ASSESSMENT OF NUTRITIONAL STATUS OF GERIATRIC POPULATION OF SIRSA DISTRICT, HARAYANA AND DEVELOPMENT OF VALUE ADDED FOOD PRODUCTS

By

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CERTIFICATE – I

This is to certify that this thesis entitled**, "Assessment of Nutritional Status of Geriatric Population of Sirsa District, Haryana and Development of Value Added Food Products**", submitted for the degree of **Doctor of Philosophy**, in the subject of **Foods and Nutrition** to the CCS Haryana Agricultural University, is a bonafide research work carried out by **Mamta Rani (Admn. No. 2014HS05D)** under my supervision and that no part of this dissertation has been submitted for any other degree.

The assistance and help received during the course of investigation have been fully acknowledged.

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This is to certify that this thesis entitled, "**Assessment of Nutritional Status of Geriatric Population of Sirsa District, Haryana and Development of Value Added Food Products**", submitted by **Mamta Rani (Admn. No. 2014HS05D)** to the CCS Haryana Agricultural University in partial fulfillment of the requirements for the degree of **Doctor of Philosophy**, in the subject of **Foods and Nutrition**, has been approved by the Student's Advisory Committee after an oral examination of the same in collaboration with an External Examiner.

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CHAPTER -I

INTRODUCTION

Ageing is normal, natural, inevitable, biological and universal phenomenon (Mundey *et al.*, 2011). Ageing is multi-dimentional change involving the physical, psychological as well as social aspects for an individual. Old age is defined as the age of retirement, for it is at the time that the combined effect of ageing, social change and diseases are likely to cause a breakdown in social aspects for an individual. It can be described as a progressive deterioration of the physical and mental functions resulting in decline in both the capacity of body to maintain homeostatic balance as well as the adaptation of the individual of various stressors thereby increasing the chances of morbidity and mortality. Ageing is generally defined as "a process of deterioration in the functional capacity of an individual that results from structural changes, physiological changes and ongoing accumulation of chronic pathological processes and reduced efficiency of the adaptive mechanism to environmental factors with advancement of age". Ageing is a process of biological reality which has its own dynamics largely beyond human control (Singh *et al.*, 2014). Ageing is characterised by progressive, time-dependent loss of function and increased likelihood of death. This loss of function includes widely recognized, relatively rapid processes such as the loss of female fertility following the menopause and much more insidious declines in brain volume and in skeletal muscle mass that can lead to cognitive and physical frailty (Mathers, 2015).

Ageing is pervasive since it is creating humanitarian, social and economic problems in many countries of the world including India. Both the number and proportion of older persons are growing in all countries; the trends are likely to continue unabated. There are changes in social, cultural and traditional family system for elderly in India which have placed significant strain in inhabitants. Ageing of the population is occurring throughout the world, more rapidly in developing countries. In 2015, there were 901 million people aged 60 years and above, comprising 12 per cent of the global population. This group of population is growing at a rate of 3.26 per cent per year. Globally, the number of persons aged 60 and above is expected to more than double by 2050 and more than triple by 2100, increasing from 901 million in 2015 to 2.1 billion in 2050 and 3.2 billion in 2100. Sixty-six per cent of the increase between 2015 and 2050 will occur in Asia (UN, 2015; WHO, 2015). Life expectancy has improved in India with better medical care and improved nutrition. Census 2011 reveals that India has the second largest population of the elderly (60 years and above) in the world (Chandramouli and General, 2011). Studies have shown that more than 50% of older population is underweight and more than 90% has an energy intake below the recommended allowances (SRSS report, 2013).

