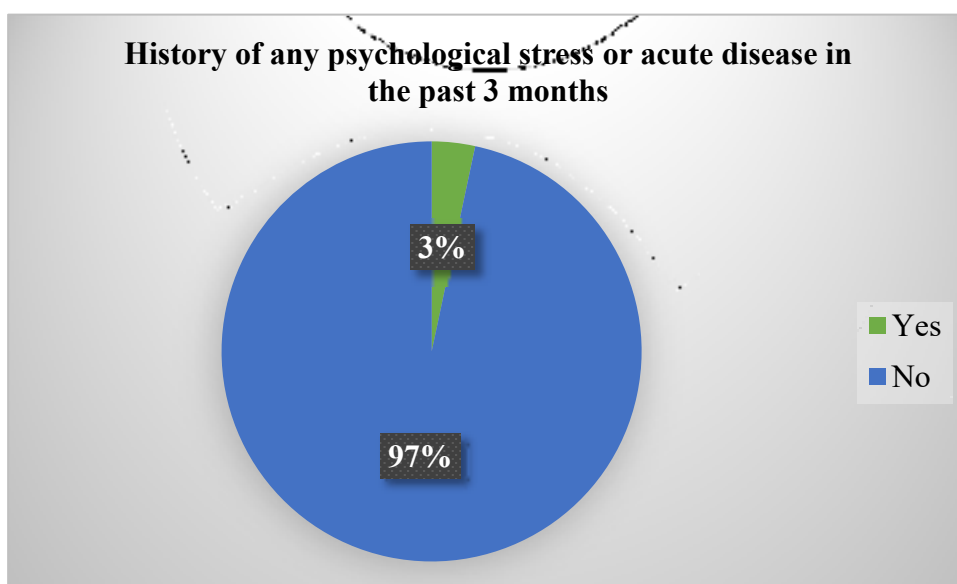
In the present study, majority of the participants 571(95%) were able to go out of their home and 29(5%) were able to get out of their bed/chair but were not able to go out of home.

**D. History of any psychological stress in the past 3 months:**

**Table 21: Distribution of the study participants according to their history of any Psychological stress or acute illness in the past 3 months (N=600)**

H/O Psychological stress or acute disease in the past 3 months	Number (n)	Percentage (%)
Yes	20	3.30
No	580	96.70
Total	600	100

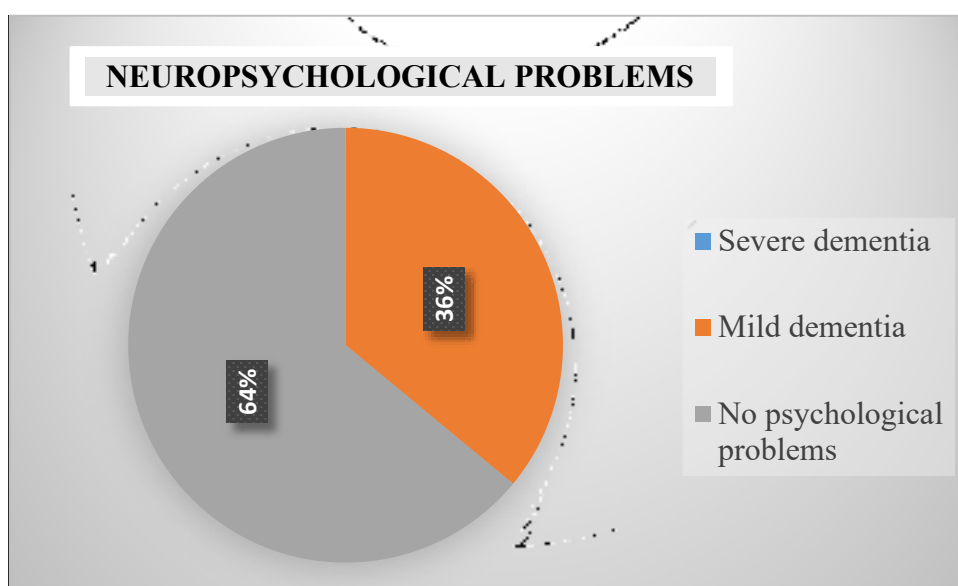
**Graph 21.**



Among the total participants, majority of them 580 ( 97%) did not suffer from any illness in the past 3 months and only 20 ( 3%) suffered from psychological stress in the past 3 months.

**E. Neuropsychological problems:****Table 22: Distribution of the participants according to their Neuropsychological problems(N=600)**

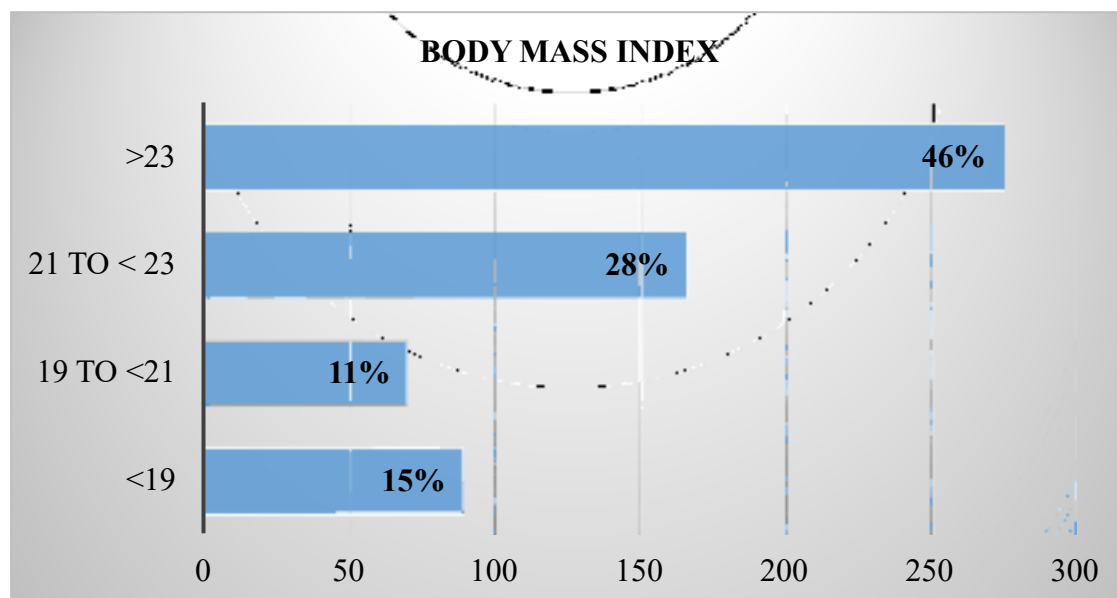
Neuropsychological problems	Number (n)	Percentage (%)
Severe dementia	0	0.00
Mild dementia	216	36.00
No psychological problems	384	64.00
Total	600	100

**Graph 22.**

Among the present study participants, more than half 384 ( 64%) did not have dementia problem and 216 (36%) had mild dementia.

**F.Body Mass Index (BMI) :****Table 23: Distribution of the study participants according to their BMI(N=600)**

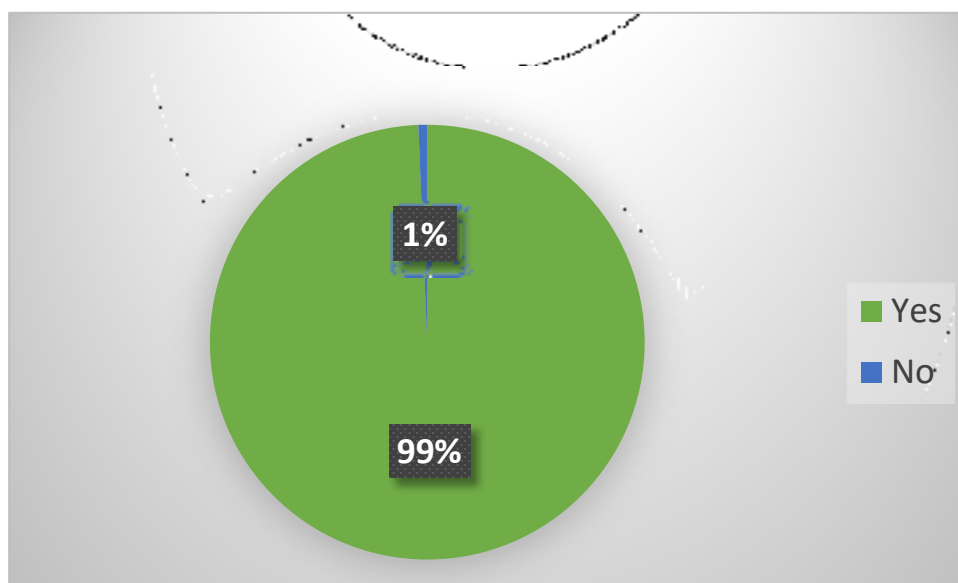
BMI	Number (n)	Percentage (%)
<19	89	14.80
19 to <21	70	11.70
21 to < 23	166	27.70
>23	275	45.80
Total	600	100

**Graph 23.**

Among the study participants, 275 (46%) had BMI >23 followed by 166(28%) had BMI 21 to <23 , 70 (11%) had BMI 19 to <21 and remaining 89 (15%) had BMI <19.

**G. Lives Independently :****Table 24: Distribution of the study participants depending on where they live: independently or hospital/nursing home(N=600)**

Lives independently	Number (n)	Percentage (%)
Yes	596	99.30
No	4	0.70
Total	600	100

**Graph 24.**

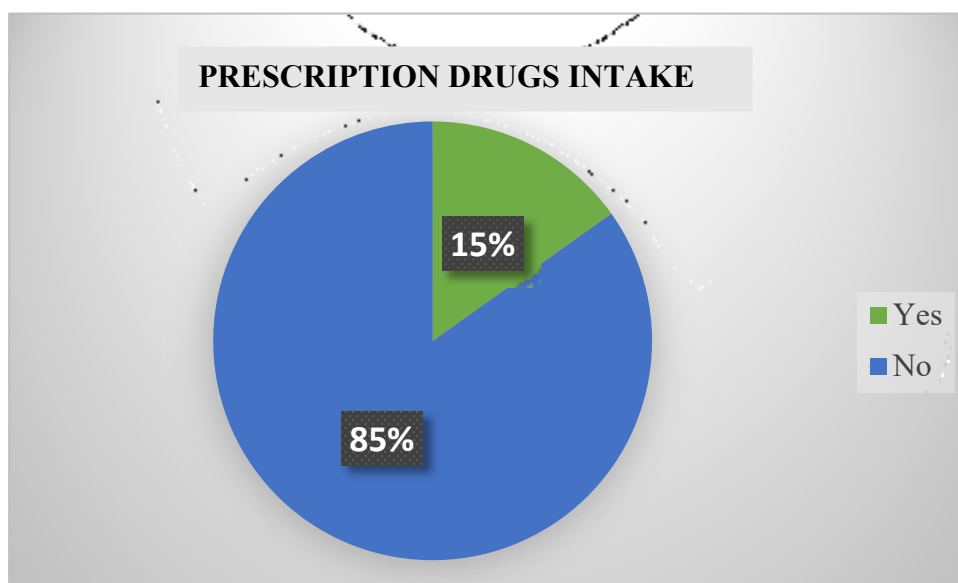
Among the study participants, majority 596(99%) lives independently and only 4(1%) lives in hospital/nursing home.

**H. Prescription Drugs intake:**

**Table 25: Distribution of the study participants according to their Prescription drugs intake(N=600)**

Takes more than 3 prescription drugs per day	Number (n)	Percentage (%)
Yes	91	15.20
No	509	84.80
Total	600	100

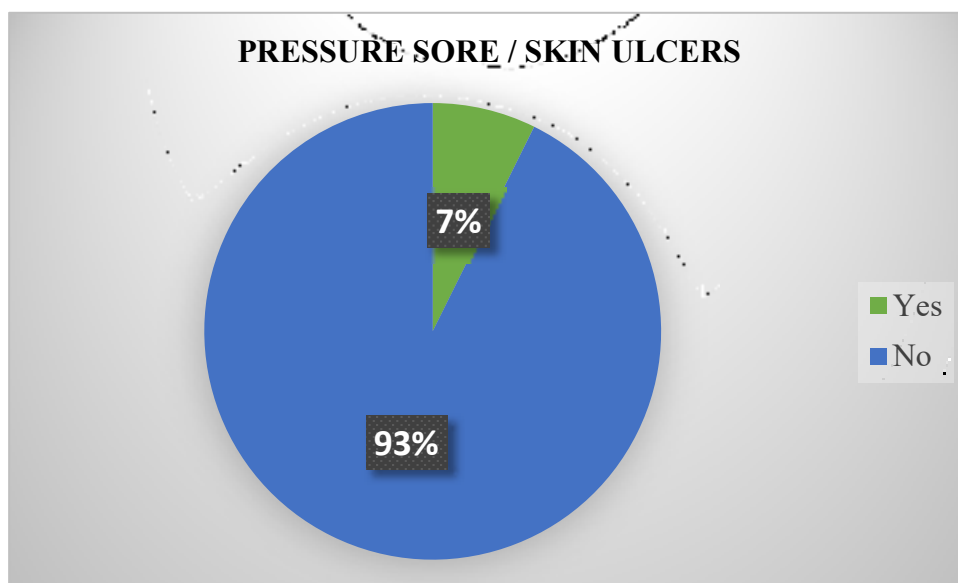
**Graph 25.**



In the present study, majority of the participants 509(85%) did not take >3 prescribed drugs per day and remaining 91 (15%) consumed > 3 prescribed drugs per day.