Some people use their chronological age as a criterion for their own aging whereas others use such physical symptoms as failing eye-sight or hearing, tendency to increase fatigue, decline in sexual potency etc. Still others assess their aging in terms of their capacity for work, their output in relation to standards set in earlier years, their lack of interest in competing with others, lack of motivation to do things or a tendency to reminisce and turn their thoughts to the past rather than dwell on the present or the future (Mayor, 2006)

Average life expectancy throughout the world is increasing year by year to an overall increase of geriatric population. The rapidly growing absolute and relative number of population in both developed and developing countries, means that more people will be entering in the age when the risk of developing certain chronic and debilitating disease is significantly higher. Certain changes take place in an organism with passage of time. Major disabilities among elders are cataract, glaucoma, deafness, osteoporosis, mental disorders etc. the chronic diseases are degenerative changes of heart and blood vessels, cancer accidents, diabetes, diseases of locomotors system, respiratory illness, complaints of genitourinary system, mental changes, sexual adjustment, emotional disorders etc (Park, 2013). Goals of improving the quality of life for all, reducing mortality and morbidity rates and increasing the life span are emphasised in all regions of the world. As such this population is emerging a new and serious challenge for national public health problems and increases burden on society and health care system (Ghani *et al.*, 2013).

The elderly population is diverse in terms of its resources, needs and abilities. As the overall number of elderly increasing, a corresponding rise in numbers of older persons with disabilities is increasing which means dependency in carrying out activities which are essential to independent living, including tasks needed for self-care at home and social role in community. The problems associated with aging of population are that of the absence of the facilities as well as lack of various securities such as lack of social, familial, economical, health and spiritual or emotional securities. Elder should not ensure just their survival rather they must sustain their productivity and enjoy reasonable standard of life. The promotion of healthy lifestyle and prevention of impaired quality of life in the elderly represent a major public health concern (Capuron *et al.*, 2009). Good health is pre-requisite of good "quality of life" and nutrition is the key of good health. Ageing is associated with predictable changes in physiology and function, income, health and psychological well-being with the potential (Mohapatra *et al*., 2009).

The ageing process is very complex and influenced by intrinsic factors such as genes of an individual and extrinsic factors such as environmental and life style, nutrition and exercise. It is estimated that only 25 per cent of what determines length of life is genes and the rest 75 per cent is determined by exogenous factors (Kirkwood, 2008). It is currently thought that the ageing process is much more malleable and could be delayed through

preventing exposure to damage, for example by improving the nutrition which helps in enhancing the body's natural mechanism of protection and repair. Ageing is linked with deterioration in many of the body's physiological functions leading to structural changes, loss of muscle mass and a relative increase in fat mass over time. Stress, poor diet and an adverse environment can accelerate the rate of damage occur. The onset of age related diseases can be delayed as a result of good diet and other life style factors (exercise) and a favourable environment (Kirkwood, 2008).

Nutrition is critical for health and well-being at all stages in life course and, indeed, the nutrition of one generation may influence aging in the next generation. While nutrition has immediate effects on metabolism and health, nutritional exposures can have very long legacies. Good nutrition is beneficial both for maintenance of health and the ability to resist and recover from disease, malnutrition leads to dependency (Ghisla *et al.*, 2007). Nutritional factors have been recently involved in pathways likely to influence mood and well-being. To combat high cost of health care, there has been a growing interest in health promotion and disease prevention and diet and nutrition of elderly, is central component of this. Examination of diet of elderly are important for several reasons:- (i) identification of specific nutrients which may be consumed inadequately by elderly (ii) identification of sub groups which are at risk of low intake of specific group or nutrient (iii) identification of dietary patterns which place the elderly at nutritional risk (iv) understanding relationship between nutrient intake or dietary patterns and disease, disability or mortality (Tucker, 2001). The problem of health of elderly is compounded by poor nutrition together with medical issues, including both communicable and non-communicable diseases.

The interactive mode between food and health is well known and the quality of food available influences the ageing process to a significant extent as good food can minimize the traumic physiological changes that accompany ageing (Potty, 1996). Aging is frequently associated with decrease in taste acuity and smell, deteriorating dental health and decrease in physical activity which may affect nutrient intake. These changes can impact on the nutrient requirements of older people. The more recent focus on dietary pattern offers promise not only in identifying with healthy aging but also in providing the evidence base for the development of public health interventions (Mathers, 2015). Investigating satisfaction with food related life of older people had high significance for several reasons. Firstly, food and energy intake tend to decrease with ageing for a number of physiological and practical reasons including reduced activity, reduced muscle tissue, a lower resting metabolic rate and smaller meals. Secondly, ageing affects the ability to taste and smell. Specially designed foods can provide relief to old age people from the discomfort and inconvenience associated with a reduced capability of physical and biological system viz. ingestion, mastication, digestion, absorption, transport, metabolism, excretion as a result of progressive deterioration

of organ system in old age. In India, the understanding of the health status of the elderly is limited because of paucity of population based representative demographic data. Reluctance to study health status in later life has also been attributed to difficulties surrounding the multiplicity of pathological conditions that exist in old age (Agrawal, 2005). Nutrition and health of elderly is often neglected, most nutritional policies and interventional programmes are directed towards infants, young children, adolescents, pregnant and lactating mothers (Agarwalla *et al*., 2015). The importance and vulnerability of elderly population has been recognized in recent years and there is lack of studies in this field in the region.

Hence keeping all the facts in view, the present study has been planned with the following objectives:-

Objectives

1. To assess the nutritional status and food preferences of geriatrics
2. To develop value added food products for geriatrics and to study their organoleptic acceptability
3. To determine the proximate composition of developed value added food products

CHAPTER -II

REVIEW OF LITERATURE

A systematic and thorough review of literature related to the problem under study provides helpful suggestions towards any investigation. This chapter includes a review of the researches conducted in India as well as abroad. The review has been organized in the following sections:

2.1 Socio-economic profile of geriatric population

2.2 Assessment of nutritional status of geriatric population

2.3 Health problems in elderly people

2.4 Development and organoleptic evaluation of value added food products

2.5 Proximate composition of organoleptically acceptable food products

2.1 Socio-economic profile of geriatric population

Mundey *et al.* (2011) compared the quality of life between rural and urban elderly population of Wardha district, Maharashtra state of India and found out the association between the socio-demographic profile and quality of life of elderly population. The community based cross sectional study was conducted on 800 elderly subjects selected from urban (n= 400) and rural (n= 400) using multistage simple random technique. The WHO-QOL BREF was used to assess the quality of life. The study showed that the elders living in the urban community reported significant lower level of quality of life in the domains of physical 51.2±3.6 and psychological 51.3±2.5 than the rural elderly populations. The rural elderly population reported significant lower quality of life in the domain of social relation 55.9±2.7 and environmental 57.1±3.2 than urban population.

Raj *et al.* (2014) studied the quality of life of elderly people (n=166) living in Varanasi city, U.P. state of India. The mean age of the study population was found to be 63.95 ± 6.08 years. Majority of them were literate (95.18%). Eye sight weakness is the most prominent health problem among the elderly. Majority (61.45%) of elderly had an average quality of life, where as 24.10% and 14.45% elderly had a poor and good quality of life respectively.

A cross-sectional field study on elderly people (n= 242) in Okharpauwa, Nepal was conducted to obtain prevalence of malnutrition by Ghimire *et al.* (2017). A total of 111 males and 131 females, with a mean age of 69.8±7.4 years, participated in this study. Malnutrition was more prevalent among females (29%) as compared to males (18%), and more prevalent among the marginalized Dalit ethnic group (40%). Elderly persons who were married and literate had better nutritional status than their counterparts.

Poor socio-economic status is a main risk factor for malnutrition. Accordingly, among Lebanese community dwelling in rural area, reporting a higher monthly income was

independently associated with a reduced risk of malnutrition (Boulos *et al*., 2014). Inversely, this relation was found neither among the urban community dwellers nor among institutional residents. Furthermore, none of the performed surveys reported a significant association between educational status and malnutrition. As for physical activity, among institutionalized elderly living in GB, doing regular physical exercise was associated with a lower risk of malnutrition. In addition, among community living elderly, both social isolation and perceived loneliness were independently associated with an increased risk of malnutrition (Boulos *et al*., 2014).