**I. Pressure sore / skin ulcers:****Table 26: Distribution of the study participants according to the presence of Pressure sore/skin ulcer(N=600)**

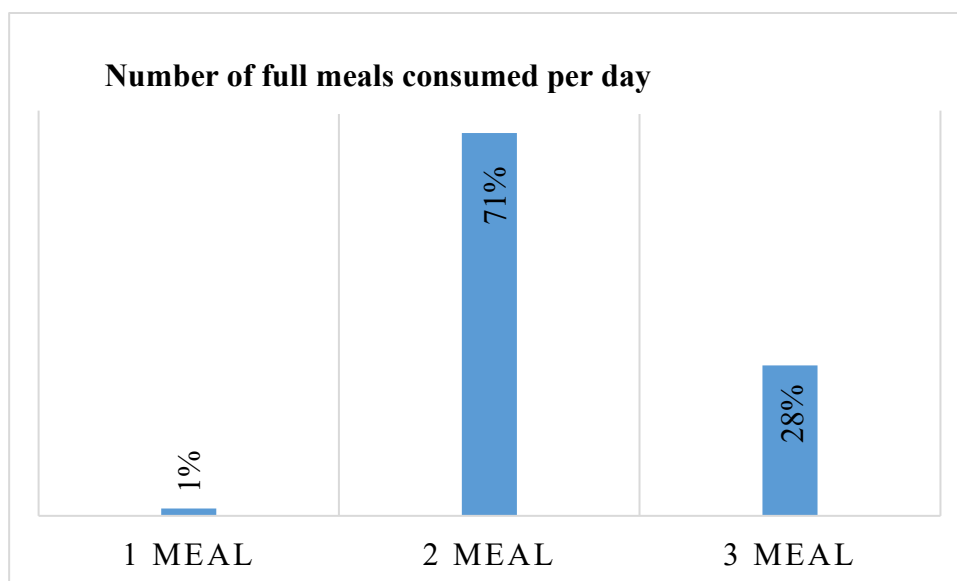
Pressure sore / skin ulcers	Number (n)	Percentage (%)
Yes	44	7.30
No	556	92.70
Total	600	100

**Graph 26.**

Among the study participants, majority of the participants 556(93%) did not have any pressure sore/ skin ulcers and remaining 44(7%) had pressure sore/skin ulcer.

**J.Number of full meals consumed per day :****Table 27: Distribution of the study participants according to the number of meals consumed per day(N=600)**

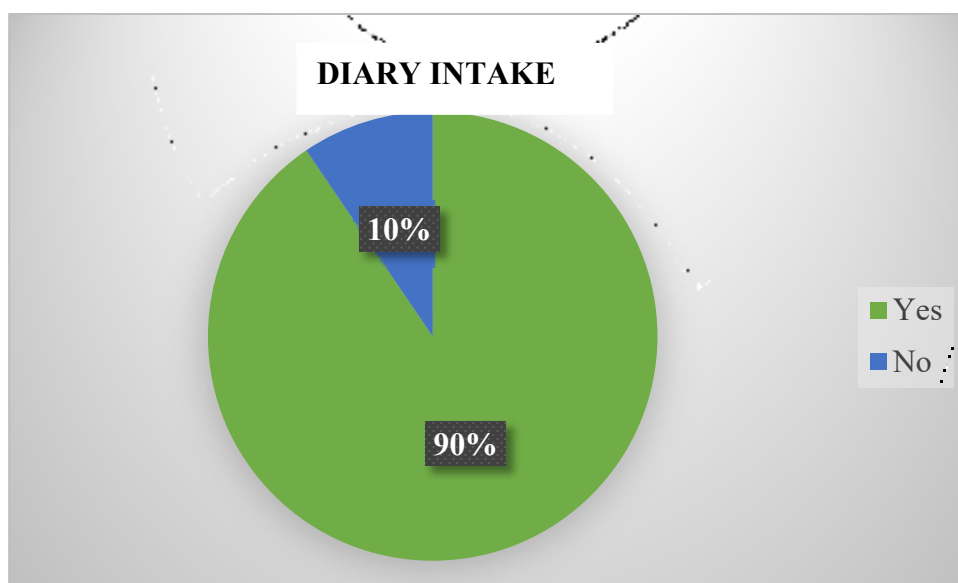
Number of full meals consumed per day	Number (n)	Percentage (%)
1 meal	8	1.3
2 meal	425	70.9
3 meal	167	27.8
Total	600	100

**Graph 27.**

Among the study participants, majority 425(71%) consumed 2 meals per day followed by 167(28%) consumed 3 meals per day and 8(1%) consumed only one meal per day.

**K. Selected consumption markers for protein intake :****Table 28a: Distribution of the study participants according to their diary intake (N=600)**

Atleast one serving of diary products	Number (n)	Percentage (%)
Yes	543	90.50
No	57	9.50
Total	600	100

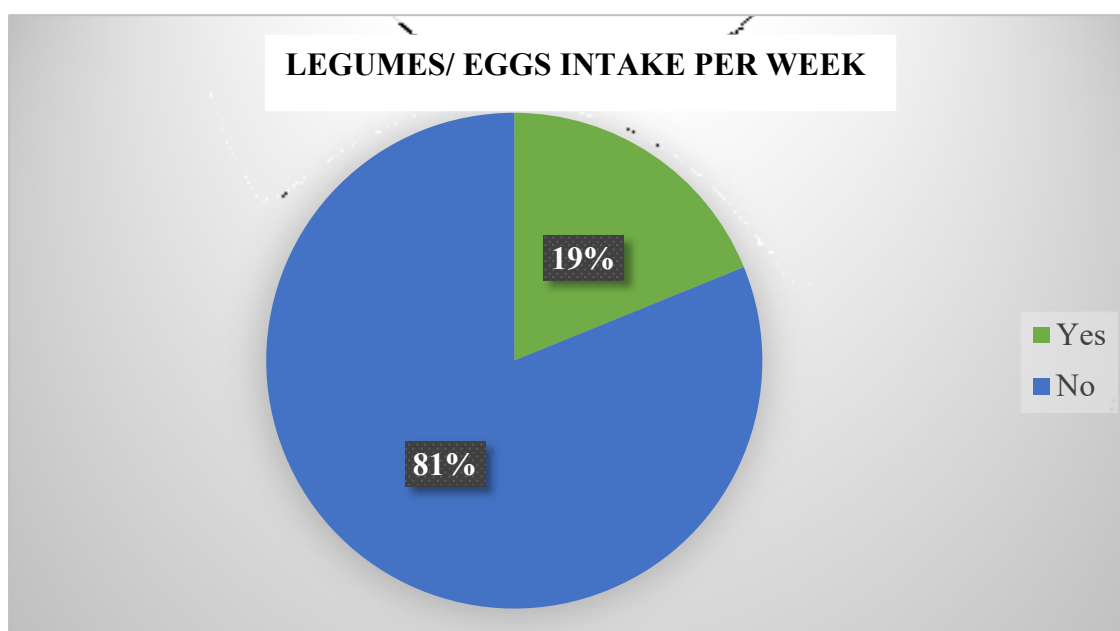
**Graph 28a.**

Among the study participants, 543(91%) consumed dairy products more than one serving per day and the remaining participants 57(9%) did not consume dairy products on daily basis.

**Table 28b: Distribution of the study participants according to their legumes/eggs intake per week (N=600)**

Two or more servings of legumes or eggs per week	Number (n)	Percentage (%)
Yes	113	18.80
No	487	81.20
Total	600	100

**Graph 28b.**



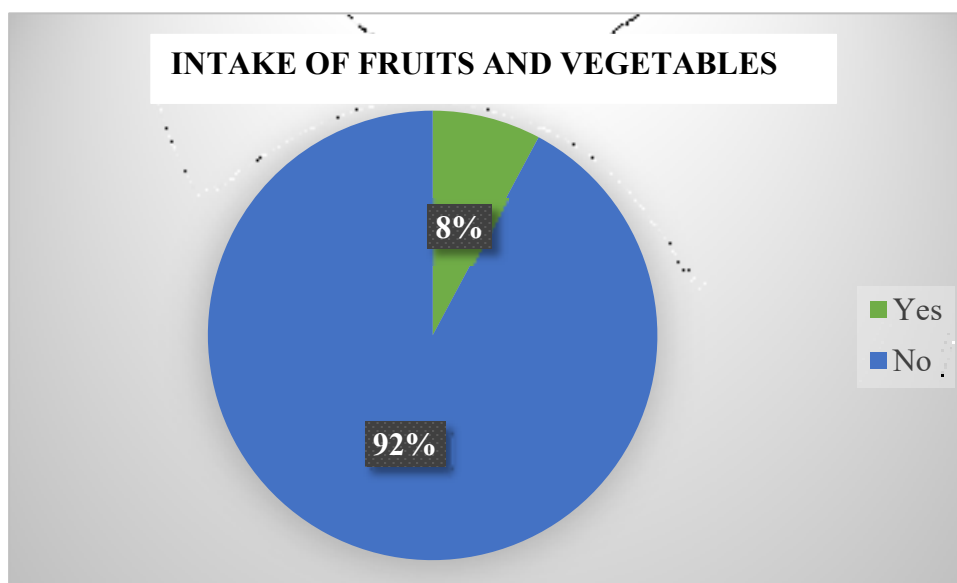
Among the study participants, 487(81%) did not consume legumes/eggs more than two servings per week and the remaining 113(19%) consumed legumes/eggs more than two servings per week.

**L. Intake of fruits and vegetables:**

**Table 29: Distribution of the study participants according to their fruits and vegetables intake(N=600)**

Consumes two or more servings of fruits and vegetables	Number (n)	Percentage (%)
Yes	47	7.80
No	553	92.20
Total	600	100

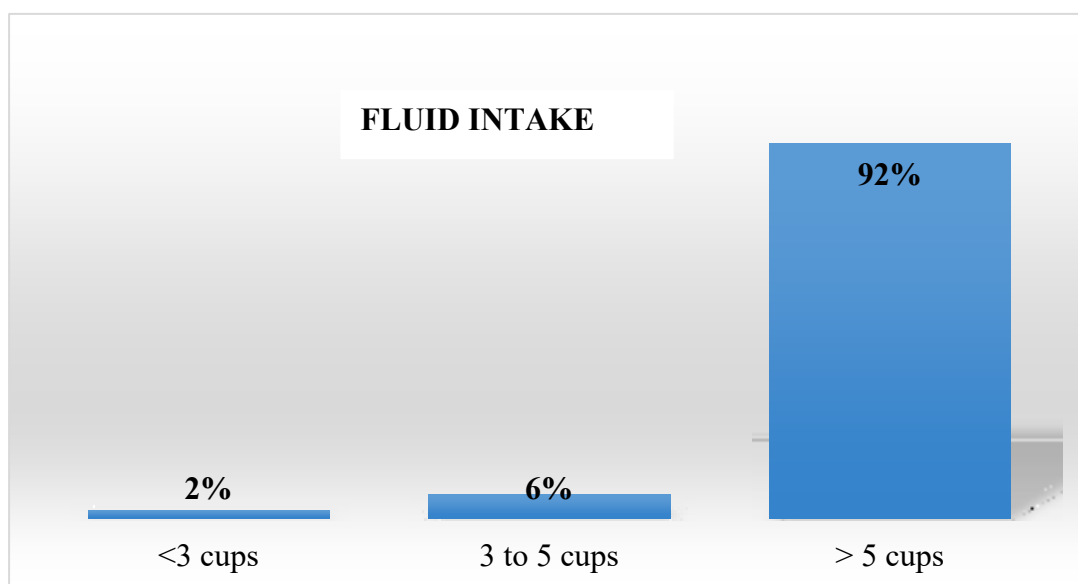
**Graph 29.**



Among the study participants, 553(92%) did not consume fruits/vegetables every day and the remaining participants 47(8%) consumed two or more servings of fruits/vegetables every day.