Nutritional status and its association with socio-demographic factors, health and functional status of community-dwelling older adults living in the Greater Beirut area was assessed using MNA (Mitri *et al*., 2017). Among the older adults, 2.8% ($p \leq 0.05$) were malnourished, and 45.5% ($p \leq 0.05$) were at risk of malnutrition. Socio-demographic variables were not associated with the nutritional status. Variables significantly associated with poorer nutritional status were: poor perception of general health, more chronic diseases, poor perception of oral health, depressive disorders, higher body mass index and disability.

2.2 Assessment of nutritional status of geriatric population

Nutritional status of 212 older individuals (≥60 years of age) in a cross - sectional study was assessed in desert areas of western Rajasthan (Arlappa *et al*., 2009).The prevalence of Chronic Energy Deficiency (CED = BMI < 18.5) was ≥ 40% in desert areas of India, indicating a "very high" public health problem. It was higher among older women (52%) compared with men (42.4%) and higher in those belonging to Scheduled Caste and Scheduled Tribes and in laborers, artisans, landless individuals, marginal farmers, and below poverty line families. Chronic Energy Deficiency (CED) did not differ (statistically) between the desert and plain areas of Rajasthan. CED prevalence among older adults in desert areas was actually lower ($p<0.001$) than their rural and tribal counterparts. It was concluded that regular nutritional monitoring of older adults in desert and drought prone areas is needed and can help appropriately to target the need for intervention measures.

Peter *et al*. (2011) concluded that the mean carbohydrate intake was significantly below the RDA in non-vegetarian only (female vegetarian 47.8±7.5E%, female non vegetarian 43.3±4.6E%, male vegetarian 48.1±3.4E%, female non-vegetarian 19.5±3.5E%, male non-vegetarian 21.0±2.0E%) and saturated fat intake (female vegetarians: 25.4±8.2g/ day, female non-vegetarians: 32.2±6.9g/day, male vegetarians: 25.4±12.9g/day, male non-vegetarians: 33.4±4.7g/day) were too high in both vegetarian and non- vegetarian. Mean blood concentrations for vitamin B_{12}, folic acid, iron and calcium were normal in all four groups.

A population based cross-sectional survey in two areas of North and South India randomly sampled people aged 60 and over was conducted (Ravindran *et al*., 2011). Vitamin

C status was categorised as deficient (<11 µmol/L), sub-optimal (11–28 µmol/L) and adequate (>28 µmol/L). The age, sex and season standardized prevalence of vitamin C deficiency was 73.9% ($p \leq 0.05$) in North India (n=2668) and 45.7 ($p \leq 0.05$) in South India (n=2970). Only 10.8% in the North and 25.9% in the South met the criteria for adequate levels. Vitamin C deficiency varied by season and was more prevalent in men, with increasing age, users of tobacco and biomass fuels, in those with anthropomatric indicators of poor nutrition and with lower intakes of dietary vitamin C.

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

Kimaya and Sharma (2013) reported that mean intake of pulses ($z=2.07$ $p \leq 0.05$), other vegetables ($z=2.03$ $p \leq 0.05$), fruits ($z=2.04$ $p \leq 0.05$) and fat ($z=2.53$ $p \leq 0.05$) was found to be significantly higher in elderly males of 60-70 years and 70-80 years of Nagpur district, Maharashtra. However, the dietary intake amongst the elderly females of 60-70 years and 70-80 years did not show any differences. The macronutrient intake in the elderly showed a significant negative correlation with age and positive correlation with number of meals consumed.

According to Shankar *et al.* (2014) the significantly ($p \leq 0.05$) higher percentage of individuals ≥ 70 years of age (59.21 per cent) had chronic energy deficiency than those between 60-69 years (45.12%). Only 3.3 per cent of elderly individuals were obese and had BMI >25. Chronic energy deficiency increased significantly ($p \leq 0.05$) with lowering of socio-economic status.

A study was conducted with the objective to describe energy and nutrient intakes, assess nutritional risk and investigate factors associated with poor intake of energy and key nutrients in community-dwelling men aged ≥75 years in Sydney, Australia (Waern *et al*., 2015). A total of 794 men (mean age 81·4 years) had a detailed diet history interview, which was carried out by a dietician. Median energy intake was 8728 kJ, and mean BMI was 27·7 kg/m^2. Men met their nutrient reference values (NRV) for most of nutrients. However, only 1% of men met their NRV for vitamin D, 19 per cent for Ca, 30 per cent for K and 33 per cent for dietary fibre.