**M. Fluid intake:****Table 30: Distribution of the study participants according to their fluid intake per day (N=600)**

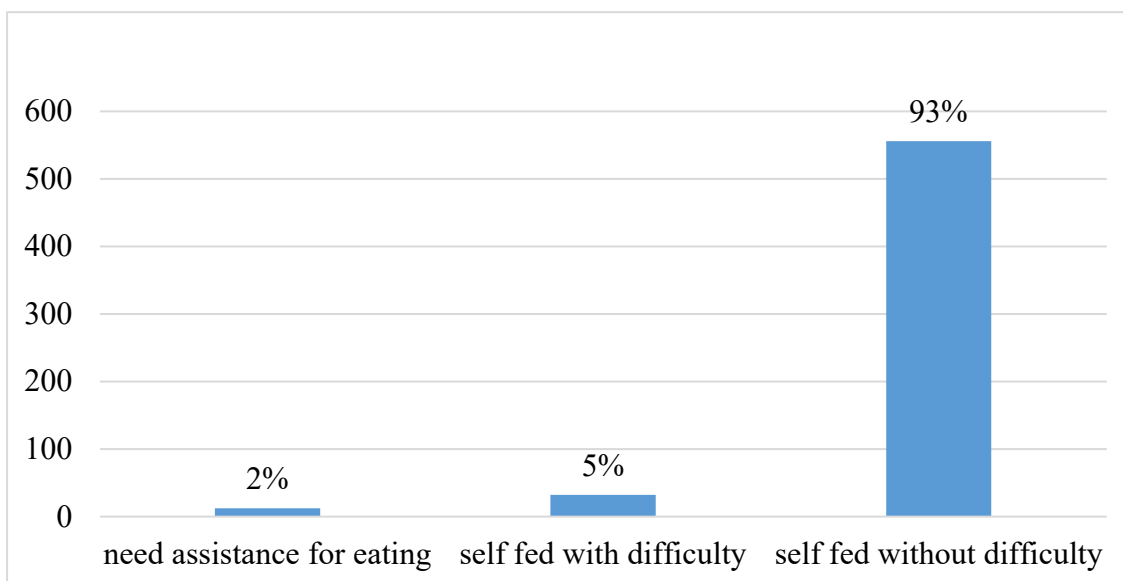
Fluid intake per day	Number (n)	Percentage (%)
<3 cups	12	2.00
3 to 5 cups	35	5.80
> 5 cups	553	92.20
Total	600	100

**Graph 30.**

Among the total participants, majority of them consumed >5 cups of fluid per day followed by 35(6%) consumed fluid between 3 to 5 cups per day and 12(2%) the fluid intake was less than 3 cups per day.

**N. Mode of feeding:****Table 31: Distribution of the study participants according to their mode of feeding(N=600)**

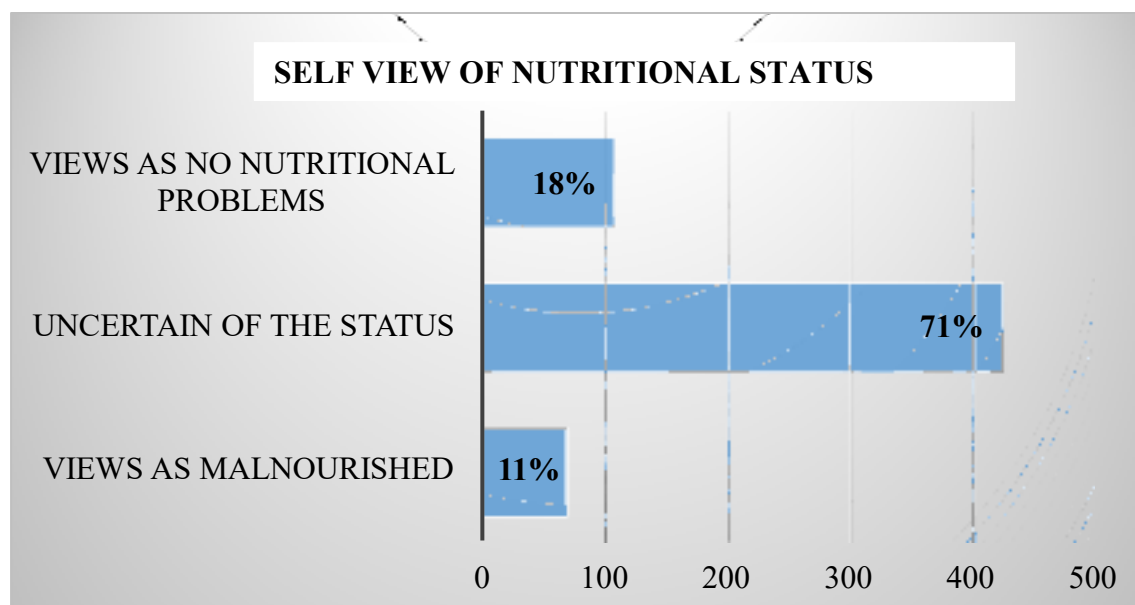
Mode of feeding	Number (n)	Percentage (%)
Need assistance for eating	12	2.00
Self fed with difficulty	32	5.30
Self-fed without difficulty	556	92.70
Total	600	100

**Graph 31.**

Among the study participants , majority of the participants 556(93%) self fed without any difficulty, followed by 32(5%) self fed but with difficulty and only 12(2%) required assistance for eating.

**O. Self view of nutritional status:****Table 32: Distribution of the study participants according to their self view of nutritional status (N=600)**

Self view of nutritional status	Number (n)	Percentage (%)
Views as malnourished	69	11.50
Uncertain of the status	424	70.70
Views as no nutritional problems	107	17.80
Total	600	100

**Graph 32.**

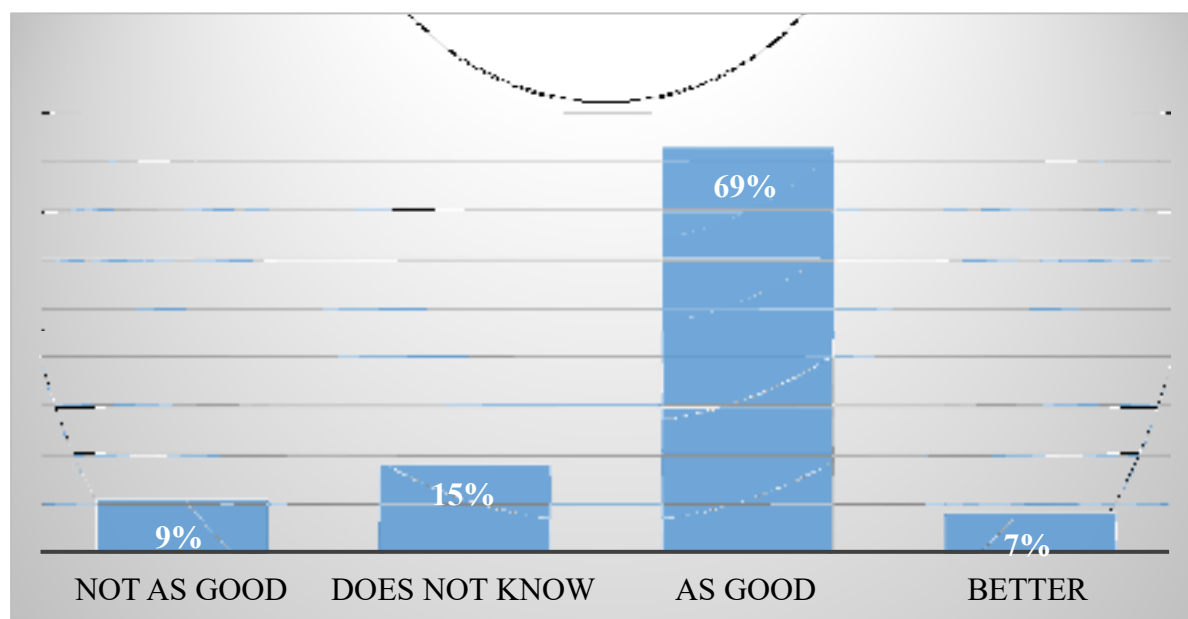
In the present study, majority of the study participants 424(71%) were uncertain about their nutritional status, followed by 107(18%) were with view of no nutritional problems and 69(11%) viewed themselves to be malnourished.

**P. Self view of Nutritional status when compared with other person of same age:**

**Table 33: Distribution of the study participants according to their self view of nutritional status when compared to other person of same age (N=600)**

When compared to other person of same age, how does the patient consider his/her nutritional status	Number (n)	Percentage (%)
Not as good	55	9.20
Does not know	90	15.00
As good	414	69.00
Better	41	6.80
Total	600	100

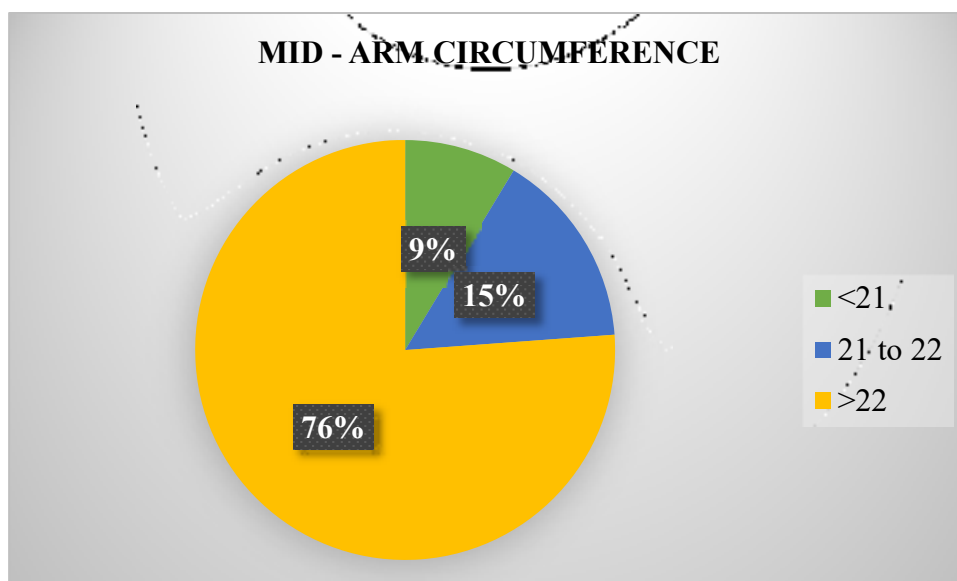
**Graph 33.**



In the present study, more than half of the study participants 414(69%) considered their nutritional status to be as good as the other person , 90(15%) does not know, 55(9%) considered their nutritional status to be not as good as the other person and only 41(7%) viewed themselves to be better than the other person of the same age.

**Q. Mid - Arm Circumference (MAC) :****Table 34: Distribution of the study participants according to their Mid - Arm Circumference (MAC in cm) (N=600)**

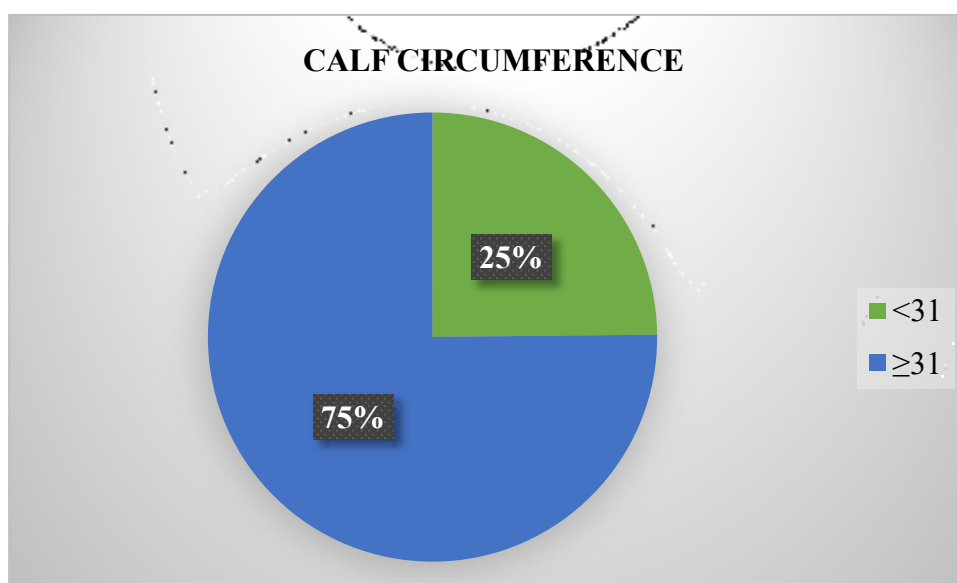
MAC in cm	Number (n)	Percentage (%)
<21	52	8.60
21 to 22	91	15.20
>22	457	76.20
Total	600	100

**Graph 34.**

Among the total participants, majority of the participants 457(76%) had MAC >22cm, followed by 91(15%) had MAC between 21 to 22cm and 52(9%) had MAC <21cm.