A community based cross-sectional study was carried out by the National Nutrition Monitoring Bureau (NNMB), during 2005-06 among the rural population of nine major states

of India (Arlappa *et al.*, 2016). A total of 2138 older adults were covered for dietary assessment. In general, the consumption of all the foods was below recommended daily intakes (RDI), and the in-adequacy (<70% of RDI) of intake was high with respect to leafy vegetables, milk & milk products, fats & oils and sugar & jaggery. Similarly, the in-adequacy of intakes of micronutrients such as vitamin A, iron, riboflavin and free folic acid was high among both genders. The poor intake of diet was reflected in high prevalence of chronic energy deficiency (CED) among the rural elderly in India.

Castaneda-Gameros *et al.* (2018) examined nutrient intake and factors influencing eating behaviors in a sample of 76 migrant older women (≥60 years) living in the UK. Nutrient intake was assessed using a 24-hr recall method by an in-depth probing dietary interview. Median energy intake was significantly lower than the UK RNIs (5,125.4 v. 7,301.1 kJ/d, p<.001). Main nutrients of concern were retinol, vitamin D, magnesium, potassium, copper, selenium, and monounsaturated fatty acids. Although women were knowledgeable about what constitutes a healthy diet, factors such as the presence and awareness of obesity and non communicable diseases, changes in household roles, and dietary restrictions related to religious beliefs were identified key influences on participants' dietary intake. Authors recommended that Strategies need to promote not only a healthy energy balance, but also dietary adequacy to optimize nutrient intake.

Nutritional status of elderly population in the rural areas of Bangladesh was examined by Das *et al.* (2012). Forty four elderly (≥ 60 years) and 88 middle aged (40–59 years) men and women were studied during April-September 2010. Their anthropomatric status, micronutrient status and biochemical markers were assessed. Mean body mass index (BMI), hemoglobin, alanine transaminase (ALT), albumin, vitamin B12, and fasting blood sugar (FBS) were significantly lower and serum creatinine, vitamin D and folate were significantly higher among elderly compared to that of middle aged population. However, uric acid (UA), calcium, zinc, and retinol were identical in both the groups. The age of the respondents had a significant impact on level of hemoglobin (0.67 gm/dl), vitamin B-12 (38.76 pmol/L), albumin (0.12 gm/dL), zinc (0.03 mg/L) and FBS (0.88 μmol/L) after adjusting for covariates. Elderly had compromised nutritional status with lower levels of hemoglobin, FBS, vitamin and micronutrient.

Pai (2011) compared the nutritional status of elderly living at old age homes and in community, in the Mangalore city, Karnataka. Subjects aged over 60 years were included in this study. Nutritional status was evaluated by anthropomatric measurements to calculate the Body Mass Index, W/H ratio, and Triceps skin fold thickness and by data collected through the Mini Nutritional Assessment (MNA). The study subjects were constituted by 108 inmates of old age homes and 102 people who were residing at their houses. The results showed that the elderly at home had higher BMI (p<0.001) and higher MNA scores (p<0.001) compared

to those living in old age homes. The MNA results revealed that 19.4% of subjects were malnourished and 57.4% were at risk of malnutrition among the old age home residents. The prevalence of malnutrition by MNA was 2%, those at risk of malnutrition were 14.7% in free living elderly.

Diet and nutritional status of the tribal elderly (above 60 years) was assessed using data from a cross sectional study carried out by National Nutrition Monitoring Bureau (NNMB) exclusively in villages of 9 provincial States in India during 1998-1999. A total of 1,239 elderly completed the diet survey (24-hour recall) and 3,932 elderly completed anthropometric measurements. In general, the mean consumption of all the foods and the median intakes of all the nutrients were below the Recommended Dietary Intakes (RDI) in both men and women. The mean heights and weights significantly decreased with increase in age in both males and females ($p \leq 0.001$). The prevalence of Chronic Energy Deficiency (CED = BMI $\leq$ 18.5) was relatively higher (65.4%) in females compared with their male counterparts (61.8%). The prevalence of CED was significantly higher ($p \leq 0.001$) among the elderly living in *kutcha* and landless households (Arlappa *et al.*, 2013).

Kimaya and Sharma (2013) assessed the macronutrient intake of the 400 elderly (60-80 years) from Nagpur city, Maharashtra, India. Higher proportions of elderly males (31.5 %) were in the age group of 65-70 years whereas 44% elderly females were from the age group of 60-65 years. Seventy four per cent elderly females and 73 per cent males were found to be consuming 4-5 meals in a day. Ninety two per cent and 91per cent of elderly females and males were consuming meals regularly, respectively. The mean intake of pulses ($z = 2.07$ $p<0.05$), other vegetables ($z = 2.03$ $p<0.05$), fruits ($z = 2.04$ $p<0.05$) and fat ($z = 2.53$ $p<0.05$) was found to be significantly higher in elderly males of 60-70 years than 70-80 years. However, the dietary intake amongst the elderly females of 60-70 years and 70-80 years did not show any significant difference. Except fat intake in elderly females, consumption of all macronutrients was found to be less than Recommended Dietary Allowances.

Nutritional status of 192 individuals of ≥60 years were examined by Kritika *et al.* (2014). The data revealed that out of total 192 elderly (≥60 years) interviewed, 48.4% were males and 51.6% were females. The mean weight (Kg) was 54.65 ± 13.44 (25-94) and mean BMI (Kg/m^2) was 22.30 ± 5.08 (12.57-44.64).According to Mini Nutritional Assessment (MNA) there were 20.83 % malnourished and 43.7 % were at risk of malnutrition and this was positively associated with age ($p – 0.004$) and female gender ($p – 0.0001$). According to MNA-SF (MNA, SH- short form), 17.2 % were malnourished while 45.3% were at risk of malnutrition and followed the same pattern of age and sex as in MNA. BMI analysis showed that 21.8% were malnourished, 15.4% were overweight and 7.4% were obese. Comorbidities were found to be more in malnourished group as compared to the well-nourished

Kansal *et al.* (2015) assessed the nutritional status of elderly living in Butramatti village, Vantamuri, Karnatka, India. Out of the total 190 participants, 85 (44.70%) were having BMI less than 19, 28 (14.70%) were having BMI 19 to less than 21, 11 (5.80%) were having BMI 21 to less than 23, and 66 (34.70%) were having BMI 23 or greater. And out of 190 participants, 31 (43.7%) males and 52 (43.3%) females were at risk of malnutrition. Eighteen (25.4%) males and 25 (21%) females were suffering from malnutrition and only 22 (31%) males and 42 (35.3%) females were well nourished. However, the association of gender and nutritional status of elderly was not found to be statistically significant (p = 0.735).

Nutritional status and associated risk factors in elderly nursing home residents in Tehran, Iran were studied. The cross-sectional study was carried out among 385 elderly people aged 60 years or elder in 2014. All subjects who were attending daily care centres for elderly people entered the study voluntarily. Of participants, 13.25% were malnourished according to MNA, 60% were at risk for malnutrition, and 26.75% were well fed. In other words, 73.25% of elderly people were at risk of or suffering from Malnutrition. Nutritional status of the elderly based on MNA, was significantly associated with history of acute illness or stress, recent mobility problems, nervous mental depression, personal views about nutrition and health status (Khalesi *et al.*, 2015).

Prevalence and correlates of malnutrition among elderly aged 60 years and above in an urban area in Coimbatore, Tamilnadu were estimated using Mini Nutritional Assessment (MNA) on 154 households and 190 elderly (Mathew *et al.*, 2017). Mean SD (standard deviation) age of the total population (n = 190) was 71.09 (87.93%) years and 30 per cent was male. In this population, 37 (19.47%) was malnourished (MNA <17.0) and 47 (24.73%) were at risk for malnutrition (MNA 17.0–23.5). The prevalence of malnutrition observed in the aged people is unacceptably high. The increasing total number of lifestyle, somatic, functional, and social factors was associated with lower MNA scores. The findings of the present study clearly indicated that malnutrition is a multifactorial condition associated with socio-demographic, somatic, and functional status.