**R. Calf Circumference (CC in cm):****Table 35: Distribution of the study participants according to their Calf Circumference (CC in cm) (N=600)**

CC in cm	Number(n)	Percentage(%)
<31	149	24.80
$\geq$ 31	451	75.20
Total	600	100

**Graph 35.**

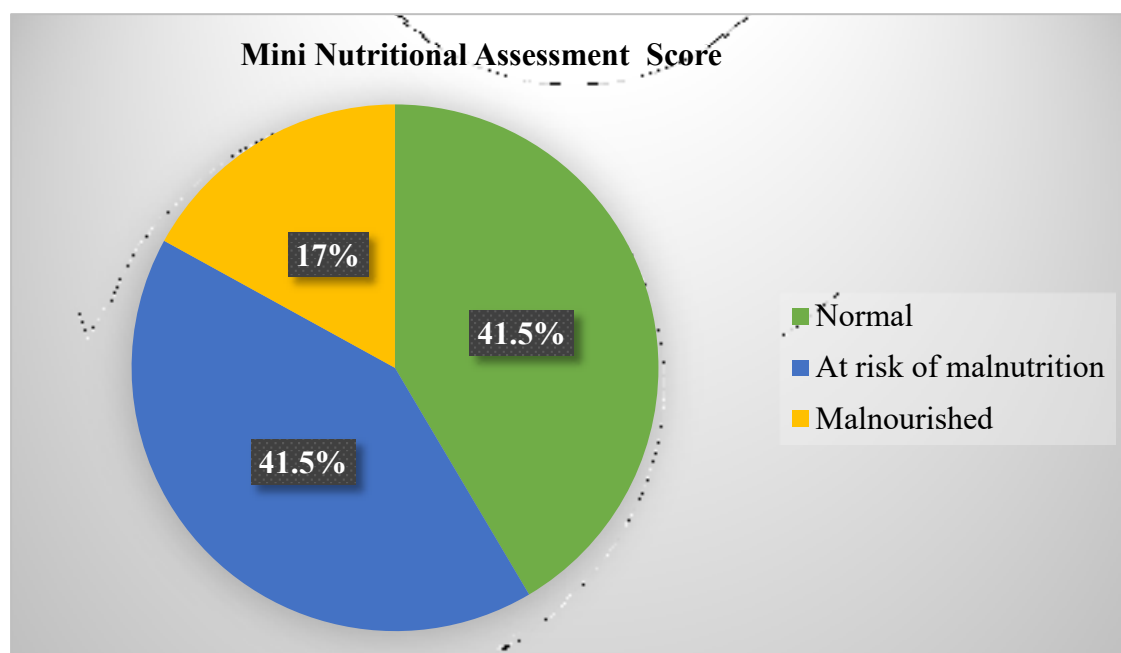
Among the total participants, majority of the participants 451(75%) had Calf Circumference of  $\geq$ 31cm and remaining 148(25%) had Calf Circumference of <31 cm.

### S. Mini Nutritional Assessment Score(MNA) :

**Table 36: Distribution of the study participants according to their Nutritional Status ( As per MNA score) (N=600)**

Nutritional Status	Number(n)	Percentage(%)
Normal	249	41.50
At risk of malnutrition	249	41.50
Malnourished	102	17.00
Total	600	100

**Graph 36.**



Among the total participants, 249(41.5%) were at risk of malnutrition, 249(41.5%) had normal nutritional status and 102(17%) were malnourished according to MNA score.

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**VI. Association between nutritional status and various factors.**
**Table 37. Association between age and gender with nutritional status.**

	<b>Malnourished or At risk of Malnutrition</b>	<b>Normal nutritional status</b>	<b>Total</b>	<b>Chi- Square</b>	<b>p- value</b>	<b>Effect Size <math>\eta^2</math></b>	<b><math>\eta^2</math></b>
<b>Age</b>							
<65	130 (41.8)	181 (58.2)	311	34.5	<b>&lt;0.001***</b>	-0.24	0.0576
>65	190 (65.7)	99 (34.3)	289				
<b>Gender</b>							
Male	151 (47.2)	169 (59.8)	320	10.4	<b>0.001**</b>	0.132	0.0174
Female	169 (60.4)	111 (39.6)	280				

In the present study, among the participants aged <65 years, 58.2% were well nourished and among the participants aged >65 years only 34.3% were well nourished. This difference in the nutritional status is statistically significant (<0.001). Among the female participants 39.6% were well nourished and among males, 59.8% males were well nourished. Therefore there is significant association between gender and nutritional status (<0.001).

Table 38. Association between educational status and nutritional status.

	Malnourished or At risk of Malnutrition	Normal nutritional status	Total	Chi- Square	p- value	Effect size $\eta^2$	$\eta^2$
<b>Education</b>							
Illiterate	127 (64.8)	69 (35.2)	196	28.415	<0.001***	0.215	0.086
Primary School	107 (52.5)	97 (47.5)	204				
High School	66 (50)	66 (50)	132				
Pre University Course (PUC) I & II	10 (40)	15 (60)	25				
Degree	10 (23.3)	33 (76.7)	43				

Among the participants who were illiterate, 35.2% were well nourished and among the participants who were degree holders, 76.7% were well nourished, hence the association between educational status and nutritional status was found to be statistically significant (<0.001).

Table 39. Association between Socio - economic status and nutritional Status.

	Malnourished or At risk of Malnutrition	Normal nutritional status	Total	Chi- Square	p- value	Effect size $\eta^2$	$\eta^2$
<b>Modified B.G.Prasad Classification</b>							
Class I	05	13	18	37.46	<b>&lt;0.001***</b>	- 0.239	0.057
Class II	17	26	43				
Class III	27	62	89				
Class IV	170	124	294				
Class V	101	55	156				

The prevalence of malnutrition was higher in class III, IV and V when compared to class I and II. The p value is <0.001, hence there is significant statistical association between the nutritional status and socio-economic class.

**Table 40. Association between marital status and type of family with nutritional status.**

	<b>Malnourished or At risk of Malnutrition</b>	<b>Normal nutritional status</b>	<b>Total</b>	<b>Chi-Square</b>	<b>p- value</b>	<b>Effect Size <math>\eta^2</math></b>	<b><math>\eta^2</math></b>
<b>Marital Status</b>							
Unmarried and widow	64 (73.6)	23 (26.4)	87	16.713	<0.001***	0.169	0.027
Married	256 (49.9)	257 (50.1)	513				
<b>Type of Family</b>							
Joint	259 (55)	212 (45.0)	471	15.97	<0.001***	0.163	0.02
Nuclear	38 (38.4)	61 (61.6)	99				
Broken	23 (76.7)	07 (23.3)	30				

The prevalence of malnutrition was found to be higher in participants who were unmarried or widowed and more in nuclear type of family. The p value is < 0.001 hence the association between marital status and type of family with nutritional status is statistically significant.

Table 41. Association between religion and type of diet with nutritional status.

	Malnourished or At risk of Malnutrition	Normal nutritional status	Total	Chi- Square	p- value	Effect size $\eta^2$	$\eta^2$
<b>Religion</b>							
Christian and Muslims	45 (54.2)	38 (45.8)	83	0.03	0.862	0.007	0.000049
Hindus	275 (53.2)	242 (46.8)	517				
<b>Type of Diet</b>							
Vegetarian	212 (54.6)	176 (45.4)	388	0.752	0.386	0.035	0.0012
Mixed	108 (50.9)	104 (49.1)	212				

The association between religion and type of diet was found to be statistically insignificant as the p value was  $>0.05$ .

**Table 42. Association between 24hrs dietary intake and habits with nutritional status.**

	<b>Malnourished or At risk of Malnutrition</b>	<b>Normal nutritional status</b>	<b>Total</b>	<b>Chi- Square</b>	<b>p- value</b>	<b>Effect size <math>\eta^2</math></b>	<b><math>\eta^2</math></b>
<b>24hrs Dietary intake</b>							
Adequate	92 (29.2)	223 (70.8)	315	155.10	<b>&lt;0.001***</b>	0.508	0.258
Inadequate	228 (80.8)	57 (19.2)	285				
<b>Habits</b>							
Tobacco, alcohol, Smoking and others	28 (68.3)	13 (31.7)	41	13.25	<b>0.047*</b>	0.081	0.0065
None	292 (52.2)	267 (47.8)	559				

The prevalence of malnutrition was found to be higher in participants who consumed inadequate calorie (80.8%, p-value - <0.001) and more in participants with history of substance abuse(68.3%, p-value - 0.047).The association between nutritional status with 24hrs dietary intake and habits was statistically significant.

Table 43. Association between past history and BMI with nutritional status.

	Malnourished or At risk of Malnutrition	Normal nutritional status	Total	Chi- Square	p- value	Effect Size g	g <sup>2</sup>
<b>Past History</b>							
None	123 (48.8)	129 (51.2)	252	13.25	<b>0.004**</b>	- 0.193	0.037
Diabetes	65 (47.1)	73 (52.9)	138				
Hypertension	53 (58.2)	38 (41.8)	91				
Diabetes + Hypertension	79 (66.4)	40 (33.6)	119				
<b>BMI</b>							
<19	58 (100)	0 (0)	58	283.23	<b>&lt;0.001***</b>	0.675	0.455
19 - < 21	50 (96.2)	02 (3.8)	52				
21 - <23	143 (77.7)	41 (22.3)	184				
≥ 23	69 (22.5)	237 (77.5)	306				

The prevalence of malnutrition was higher in participants with chronic illness and with lower BMI. Thus the association between chronic illness (p-value 0.004) and BMI (p-value <0.001) with nutritional status was statistically significant.

**VII. Multiple logistic regression analysis to assess the influence of factors on nutritional status.**

**Table 44. Multiple logistic regression analysis between gender and age with nutritional status.**

		Univariate Analysis		Multivariate Analysis	
		Unadjusted Odds Ratio	P-value	Adjusted Odds Ratio	P-value
<b>Sex</b>		1.70 (1.23-2.35)	<b>0.001**</b>	2.37 (1.31-4.26)	<b>0.004 **</b>
Male	320				
Female (Ref)	280				
<b>Age</b>		0.37 (0.26 – 0.52)	<b>&lt;0.001***</b>	0.46 (0.27 – 0.76)	<b>0.003 **</b>
<65 (Ref)	311				
>65	289				

Target group - Normal nutritional status

Reference group - Malnutrition/ at risk of malnutrition.

The present study highlighted that males as compared to females were 2.37 times more likely to be in normal nutritional status than to be at risk of malnutrition or malnutrition ( AOR - 2.37,95% CI: 1.31-4.26,P-value - 0.004) and participants aged <65 years were 0.46 times more likely to be in normal nutritional status than to be at risk of malnutrition or malnutrition than participants aged >65 years ( AOR - 0.46,95% CI: 0.27 - 0.76,P value - 0.003) .

**Table 45. Multivariate regression analysis of Socio-economic status and type of family with nutritional Status.**

		<b>Univariate Analysis</b>		<b>Multivariate Analysis</b>	
B.G.Prasad classification		<b>Unadjusted Odds Ratio</b>	P-value	<b>Adjusted Odds Ratio</b>	P-value
Class I	18	4.77 (1.61 – 14.09)	<b>0.005 **</b>	1.05 (0.24 -4.44)	0.959
Class II	43	2.80 (1.40 – 5.62)	<b>0.004 **</b>	2.35 (0.82 – 6.76)	0.112
Class III	89	4.21 (2.41 – 7.37)	<b>&lt; 0.001 ***</b>	5.26 (2.07 – 13.37)	<b>&lt;0.001***</b>
Class IV	294	1.33 (0.89 – 2.00)	<b>0.154</b>	1.52 (0.85 – 2.71)	0.154
Class V (Ref)	156				

Participants who belonged to class III compared to those who belonged to class V were 5 times more likely to be in normal nutritional status than to be in at risk of malnutrition or malnutrition (AOR- 5.26, 95% CI: 2.07 - 13.37, P value - <0.001).

**Table 46. Multiple logistic regression analysis between habits and nutritional Status.**

		Univariate Analysis		Multivariate Analysis	
Habits		Unadjusted Odds Ratio	P-value	Adjusted Odds Ratio	P-value
Tobacco, Smoking, Alcohol And others (Ref)	41				
None	559	1.96 (0.99 –3.881)	0.050	3.25 (1.243 –8.493)	<b>0.016 *</b>

The participants with habits as compared to participants without habits were 3.25 times more likely to be in normal nutritional status than to be at risk of malnutrition or malnutrition ( AOR - 3.25,95% CI : 1.243 - 8.493, P- value - 0.016).

**Table 47. Multivariate regression analysis between past history and 24hr dietary intake with nutritional Status.**

		Univariate Analysis		Multivariate Analysis	
Past history		Unadjusted Odds Ratio	P-value	Adjusted Odds Ratio	P-value
None	252	2.07 (1.31 – 2.26)	<b>0.002**</b>	2.48 (1.27 -4.84)	<b>0.008**</b>
Diabetes	138	2.21 (1.33 – 3.68)	<b>0.002**</b>	1.58 (0.75 – 3.31)	0.222
Hypertension	91	1.41 (0.80 – 2.48)	0.227	0.86 (0.40 – 1.86)	0.708
Diabetes + Hypertension (Ref)	117				
<b>24 hrs dietary</b>					
Adequate	315	9.69 (6.64 – 14.15)	<b>&lt;0.001***</b>	2.65 (1.43 – 4.57)	<b>0.001**</b>
Inadequate (Ref )	285				

Our study highlighted that people without past history when compared to people with past history were 2.48 times more likely to be in normal nutritional status than to be at risk of malnutrition or malnutrition( AOR - 2.48, 95% CI: 1.27 -4.84, P-value - 0.008).

Participants who had adequate food intake when compared to those who had inadequate food intake were 2.65 times more likely to be in normal nutritional status than to be at risk of malnutrition or malnutrition (AOR - 2.65, 95% CI: 1.43 - 4.57, P - value - 0.001)

**Table 48. Multivariate regression analysis between Body Mass Index and nutritional Status.**

		<b>Univariate Analysis</b>		<b>Multivariate Analysis</b>	
<b>BMI</b>		<b>Unadjusted Odds Ratio</b>	P-value	<b>Adjusted Odds Ratio</b>	P-value
BMI >23 & 21 TO 23	52	0.005 (0.001 – 0.022)	< <b>0.001</b> ***	0.009 (0.002-0.043)	< <b>0.001</b> ***
BMI 19 TO <21	184	0.083 (0.054 – 0.129)	< <b>0.001</b> ***	0.125 (0.071 – 0.220)	< <b>0.001</b> ***
BMI <19 (Ref)	306				

In this study, participants with BMI >23 and between 21 to 23 as compared to people with BMI <19 were 0.009 times more likely to be in normal nutritional status than to be at risk of malnutrition or malnutrition ( AOR - 0.009,95% CI: 0.002 - 0.043, P-value - <0.001).

## DISCUSSION

### **Table 1. Distribution of the study participants according to Age.**

In our study, 219(36.5%) were in the age group of 60 - 64 years , 209(34.8%) were in 65 - 69 years age group, 97(16.2%) were in 70 -74 years age group, 59(9.8%) were in 75 - 79 years age group , 11(1.8%) were in 80 - 84 years age group, 4 (0.7%) were in 85 - 89 years age group and only 1( 0.7%) was above 90 years.

A similar study done in Uchagaon, Belagavi by Patil DJ et al on the elderly population in 2018 revealed that, majority (65.1%) were in 60 -69 years age group, 26.6% were in 70-79 years age group and 8.3% were  $\geq$ 80 years old. <sup>(4)</sup>

### **Table 2. Distribution of the study participants according to Gender.**

In the present study, of the total participants, 320(53.3%) were males and 280(46.7%) were females.

A similar study conducted by Arslappa N et al in 2016 in Hyderabad, showed that nearly half (49.5%) were males and 50.5 % were females. <sup>(17)</sup> While a study conducted in Rajasthan in 2018 by Gandhi et al showed that 48% were male participants and 52% were females. <sup>(41)</sup>

### **Table 3. Distribution of the study participants according to religion.**

In the present study majority of the study participants, 517 ( 86.17%) were Hindus, followed by 72( 12%) were Muslims and 11(1.83%) were Christian.

A similar study conducted by Kansal et al in rural areas of Belagavi in 2014 showed that majority (85.26%) were Hindu by religion, 14.74% were Muslims and there were no Christian participants. <sup>(10)</sup>

**Table 4. Distribution of the study participants according to Education.**

In this study majority of the study participants, 204 (34%) studied up to primary school, 132 ( 22%) completed high school, 25(4.2%) completed PUC, 43(7.1%) were Degree holders and 196(32.7%) were illiterate.

A similar study done by Bakhtiari et al in 2020 in Babol city, Iran, revealed that 23.6% studied up to primary school, 26.8% completed high school, 17.1% attended university and 31.1% were illiterate. <sup>(42)</sup>

**Table 5. Distribution of the study participants according to Occupation.**

In the present study, 203(33.8%) were home makers , 200(33.3%) were Agriculturist, 59(9.9%) were retired, 49(8.2%) were labourers, 35(5.8%) were unemployed,10(1.85) were Private employee and 6(1%) were Government employee.

A similar study done in rural areas of Varanasi by Ravi Shankar et al in 2014, showed that 44.2% were Agriculturist, 23.8% were unemployed, 13.8% were labourers, 12.9% were home makers and 5.4% were retired. <sup>(23)</sup>

**Table 6. Distribution of the study participants according to Marital status.**

In this study, majority 513(85.5%) were married, 85 (14.2%) were widowed and 2 (0.3%) were unmarried.

A similar study done in rural areas of France by Tores M et al in 2014, showed that one - third (71.0 %) were married, 21.2% were widowed and 7.8% were unmarried. <sup>(21)</sup>

**Table 7. Distribution of the study participants according to Socio - economic status (Modified B.G.Prasad Classification).**

In the present study according to modified B.G.Prasad classification majority of the study participants 294(49%) belonged to class IV, followed by 156 ( 26%) to class V, 89 (14.8%) to class III, 43 ( 7.2%) to class II and only 18 (3%) to class I.

A similar study, conducted by Lahiri et al in 2015 in Kolkata, showed that 1.7% belonged to class I, 12.3 % to class II, 51.5% to class III, 18.3% to class IV and 16.2% to class V. <sup>(43)</sup>

The difference in the results may be due to the fact that, majority of our participants were farmers ,living in joint family and had low literacy rate.

**Table 8. Distribution of the study participants according to type of family.**

In the present study, large number of study participants 471 (78.5%) were living in joint family,99 (16.5%) were in nuclear family and 30 ( 5%) were living in broken family.

A similar study conducted in 2016 by S. Kalaiselvi et al in rural areas of Puducherry , revealed that majority (56%) were living in joint family , 17.5% in nuclear family and 17.2% were living alone. <sup>(44)</sup>

The disparity may be because of the social, cultural and method of living varies with each state.

**Table 9. Distribution of the study participants based on their past history of chronic illness.**

In this study, majority 252(42%) did not have any past history of chronic illness, followed by 138(23%) were Diabetic, 91(15.2%) were Hypertensive, 117(19.5%) were both Diabetic and Hypertensive .

A similar study conducted by Vaish et al in 2020 in East Delhi, revealed that 39% participants did not have any past history of chronic illness, 27.8% were Hypertensive and 16.4% were Diabetic. <sup>(45)</sup>

The difference in the results could be because of different genetic makeup , the way of living and diet type differs in every state.

**Table 10 . Distribution of the study participants depending on their type of Diet intake.**

In the present study of the total participants, 388(64.7%) were vegetarian. A similar study conducted by Khushboo et al in the Yamuna areas, Allahabad in 2015, showed that majority (70.7%) were vegetarians. <sup>(46)</sup>

**Table 11. Distribution of the study participants according to their 24hr Dietary intake.**

In the present study, majority 314(52%) consumed adequate calories and 286(48%) had inadequate calorie intake. Similar results were seen in a study conducted in Kampur district, Assam by Agarwalla et al in 2015, where 52.5% had inadequate calorie consumption and 47.3% consumed adequate calorie. <sup>(7)</sup>

**Table 12. Distribution of the study participants according to their Habits.**

In this present study , of the total participants, majority 559(93.2%) did not have any habits, followed by 25(4.2%) used to chew tobacco, 8 ( 1.3%) used to smoke, only 3(0.5%) consumed alcohol. Five participants (0.8%) had a habit of consuming both alcohol and tobacco.

A similar study done by Joymati et al in rural areas of Manipur in 2018, revealed that 74.8% did not consume alcohol, tobacco consumption was seen in 51.2% and smoking was seen in 52.4%.<sup>(16)</sup>

The disparity of results in habits may be due to different social cultures and beliefs.

**Table 13. Distribution of the study participants according to their Hemoglobin level.**

In the present study , among total male participants 195(61%) were anemic and among female participants majority 176(63%) were anemic.

A study conducted by Bayyapa Reddy et al in rural areas of Tamil Nadu in 2014 revealed that, 44.3% males were anemic and 55.7% females were anemic.<sup>(29)</sup>

The difference in the results can be owed to their different food practices like dietary intake, food taboos and type of diet .

**Table 14. Distribution of the study participants according to their Random blood sugar level.**

In the present study, more than one-third, 449(75%) were in pre - diabetic stage, 56(9.4%) were diabetic and 95(16%) were non-diabetic.

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**Table 15. Distribution of the study participants according to their built and nourishment.**

In this study, majority 476(79%) were moderately built and nourished, 109(18%) were poorly built and nourished and only 15(3%) were fairly built and nourished.

**Table 16 . Distribution of the study participants according to presence of Pallor.**

In this present study, out of the total participants, 316(53%) had pallor on examination. Almost similar results was seen in a study done in Doiwala block, Dehradun by Kritika et al in 2014, where pallor was seen in 54.2%.<sup>(18)</sup>

**Table 17. Distribution of the study participants according to their Waist : Hip Ratio.**

In this study, among male participants, more than half 222(69%) had waist/hip ratio  $>0.96$  and among the female participants, more than half 155(55%) had waist/hip ratio  $>0.81$ .

A Similar study conducted by Sanchez- Garcia et al in 2007 in Mexico, showed that among male participants 19.1% had waist/hip ratio  $> 1.0$  and 73.7% females had waist/hip  $> 0.85$ .<sup>(47)</sup>

Another study conducted by Fauziana in Singapore in 2016 showed that 79.01% males had high waist/hip ratio and 80.5% females had high waist /hip ratio.<sup>(48)</sup>

The disparity in the results may be due to different ethnicity, measuring technique and cut off value.

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**Table 18 to 33. Distribution of the study participants according to their Mini Nutritional Assessment scale .**

In the present study, more than half of the participants 317(53%) had no decrease in the food intake, 273(45%) had no weight loss history,571(95%) were able to go out of their home,580 ( 97%) did not suffer from any illness in the past 3 months, 384 ( 64%) had no dementia problems ,70 (11%) had BMI 19 to <21,91 (15%) consumed > 3 prescribed drugs per day,556(93%) did not have any pressure sore/ skin ulcers,8(1%) consumed only one meal per day,553(92%) did not consume fruits/vegetables every day, in 12(2%) people the fluid intake was less than 3 cups per day, 556(93%) were self feeding without any difficulty,69(11%) viewed themselves to be malnourished,55(9%) considered their nutritional status to be not as good as the other person.

A similar study done by Krishnamoorthy et al in Puducherry in 2019, showed that 43.4% had no decrease in the food intake, 35.5% had no weight loss history in the past 3 months ,87.8% were able to go out of their home,72% did not suffer from any illness in the past 3 months, 51.2% had no dementia problems, 15.1% were underweight, 55.2% consumed >3 meals per day, 38.4% did not consume adequate fruits and vegetables per day,98.2% did not have any difficulty in self feeding, 44.5% viewed themselves to be malnourished and 39.5% considered them to be not as good when compared to other person of the same age. <sup>(12)</sup>

Another similar study conducted by Shrivasthava DN et al in 2019 in rural areas of Mangaluru showed that among the total participants, 56.4% had no decrease in the quantity of food intake, 47.9% had no weight loss in the past 3 months,80.3% were able to go out of their home,80.3% did not have any psychological stress ,

80.3% did not have any dementia, 15.4% had BMI 19 to <21, 37.6% were taking >3 prescribed drugs per day, 88% were not having any pressure sores/ulcers, 60.7% consumed adequate fruits/vegetables per day, 5.1% consumed fluid less than 3 cups per day, 87.2% were self fed without any difficulty, 16.2% viewed themselves as malnourished, 13.7% considered themselves to be not as good as other people of the same age. <sup>(49)</sup>

**Table 34 & 35. Distribution of the study participants according to their Mid - Arm Circumference (MAC in cm) & Calf circumference (CC in cm).**

In this present study, majority 457(76%) had MAC >22cm, followed by 91(15%) had MAC 21 to 22cm and 52(9%) had MAC <21cm, Calf Circumference was  $\geq 31$ cm in 451(75%) .

A similar study conducted in 2017 by Deepthi Shanbhag et al in Bangalore showed that 68% had MAC>22cm, 23% had MAC 21 to 22cm and 9% had MAC <21cm. Calf circumference was  $\geq 31$ cm in 72%. <sup>(13)</sup>

**Table 36. Distribution of the study participants according to their Mini Nutritional Assessment Scores (MNA).**

Among the total participants, 249(41.5%) were at risk of malnutrition, 249(41.5%) had normal nutritional status and 102(17%) were malnourished according to MNA score.

A similar study conducted in 2018 in Kerala by Abraham revealed that, 46.5% were at risk of malnutrition, 41.9% had normal nutritional status and 11.6% were malnourished. <sup>(50)</sup>

Another similar study conducted by Mathew et al in urban area of Coimbatore in 2016 showed that, 24.7% were at risk of malnutrition 19.4% were malnourished and 55.9% were well nourished. <sup>(51)</sup>

A similar study conducted in Iran by Abolghasem Gorji et al in 2017 reported that, 12.2% were malnourished. <sup>(52)</sup>

The difference in the results may be due to the fact that rural population people are more prone to malnutrition, have low socio economic status & literacy rate.