Dietary habits, clinical signs and symptoms and existing ailments of elderly people (n=150) aged >60 years of rural areas of Bulandshahar, Utter Pradesh were studied (Tripathi *et al.*, 2017). Results indicated that 85.33 % males and 89% females consumed milk and milk products daily. Water intake among 45.33% females and 29.33% males was 6-10 glasses and 11-15 glasses/day respectively. Consumption of fat was 50% surplus in males and 37.03% in females. The intake of other nutrients like carbohydrates, protein, calcium, vitamin C and iron was lower among female who were having moderate work load. Total calorie intake was found to be deficit in elderly respondents leading sedentary lifestyle.

Orange *et al.* (2018) compared malnutrition among elderly people with and without cardiovascular diseases on 64 healthy elder subjects (as a control group) and 64 elderly patients with CVDs (as a case group) in Shiraz, Iran. Malnutrition distribution was significantly different between two groups based on MNA score (P<0.001) and 48 (75%) of healthy elderly participants and 18 (28.1%) of patients weren't malnourished. Risk of malnutrition was 54.7% and 25% in unhealthy and healthy groups respectively. Only 11 (17.2%) of elderly patients with CVDs were malnourished. It was observed that avoidance of food in the disease is the cause of higher malnutrition rate among respondents.

Pattern of calorie deficiency among elderly people (n=17079) in rural village of Puducherry were reported by Prasad *et al.* (2015). There were equal number of men and women. Sixty percent of the subjects were aged between 60-70 years and 7% were aged more than 80 years. Caloric deficit was more in females and 35% of them were either overweight or obese according to BMI. There were no serious micro nutrient deficiency in individuals but more than 35% are already obese/ overweight and 50% are suffering from age related problems.

Goswami *et al.* (2016) assessed the nutritional status of elderly persons (n=711) aged ≥60 years residing in an urban resettlement colony of Delhi. About half (53.2%) had normal nutritional status, 20.8% were underweight and 19.4% were overweight and 6.6% were obese. Under-nutrition was significantly associated with gender, while overweight/obesity was found to be significantly associated with age (p<0.001), gender (p<0.001), occupation (p<0.001) and economic dependency (p< 0.001). Dual burden of malnutrition was seen, so there is a need to promote healthy eating and lifestyle to address both spectrum of malnutrition.

2.3 Health problems among geriatric respondents

Joshi *et al*. (2003) selected 200 subjects over 60 years old (100 each from the urban population of Chandigarh City and 100 from the rural population of Haryana State of India) to study the pattern of morbidity and patterns of treatment seeking. Data revealed that 88.9% reported illness based on their perception, and of these 43.5% were seeking treatment and actually taking medicines, and 42.5% were diagnosed as having 4–6 morbidities. The mean number of morbidities among elderly people was 6.1 (SD 2.9). A total of 87.5% had minimal to severe disabilities and 66% of elderly people were distressed physically, psychologically, or both. The most prevalent morbidity was anaemia, followed by dental problems, hypertension, chronic obstructive airway disease (COAD), cataract, and osteoarthritis. Morbidities like asthma, COAD, hypertension, osteoarthritis, gastrointestinal disorders, anaemia, and eye and neurological problems were significantly (p<0.01) associated with disability and distress. Morbidity was significantly associated with age (b value 0.06, 95% CI: 0.01, 0.12), sex (b value 1.03, 95% CI: 0.02, 2.05), and occupation (b value 0.20, 95% CI: 0.07, 0.33).

Kashyap and Sharma (2008) studied the health profile of geriatric population aged 60- 80 years or more. The present study was conducted in two regions of Uttarakhand State i.e. Kumaon Haldwani block and Garhwal thus making total sample size of sixty elderly (26 male and 34 female). The females had better smell and hearing capacity than males, but general health status of males was better than females. Majority of them suffered from hypertension, osteoporosis, heart disease, asthma, and few had diabetes mellitus and cancer. Some of the diseases and conditions found in this study could easily be identified and treated in the present health system through a health care programmes.