**Table 37 to 43. Associations of nutritional status with various variables by chi square test.**

In the present study, association was found to be statistically significant with socio - demographic variables like older age, female gender, illiteracy, lower socio economic status, participants who are either widowed or unmarried, type of family, inadequate dietary intake, people with habits ,people who are suffering from chronic illness and lower BMI. However it was not associated with religion and type of diet.

A study done in Tamil Nadu by M.Vijaylaxmi et al in 2021 showed that older age, female gender, nuclear family, illiteracy and inadequate calorie intake had statistical significant association with the malnutrition. <sup>(27)</sup>

A similar observation was seen in a study conducted in 2018 by Son Nazon, Turkey. It showed a statistically significant association between nutritional status and older age, female gender and nuclear family. <sup>(53)</sup>

Another study done in rural areas of Rajasthan in 2020 by Mena M et al, revealed that the association between the female gender and malnutrition was statistically significant. <sup>(54)</sup>

A study done in Baghdad in 2020 showed significant association between nutritional status and older age, female gender and participants who were unmarried or divorced. <sup>(55)</sup>

**Table 44 to 48. Multiple logistic regression analysis to assess the influence of factors on nutritional status.**

In our study, when multivariate analysis was performed there was significant association between nutritional status and female gender, older age, people who had a history of substance abuse, participants who were suffering from chronic illness, who consumed inadequate calorie and had lower BMI.

A study done in Ernakulam, Kerala in 2021 had similar results where the association between malnutrition and older age, female gender, widowed participants and income status was statistically significant. <sup>(56)</sup>

A study conducted in South India in 2020 by Govind et al, showed that the association between malnutrition with variables like older age, female gender ,marital status and participants who had history of substance abuse was statistically significant. <sup>(14)</sup>

A similar result was seen in a study conducted in 2021 by Sharma S et al in Nepal. It showed a statistically significant association between malnutrition and older age. <sup>(57)</sup>

## **CONCLUSION**

The current cross sectional study, which was performed using MNA tool, observed 17% prevalence of malnutrition among elderly population residing in Peeranwadi, a rural field practise area of Department of Community Medicine, Jawaharlal Nehru Medical College. Among the 600 study participants there was a high prevalence of both at risk of malnutrition 249 (41.5%) and normal nutritional status was seen in 249 (41.5%).

The prevalence of malnutrition was significantly associated with the various factors like older age, female gender, lower educational status, lower socio - economic status, type of family, marital status, lower Body Mass Index, those who had inadequate calorie intake, who were suffering from chronic illness and those who had a history of substance abuse.

## **RECOMMENDATIONS**

The following recommendations are formulated based on the present study findings to prevent malnutrition and also to enhance the nutritional status of the geriatric population by assessing the various risk factors:

1. The key to the prevention of malnutrition is the early intervention. People who are already malnourished, curative therapy should be provided and more emphasis and preventive therapy should be provided to those who are at risk of malnutrition by dietary intervention to revert back the condition.
2. The care givers/family members of the elderly people play a major role, thus they should be made aware of the role of family support, the concept of balanced diet, symptoms of malnutrition and the awareness about health facilities and benefits available for the elderly people.
3. Geriatric clinic should be integrated in all Rural health centres .Nutritional status should be regularly assessed with the help of dietary assessment and anthropometric measurements.
4. The health care workers should educate and create awareness about the health facilities and benefits available at the nearest health facility and also promote involvement of local community, NGO's and organizations in the program.
5. To promote successful ageing, the government of India should form newer strategies, policies and programs intended towards geriatric population to uplift their nutritional status and also social well-being. Importance to research, training of the health care providers and funding should also be considered.

## **STRENGTHS**

The strengths of the study are:

1. The MNA tool used in the present study is a well - validated and customarily used nutrition screening tool specific to elderly population.
2. The various factors which might potentially affect the nutritional status were considered and evaluated.
3. Biochemical analysis like HB and RBS estimation were done.

## **LIMITATIONS**

The limitations of the study are :

1. Recall bias might be there as 24hr dietary assessment was done based on self reporting by the participants, thus it could lead to slightly over or under estimation.
2. Generalization of the study findings might be difficult as it highlighted the nutritional status of elderly population of a selected area of Belagavi.
3. Since it's a cross sectional study design, it is not an ideal design to establish causal relationships.

## **SUMMARY**

The present study which is a community based cross sectional study was undertaken to assess the nutritional status and it's associated factors among the rural elderly population using MNA tool.

The study was conducted in Peeranwadi, kinaye which is the rural field practise area of the Department of Community Medicine, J.N.Medical. College, KAHER, Belagavi. Totally 600 study participants were enrolled for the study .The duration of the study was 12 months from 1<sup>st</sup> January 2020 to 31<sup>st</sup> December 2020 .

In the present study,36.5% were in the age group of 60 - 64 years and 34.8% were in 65 - 69 years age group. More than half (53.3%) were male participants and majority (86.17%) were Hindus. More than one third (34%) of the older population had completed primary school and 32.7% were illiterate, 33.3% were farmers by occupation and 33.8% were home makers. Majority of the participants (85.5%) were married and 14.2% were widowed. Nearly half of the participants (49%) belonged to class IV, according to Modified B.G.Prasad classification. More than three - fourth (78.5%) were living in joint type family.

More than one - third (42%) did not have any history of chronic illness, 23% were diabetic , 15.2% were hypertensive and 19.5% were both diabetic and hypertensive. Majority of the participants (64.7%) consumed vegetarian diet and nearly half of them ( 47.7%) did not consume adequate calories. Majority of the elderly population (93.2%) did not have history of substance abuse.

Among the male participants, majority of them (60.9%) were non-anemic and among female participants, more than half (62.9%) were anemic. When RBS level of

the participants was tested, majority (74.8%) were in pre-diabetic stage. Majority of them (79.3%) were moderately built and nourished, in nearly half of the participants (47.3%) pallor was present. The W/H ratio was high in 69.3% and 55.45% of the male and female participants respectively.

Nearly half of the participants (44.7%) had moderate decrease in the food intake and 45.5% had no history of weight loss in the past three months of duration. A large number of the participants (95.2%) had no difficulty in mobility and could go out of their house on their own. Majority of them (96.7%) did not have any history of psychological stress and 64% had no history of any neuro - psychological problem.

Nearly half of the participants (45.8%) had BMI >23, followed by 27.7% had BMI 21 to < 23. Almost all the participants (99.3%) lived in their home residency and not in nursing homes or hospital. Majority (84.8%) had to consume < 3 prescription drugs on daily basis and a large number of elderly population (92.7%) did not have any pressure sore or skin ulcer.

Majority of the participants (70.9%) consumed only two meals per day and 90.5% consumed at least one serving of dairy products. More than one-third of the participants (81.2%) did not consume adequate amount of legumes and eggs and only 7.8% consumed two or more servings of fruits and vegetables every day.

Majority of the elderly individuals (92.2%) had adequate fluid intake per day and most of them (92.7%) did not have any difficulty in feeding and consumed food on their own without any assistance. Nearly one-third (70.7%) were uncertain of their nutritional status and 69% considered their nutritional status to be as good as the other person of the same age.

In this study, the results revealed that, 76.2% had MAC >22cm and majority of the participants (75.2%) had CC  $\geq$ 31 cm. According to the MNA score , the prevalence of malnutrition was found to be 17% , 41.5% were at risk of malnutrition and 41.5% were well nourished.

Various socio-demographic factors had impact over nutritional status of the elderly individuals. Significant association was established between older age( p value - <**0.001**), female gender (p value - **0.001**), low educational status (p value - <**0.001**), lower SES (p value - <**0.001**), marital status (p value - <**0.001**), type of family (p value - <**0.001**), 24-hrs dietary intake (p value - <**0.001**), history of substance abuse (p value - <**0.047**), BMI ( p value - <**0.001**) and past history of chronic illness (p value - <**0.004**) with nutritional status.

On multivariate analysis , there was a significant association between female gender( AOR - 2.37, 95% CI 1.31-4.26, P value - **0.004** ), older age ( AOR - 0.46, 95% CI 0.27-0.76, P value - **0.003** ), participants who belonged to class III according to modified B.G.Prasad classification ( AOR - 5.26, 95% CI - 2.07 – 13.37, P value - <**0.001**), History of substance abuse ( AOR - 3.25, 95% CI - 1.243 –8.493, P value - 0.016) ,History of chronic illness ( AOR - 2.48, 95% CI - 1.27 -4.84, P value - 0.008) and those who had inadequate calories consumption (AOR -2.65, 95% CI - 1.43 – 4.57, P value - 0.001) with nutritional status.

However, no statistical significant association was observed between religion and type of diet with nutritional status.

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ANNEXURE-I

ETHICAL CLEARANCE LETTER

	K.J.SOMAIYA ACADEMY OF HIGHER EDUCATION AND RESEARCH (Instituted in 1963)	Post: Dhulegaon (Dist. Jalgaon)
	Approved by AICTE by No. AICTE/1997/1000 <b>JAWAHARLAL NEHRU MEDICAL COLLEGE,</b> NEHRU NAGAR, BELAGAVI-590010 (KARNATAKA-INDIA)	Post: Dhulegaon (Dist. Jalgaon)
Website: <a href="http://www.jnmc.edu">http://www.jnmc.edu</a> E-Mail: <a href="mailto:info@jnmc.edu">info@jnmc.edu</a>	Phone: 9140881 Office: 2472540 Principal: 2471770 Fax No. 91 90851 - 2470799	
Ref: MDC/DMR/2/89		Date: 24/12/2019
To,		
PG student in Community Medicine, J.N.Medical College, BELAGAVI.		
Sub: Institutional Ethical Clearance for the study.		
With reference to the above, we wish to inform you that your proposed research project titled "ASSESSMENT OF NUTRITIONAL STATUS OF ELDERLY POPULATION IN RURAL AREAS: A COMMUNITY BASED CROSS SECTIONAL STUDY", is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.		
 (Dr. Anita Dulal) Member Secretary JNMC Institutional Ethics Committee on Human Subjects Research, J.N.Medical College, Belagavi.	 (Dr. Ruopa M Bellad) Chairman, JNMC Institutional Ethics Committee on Human Subjects Research, J.N.Medical College, Belagavi.	

## **ANNEXURE-II**

### **INFORMED CONSENT**

#### **ASSESSMENT OF NUTRITIONAL STATUS OF ELDERLY POPULATION OF RURAL AREAS: A COMMUNITY BASED CROSS SECTIONAL STUDY**

#### **INVESTIGATORS:**

#### **INTRODUCTION**

The geriatric population is growing in a rapid phase and they are highly vulnerable to develop malnutrition due to various reasons like low food consumption. This malnutrition will lead to morbidity and mortality. Elderly population do make contribution in socioeconomic segment of society invaluablely and their health has an important part in defining population health. Timely examination and nutritional intervention will reduce the burden of malnutrition in elderly population and will help to improve their life style quality. Thus, this study is being conducted to determine the nutritional status of elderly population residing in the rural field practice area of Kinaye Rural Health Centre and you are invited to participate in this study. Participation in this study is completely voluntary.

#### **EXPLANATION OF PROCEDURES**

In this study, you will have to give answer to questions about your general health information, socio-demographic details, nutritional health status and interventional procedure. The whole procedure may take 1-2 hours.

### **POSSIBLE BENEFITS**

The investigator does not promise or guarantee that you will receive direct benefit by being in this study. It will benefit the whole community by this study, we will know the Nutritional status of the elderly population in the community and accordingly, health education on preventive and control measures will be given.

### **POSSIBLE RISKS:**

The methods of investigation involved in the study are safe .No risks involved.

### **CONFIDENTIALITY**

Your identity will not be revealed. All information will be collected, coded and anonymized so that no one will know the identify.

### **WITHDRAWAL**

Participation in this study is voluntary. If you do not wish to participate in this study, you will not lose benefits to which you are entitled.

### **COSTS OF PARTICIPATION**

The cost of the study will be borne by the investigator. There will be no additional cost to you for participating in this study.

### **PAYMENT OF PARTICIPATION**

There will be no incentives to you for participating in this study.

## **AUTHORIZATION TO PUBLISH RESULTS**

The investigators may use the information gathered from this study for presentation in scientific journals. However, your identity will not be disclosed in such presentation or publication.

## **LEGAL RIGHTS**

By signing this consent form, you are not waiving any of your legal rights.

## **QUESTIONS**

If you have any questions about your rights as a study participant, you may contact **DR. ROOPA BELLAD**, Chairperson, JNMC Institutional Ethics Committee on human subjects' research at 0831-2741701.

**CONSENT STATEMENT**

“I have been explained all the contents of this consent form in my local language and have understood and clarifies all my queries about the study to the best of my knowledge. Furthermore, I recognize that I have the complete right to withdraw the consent at any point during the study. I understand that the information given by me will be confidential and will be used for research purpose only. Further, I am aware that the result of this research will be presented/published without disclosing any personal identification of the participants.

I hereby give my voluntary consent for participation in this study. I do sign the informed consent form in front of an eyewitness whom I recognize.”

Name of the participant: \_\_\_\_\_ Signature/ left thumb impression

Name of the eyewitness: \_\_\_\_\_ Signature/ left thumb impression

Name of the investigator: \_\_\_\_\_ Signature

Signature of the guide:

Date: 

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**ANNEXURE-III**  
**QUESTIONNAIRE**

**ASSESSMENT OF NUTRITIONAL STATUS OF ELDERLY POPULATION OF  
RURAL AREAS : A COMMUNITY BASED CROSS SECTIONAL STUDY**

**PART-1 SOCIO-DEMOGRAPHIC ASPECTS**

S.No:

Name:

Age: \_\_\_\_\_ years

Sex:

Address:

Contact No:

1. Religion:
  - a. Hindu
  - b. Muslim
  - c. Christian
  - d. Others (specify)
2. Education:
  - a. Illiterate
  - b. Primary school
  - c. High school
  - d. Pre-university I & II
  - e. Degree

3. Occupation:
4. Marital Status:
  - a. Unmarried
  - b. Married
  - c. Widowed
  - d. Divorced/ Separated
5. Type of Family:
  - a. Joint
  - b. Nuclear
  - c. Broken family
  - d. Problem family
6.
  - a. Monthly income of the family:
  - b. Total number of family members:
  - c. Monthly per capita income:
7. Socio-economic status – Modified B.G. Prasad classification
  - a. Class I
  - b. Class II
  - c. Class III
  - d. Class IV
  - e. Class V

## **PART II – PAST HISTORY**

8. Any past history of chronic illness?
  - a. Yes
  - b. No

If yes, please specify –

**PART III – PERSONAL HEALTH HABITS**

9. Type of diet:      a)Vegetarian      b)Mixed

10. 24 hr dietary recall.

11. Habits :

a)Tobacco

b)Smoking

c)Alcohol consumption

d) None

e) Other's(please specify)

If yes, duration : \_\_\_\_\_      Frequency : \_\_\_\_\_

If stopped, since : \_\_\_\_\_

**PART IV – ANTHROPOMETRY**

1.Height (cms) :

2.Weight( Kgs) :

3.BMI(Kgs/m<sup>2</sup>) :

4.Mid arm circumference (cms) :

5.Waist circumference(cms) :

6.Hip circumference (cms) :

**PART V – CLINICAL EXAMINATION**

**I. GENERAL PHYSICAL EXAMINATION**

1. Build and Nourishment: Poor/ Moderate/ Fair
2. Height (cm):
3. Weight (kg):
4. BMI (kg/m<sup>2</sup>):
5. Waist/ Hip Ratio:
6. Pallor:
7. Icterus:
8. Cyanosis:
9. Clubbing:
10. Lymphadenopathy:
11. Pedal edema:
12. Any other (please specify) :

**Vital signs**

1. Respiratory Rate (/min):
2. Pulse (/min):
3. Blood Pressure (mm/Hg):
  - a. At supine position:
  - b. At standing position:
4. Temperature (°C): Febrile/ Afebrile

**II. SYSTEMIC EXAMINATION**

1. Cardiovascular System:
2. Respiratory System:
3. Central Nervous System:
4. Per abdomen:

**PART VI– INVESTIGATION PROFILE**

TEST	RESULT
Random Blood Sugar	
Hemoglobin	

**Mini Nutritional Assessment**

Last name:

First name:

Sex:

Age:

Weight:

kg

Height:

cm

Date:

**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)<sup>2</sup>**

0 = BMI less than 19

1 = BMI 19 to less than 21

2 = BMI 21 to less than 23

3 = BMI 23 or greater

**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

yes

no

(milk, cheese, yoghurt) per day

•Two or more servings of legumes

yes

no

or eggs per week

•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 greater than 22

**R. Calf circumference (CC) in cm**

0 = CC less than 31

1 = CC 31 or greater

**Malnutrition Indicator Score**

24 to 30 points

Normal nutritional status

17 to 23.5 points

At risk of malnutrition

Less than 17 points

Malnourished

**ANNEXURE-IV**

**KEY TO MASTER CHART**

**ASSESSMENT OF NUTRITIONAL STATUS OF ELDERLY POPULATION OF  
RURAL AREAS : A COMMUNITY BASED CROSS SECTIONAL STUDY**

**PART-1 SOCIO-DEMOGRAPHIC ASPECTS**

Age: \_\_\_\_\_ years

Sex: male - 1, female -2

1. Religion:

- a. Hindu - 1
- b. Muslim -2
- c. Christian -3
- d. Others (specify) - 4

2. Education:

- a. Illiterate -1
- b. Primary school - 2
- c. High school - 3
- d. Pre-university I & II - 4
- e. Degree - 5

3. Occupation:

- |                   |                     |
|-------------------|---------------------|
| Farmer - 1        | Pvt employee - 5    |
| Labourer - 2      | Retired/pension - 6 |
| Self employed - 3 | Unemployed - 7      |
| Govt employee - 4 | Home maker - 8      |

4. Marital Status:
  - a. Unmarried - 1
  - b. Married - 2
  - c. Widowed -3
  - d. Divorced/ Separated -4
5. Type of Family:
  - a. Joint - 1
  - b. Nuclear -2
  - c. Broken family-3
  - d. Problem family- 4
6. Socio-economic status – Modified B.G. Prasad classification
  - f. Class I -1
  - g. Class II -2
  - h. Class III - 3
  - i. Class IV -4
  - j. Class V - 5

**PART II – PAST HISTORY**

7. Any past history of chronic illness?
  - 0 - none
  - 1 - DM
  - 2 - HTN
  - 3 - DM + HTN
  - 4 - Epilepsy

**PART III – PERSONAL HEALTH HABITS**

8. Type of diet: Vegetarian -1 , Mixed -2
9. 24 hr dietary recall. : Adequate - 1, Inadequate - 2
10. Habits :
  - a)Tobacco - 1
  - b)Smoking - 2
  - c)Alcohol consumption - 3
  - d) None - 4
  - e) others - 5
  - Alcohol + tobacco - 6

**PART IV – ANTHROPOMETRY**

- 1.Height (cms) :
- 2.Weight( Kgs) :
- 3.BMI(Kgs/m<sup>2</sup>) :
- 4.Mid arm circumference (cms) :
- 5.Waist circumference(cms) :
- 6.Hip circumference (cms) :

**PART V – CLINICAL EXAMINATION**

**I. GENERAL PHYSICAL EXAMINATION**

1. Build and Nourishment: Poor - 1, Moderate - 2, Fair -3
2. Height (cm):
3. Weight (kg):
4. BMI (kg/m<sup>2</sup>):
5. Waist/ Hip Ratio:
6. Pallor: present - 1, absent - 2
7. Icterus:
8. Cyanosis:
9. Clubbing:
10. Lymphadenopathy:
11. Pedal edema:
12. Any other (please specify) :

Vital signs

1. Respiratory Rate (/min):
2. Pulse (/min):
3. Blood Pressure (mm/Hg):
  - c. At supine position:
  - d. At standing position:
4. Temperature (°C): Febrile/ Afebrile

**II. SYSTEMIC EXAMINATION**

1. Cardiovascular System: NAD - 1, Abnormal - 2
2. Respiratory System:
3. Central Nervous System:
4. Per abdomen: past h/o herniotomy - 2, Hepatomegaly - 3

---

**PART VI– INVESTIGATION PROFILE**

TEST	RESULT
Random Blood Sugar	
Hemoglobin	

**MINI NUTRITIONAL ASSESSMENT**
**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)<sup>2</sup>**

0 = BMI less than 19

1 = BMI 19 to less than 21

2 = BMI 21 to less than 23

3 = BMI 23 or greater

**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**

a. At least one serving of dairy products

yes 1 , no - 2

(milk, cheese, yoghurt) per day

b• Two or more servings of legumes

yes 1,    no - 2

or eggs per week



**Q. Mid-arm circumference (MAC) in cm**

0.0 = MAC less than 21

0.5 = MAC 21 to 22

1.0 = MAC greater than 22

**R. Calf circumference (CC) in cm**

0 = CC less than 31

1 = CC 31 or greater

**Malnutrition Indicator Score**

24 to 30 points

Normal nutritional status

17 to 23.5 points

At risk of malnutrition

Less than 17 points

Malnourished

Age	Sex	Religion	Education	Occupation	Marital status	Type of family	Modified B.G.prasad class	past history	duration in years	Type of diet	24hr dietary recall	Habits	duration	frequency	stopped since	Height	Weight	WC	HC	W/H Ratio	Build and nourishment	pallor	icterus	cyanosis	clubbing	lymphadenopathy	pedal edema	others	RR	Pulse	BP	Temperature	CVS	RS	CNS	P/A	RBS	HB	S1	S2	S3	S4	S5	S6	A1	A2	A3	A4	A5a	A5b	A5c	A5 Total	A6	A7	A8	A9	A10	A11	A12	Main nutrition Indicator score		
60	1	1	4	3	2	1	4	0								174	75	74	72	1.02	2	2	2	2	2	2	2	16	70	130/70	2	1	1	1	1	174	13.2	2	3	2	2	2	3	1	1	1	2	1	2	1	2	2	1	0	1	2	1	1	1	1	1	26
64	1	1	3	1	2	1	4	1	2	1	1	4				172	74	72	71	1.01	2	2	2	2	2	2	2	15	70	120/80	2	1	1	1	1	196	13.7	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	26			
68	1	1	3	2	2	1	3	3	4,5	2	2	4				174	58	70	69	1.01	2	2	2	2	2	2	2	16	70	110/70	2	1	1	1	1	176	13.1	1	2	2	2	2	2	1	1	1	1	1	2	1	0	1	2	1	1	1	1	22				
65	2	1	2	8	2	1	4	0								156	52	70	75	0.93	2	2	2	2	2	2	2	16	72	130/70	2	1	1	1	1	172	12.4	1	2	2	2	2	2	1	1	1	1	2	2	1	0	1	2	1	1	1	1	22				
60	1	1	1	1	2	1	4	0								162	55	70	69	1.01	2	2	2	2	2	2	2	16	70	130/80	2	1	1	1	1	174	13.1	1	1	2	2	2	2	1	1	1	1	1	2	2	1	0	1	2	1	0.5	0.5	1	19			
60	1	1	3	1	2	1	4	0								170	69	70	68	1.02	2	2	2	2	2	2	2	18	70	120/80	2	1	1	1	1	173	12.8	2	3	2	2	2	2	1	1	1	1	2	2	1	0	1	2	1	1	1	1	25				
64	2	1	2	1	2	1	4	0								158	63	64	69	0.92	2	2	2	2	2	2	2	16	70	110/80	2	1	1	1	1	174	12.6	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	26			
64	1	1	3	2	2	2	3	1	2	1	1	4				179	74	70	68	1.02	2	2	2	2	2	2	2	16	70	120/80	2	1	1	1	1	174	13.3	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	24			
61	2	1	2	8	2	1	4	0								158	65	70	76	0.92	2	1	2	2	2	2	2	16	70	130/70	2	1	1	1	1	146	12.8	2	3	2	2	2	3	1	1	1	1	2	2	1	0	1	2	1	1	1	1	25				
60	1	1	2	1	2	1	5	3	2	2	1	4				177	79	108	104	1.03	2	2	2	2	2	2	2	18	70	140/90	2	1	1	1	1	194	13	2	3	2	2	1	3	1	0	1	1	1	2	2	1	0	1	2	1	1	1	1	23			
69	1	1	2	1	2	1	4	0								158	52	74	86	0.86	2	1	2	2	2	2	2	16	68	110/70	2	1	1	1	1	192	11.8	2	3	2	2	2	2	1	1	1	1	1	2	2	0	1	2	1	1	1	1	23.5				
67	2	1	2	8	2	1	4	1	4	1	1	4				150	53	68	78	0.8	2	2	2	2	2	2	2	16	70	120/70	2	1	1	1	1	200	12	2	3	2	2	2	3	1	1	1	1	1	2	2	1	0	1	2	1	1	1	25				
68	1	1	1	7	3	1	4	3								165	45	65	76	0.8	1	1	1	2	2	2	2	16	64	100/70	2	1	1	1	1	184	11.5	1	2	2	2	1	0	1	1	1	1	1	1	1	0	1	2	0	0	0.5	0	15.5				
62	1	1	3	2	2	1	4	3								174	72	76	74	1.05	2	1	2	2	2	2	2	16	70	130/80	2	1	1	1	1	174	13.4	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	26			
60	2	2	2	8	2	1	4	3								153	65	66	69	0.9	2	2	2	2	2	2	2	18	68	110/70	2	1	1	1	1	176	12.3	2	3	2	2	2	3	1	1	1	1	2	2	1	0	1	1	1	1	1	1	25				
64	2	1	2	8	2	1	4	1	2	1	2	4				156	53	62	66	0.9	2	2	2	2	2	2	2	17	66	120/70	2	1	1	1	1	146	10	1	2	2	2	1	2	1	0	1	1	1	2	2	1	1	1	2	1	0.5	1	1	0.5	1	20.5	
65	2	2	1	8	3	1	5	2	6	2	2	4				145	45	66	69	0.95	1	1	2	2	2	2	2	20	80	140/90	2	1	1	1	1	146	10	1	1	1	2	1	2	1	1	0	1	0	1	2	1	2	1	0	0.5	1	1	0	1	1	15.5	
74	1	2	3	7	2	2	5	3					20			165	60	70	68	1.02	1	1	2	2	2	2	24	80	100/70	2	1	1	1	1	184	12.2	1	1	1	2	1	2	1	1	1	1	2	2	0	0.5	1	1	0.5	1	1	1	18.5					
70	2	1	1	7	2	1	5	3								158	58	70	72	0.9	2	1	2	2	2	2	2	14	70	110/70	2	1	1	1	1	154	11	1	1	0	2	2	3	1	1	1	2	1	2	2	0	1	2	2	0	1	1	1	19.5			
65	1	2	2	2	1	5	0									156	60	70	68	1.02	2	2	2	2	2	2	2	19	76	120/80	2	1	1	1	1	176	13.2	1	3	2	2	2	3	1	1	1	1	2	2	1	2	1	0.5	2	1	1	1	1	24.5			
64	1	1	2	1	2	1	3	0								179	74	70	69	1.01	2	2	2	2	2	2	2	16	70	130/80	2	1	1	1	1	165	13	2	3	2	2	2	3	1	1	1	1	2	2	1	0	1	2	1	1	1	1	25				
60	2	1	2	8	2	2	3	1	0.5	2	1	4				158	64	70	74	0.94	2	2	2	2	2	2	2	18	72	120/70	2	1	1	1	1	170	12.5	2	3	2	2	2	3	1	1	1	1	2	2	1	0	1	2	1	1	1	1	25				
65	1	1	1	2	2	1	5	3								157	54	86	94	0.9	2	2	2	2	2	2	2	18	70	120/80	2	1	1	1	1	159	12.8	2	3	2	2	2	2	1	1	1	2	1	2	2	1	0	1	2	2	2	1	1	1	28.5		
67	1	1	1	1	2	1	5	0								162	63	80	84	0.9	1	1	2	2	2	2	2	18	70	110/70	2	1	1	1	1	169	11	2	3	2	2	1	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	25			
76	2	1	2	8	2	1	3	1	3	1	2	4				156	58	80	82	0.9	2	1	2	2	2	2	2	15	66	120/80	2	1	1	1	1	181	11.8	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	26			
60	1	1	1	1	2	1	5	0								163	65	94	103	0.9	2	2	2	2	2	2	2	18	70	120/80	2	1	1	1	1	172	12.2	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	2	1	1	1	1	27		
63	1	1	1	1	2	2	5	0								164	50	79	89	0.89	1	1	2	2	2	2	2	18	74	120/80	2	1	1	1	1	180	12.8	1	2	2	2	2	0	1	1	1	1	1	2	1	1	0.5	2	0	0.5	1	1	0	16.5			
72	2	1	1	8	2	1	4	2	2	1	1	4				143	35	67	80	0.8	1	1	2	2	2	2	2	18	66	170/100	2	1	1	1	1	150	11	2	2	2	2	2	0	1	0	1	1	2	2	1	0	1	2	1	1	0	0	20				
70	1	1	1	7	3	1	5	2	4	2	1	4				156	60	93	93	1	2	2	2	2	2	2	2	18	70	130/80	2	1	1	1	1	186	12.5	2	3	2	2	2	1	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	25			
71	1	1	4	5	2	2	1	1	1	1	1	4				174	70	74	72	1.08	2	2	2	2	2	2	2	16	72	130/70	2	1	1	1	1	146	13	2	3	2	2	2	3	1	1	1	1	2	2	1	0	1	2	1	1	1	1	25				
70	2	1	2	8	2	2	2	2	2	1	1	4				156	60	68	74	0.8	2	2	2	2	2	2	2	16	68	140/90	2	1	1	1	1	186	12	2	3	2	2	2	3	1	1	1	1	2	2	1	0	1	2	1	1	1	1	24				
60	2	1	2	8	2	2	3	2	2	1	1	4				153	62	68	72	0.82	2	2	2	2	2	2	2	16	68	110/70	2	1																														

















Age	Sex	Religion	Education	Occupation	Marital status	Type of family	Modified B.G.prasad class	past history	duration in years	Type of diet	24hr dietary recall	Habits	duration	frequency	stopped since	Height	Weight	WC	HC	W/H Ratio	Build and nourishment	pallor	icterus	cyanosis	clubbing	lymphadenopathy	pedal edema	others	RR	Pulse	BP	Temperature	CV'S	RS	CNS	P/A	RBS	HB	S1	S2	S3	S4	S5	S6	A1	A2	A3	A4	A5a	A5b	A5c	A5 Total	A6	A7	A8	A9	A10	A11	A12	Main nutrition indicator score																
80	1	1	3	7	3	3	15	1	2	4					168	53	90	85	1.05	1	1	2	2	2	2	2	2	18	66	140/80	2	1	1	1	1	212	11.1	0	1	2	2	1	0	1	0	1	1	1	1	2	2	1	0	0	0	0.5	0	12.5																		
79	1	1	5	6	3	3	5	0	1	1	4				177	67	98	93	1.05	2	2	2	2	2	2	2	2	16	60	140/80	2	1	1	1	1	118	12.8	2	3	2	2	2	3	1	1	1	2	1	1	2	2	1	1	1	1	28.5																				
75	1	1	3	6	2	1	3	2	10	2	2	4			172	67	99	91	1.08	3	2	2	2	2	2	2	2	18	68	150/90	2	1	1	1	1	190	12.7	2	3	2	2	2	1	2	1	1	1	2	2	1	1	1	1	1	1	25.5																				
68	2	1	2	8	2	1	3	2	15	1	2	4			163	60	92	110	0.8	2	1	2	2	2	2	2	2	6	16	70	140/80	2	1	1	1	1	180	12.4	2	3	2	2	2	2	1	1	2	1	1	2	2	1	1	1	1	1	1	26.5																		
62	1	3	4	6	2	1	4	3	10	1	2	4			169	50	95	87	1.09	2	1	2	2	2	2	2	2	18	62	130/80	2	1	1	1	1	115	11.1	1	1	2	2	1	0	1	1	1	1	1	2	2	1	0	1	2	1	0.5	0.5	1	1	17																
72	1	1	3	3	2	1	4	3	3	1	2	4			141	62	63	73	0.8	1	1	2	2	2	2	2	2	18	88	130/90	2	1	1	1	1	102	10.8	2	3	2	2	2	0	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	22															
68	1	1	5	6	2	1	1	0	1	1	4				165	65	86	98	0.8	2	2	2	2	2	2	2	2	16	68	130/90	2	1	1	1	1	150	13.1	2	3	2	2	2	3	1	1	1	1	1	2	2	1	1	2	2	1	1	1	1	1	1	26.5															
69	2	1	3	8	2	1	5	2	4	1	1	4			151	63	99	114	0.8	3	2	2	2	2	2	2	2	18	66	140/90	2	1	1	1	1	88	12.1	2	3	2	2	2	3	1	1	1	2	2	1	1	2	2	1	1	2	2	1	1	1	1	1	1	26.5													
65	1	1	2	6	2	1	5	0	1	2	4				169	65	91	87	1.04	2	2	2	2	2	2	2	2	18	70	150/90	2	1	1	1	1	107	12.7	1	2	2	2	2	2	1	1	1	1	2	2	2	0	1	2	2	1	1	1	1	1	1	1	1	22													
60	2	1	3	8	3	1	5	0	2	2	4				141	35	63	73	0.8	1	1	2	2	2	2	2	2	18	68	130/80	2	1	1	1	1	116	10.8	1	2	2	2	1	0	1	1	1	2	1	2	2	2	0	1	2	1	1	0	0	0	0	0	18														
73	1	1	5	6	2	1	1	2	4	1	1	4			178	88	95	85	1.1	2	1	2	2	2	2	2	2	18	62	150/100	2	1	1	1	1	131	11.5	2	1	2	2	1	3	1	1	1	1	1	2	2	2	0	1	2	1	1	1	1	1	1	1	1	1	23												
72	2	1	1	8	3	3	5	0	2	2	4				152	48	86	98	0.8	2	1	2	2	2	2	2	2	18	66	130/60	2	1	1	1	1	156	11.6	2	2	2	2	1	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	21													
76	2	1	1	8	3	1	5	2	2	2	1	4			148	66	86	98	0.8	3	1	2	2	2	2	2	2	16	60	150/90	2	1	1	1	1	112	11.2	2	2	2	2	1	3	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	23												
76	2	1	3	8	3	3	2	0	2	1	4				171	68	90	103	0.8	1	2	2	2	2	2	2	2	18	68	130/80	2	1	1	1	1	167	12.2	1	1	2	2	1	2	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	20											
68	1	1	1	2	1	5	2	10	1	1	4				169	65	90	87	1.04	1	1	2	2	2	2	2	2	16	66	120/70	2	1	1	1	1	127	12.8	1	2	2	2	2	2	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	22											
66	2	1	3	8	3	1	5	1	1	2	1	4			152	60	80	92	0.8	2	1	2	2	2	2	2	2	18	60	120/70	2	1	1	1	1	120	11.5	1	2	2	2	1	3	1	1	1	1	2	1	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	19											
64	2	1	3	6	2	1	2	10	2	1	4				159	76	93	115	0.8	3	2	2	2	2	2	2	2	18	60	140/90	2	1	1	1	1	124	12.1	2	1	2	2	2	3	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	23											
65	1	1	5	6	2	1	3	0	2	1	4				171	78	92	87	1.01	3	2	2	2	2	2	2	2	16	66	150/90	2	1	1	1	1	156	13	2	3	2	2	2	3	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	25											
63	2	3	5	8	2	1	4	3	8	2	1	4			168	60	90	103	0.8	1	1	2	2	2	2	2	2	18	68	130/60	2	1	1	1	1	188	11.8	1	2	2	2	2	2	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	22										
68	1	1	2	1	2	1	5	2	2	1	2	4			169	65	91	87	1.04	2	2	2	2	2	2	2	2	18	66	120/70	2	1	1	1	1	156	12.9	1	2	2	2	2	2	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	22										
60	1	1	4	3	2	1	4	0	1	1	4				174	75	74	72	1.02	2	2	2	2	2	2	2	2	16	70	130/70	2	1	1	1	1	174	13.2	2	3	2	2	2	3	1	1	1	1	2	1	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	1	26									
64	1	1	3	1	2	1	4	1	2	1	1	4			172	74	72	71	1.01	2	2	2	2	2	2	2	2	15	70	120/80	2	1	1	1	1	196	13.7	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	26								
68	1	1	3	2	2	1	3	4.5	2	2	4				174	58	70	69	1.01	2	2	2	2	2	2	2	2	16	70	110/70	2	1	1	1	1	176	13.1	1	2	2	2	2	2	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	22										
65	2	1	2	8	2	1	4	0	1	2	4				156	52	70	75	0.93	2	2	2	2	2	2	2	2	16	72	130/70	2	1	1	1	1	172	12.4	1	2	2	2	2	2	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	22								
60	1	1	1	2	1	4	0	1	2	1	2	4			162	55	70	69	1.01	2	2	2	2	2	2	2	2	16	70	130/80	2	1	1	1	1	174	13.1	1	1	2	2	2	2	1	1	1	1	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	19					
60	1	1	3	1	2	1	4	0	1	2	4				170	69	70	68	1.02	2	2	2	2	2	2	2	2	18	70	120/80	2	1	1	1	1	173	12.8	2	3	2	2	2	3	1	1	1	1	1	2	1	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25					
64	2	1	2	1	2	1	4	0	1	1	4				158	63	64	69	0.92	2	2	2	2	2	2	2	2	16	70	110/80	2	1	1	1	1	174	12.6	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26			
64	1	1	3	2	2	2	3	1	2	1	1	4			179	74	70	68	1.02	2	2	2	2	2	2	2	2	16	70	120/80	2	1	1	1	1	174	13.3	2	3	2	2	2	3	1	1	1	2	1	2	2	1	0	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
61	2	1	2	8	2	1	3	0	1	1	4				158	65	70	76	0.92	2	1	2	2	2	2	2	2	16	70	130/70	2	1	1	1	1																																									