Life style and morbidity profile of elderly population (n=692) aged above 65 years in Kashmir valley was studied by Parry *et al.* (2008). Among 692 elderly registered in the study, 321 were males and 371were females. A large number of the subjects (89%) were suffering from at least one health related problem. Morbidity among rural subjects was observed to be less as compared to urban subjects. Females had higher rate of morbidity. Common prevalent symptoms were pain/ swelling of joints (36.5%), backache (20.2%), indigestion/ heartburn (17.7%), headache (17.4%) and excessive tiredness (7.21%).

Kamble *et al.* (2012) examined the health status and morbidity pattern among the rural elderly. Twenty per cent of all elderly persons from all the villages in selected PHC by systematic random sampling which formed the study sample (494).All these peoples were examined clinically and necessary information was collected from them. Commonest morbidity observed among the elderly people was depression (31.4 %) followed by musculoskeletal disorder (25.5 %), hypertension (24.1 %), gastrointestinal problems (11.5 %), diabetes mellitus (5.9 %) and neurological problems (4.7 %). This study has highlighted that the elderly suffers from multiple morbidities, which they often attribute to ageing.

Mental health status of the elderly persons in rural area of Nasik district, Maharashtra was studied by Kamble *et al.* (2012). Twenty per cent of all elderly persons (60 years and above) from all the villages in one selected PHC were included by systematic random sampling method (Total 494). Poor mental health status was observed in41.3 % elderly persons. Female sex, illiteracy, low socioeconomic status, widowhood, lack of hobby, physical dependence and lack of family care and affection are the factors associated with poor mental health status of elderly persons. This study has revealed that geriatric psychiatry is important public health problem in India and requires immediate solutions

Katta *et al.* (2013) studied the morbidity pattern and nutritional status of 1484 elderly (>60 years) population in rural Kancheepuram district, Tamilnadu, India. The information about the demographic profile, clinical diagnosis and anthropomatric measurements were collected. Three fifth of the elderly were females and majority (40.05%) belonged to 60-64 years age group. Morbidities associated with musculoskeletal system (38.8%) were reported predominantly such as arthritis, lumbar pain etc. Numbers of patients reported with

communicable diseases were found to be low (1.7%). Similarly morbidities associated with ENT and other systems were also found to be low. Nearly one fifth respondents were found to be obese. Overweight and obesity were reported more among females and nearly three fourth of the males were below or equal to normal BMI. Increasing age is associated with decline in prevalence of obesity and increase in prevalence of underweight. From this study, it was found that the burden of chronic diseases was high among the elderly.

Morbidity, co-morbidity, and treatment-seeking behaviour of the elderly in urban population of Jamnagar, Gujrat were observed by Mahesh *et al.* (2013). Majority of the elderly were in the age group of 71-75 years of age (28%) followed by 60-65 years of age (21%) and males constituted 57 per cent of the respondents. Most common geriatric problems reported by the study population were visual problems (65%), hypertension (40%), dental problems (34%), diabetes (26%), joint complain (26%) and hearing problems (22%). Treatment seeking behaviour was more prevalent for hypertension (90%) and diabetes (92%) as compared to others health related medical problems.

Qadri *et al.* (2013) determined the pattern of physical morbidity in rural elderly population and studied health related quality of life and utilization of health services among them. An overwhelming majority (68.2%) of elderly enjoyed a good quality of life, while those having a fair/poor quality of life were ≤ 15%. Quality of life was better in males in physical, psychological, social and environmental domains. It was more in subjects who were graduated and living with spouse, belonged to non-scheduled cast and living in extended families ($p<0.001$). Majority of the subjects were anaemic (64.5%), suffering from dental problems (62.2%) and joint pains (51.4%). Maximum numbers of subjects (92.7%) were utilizing non-government health care facility due to long distance from their houses.

Gupta *et al.* (2014) examined 382 elderly, out of these elderly, 46.85% was males and rests were female. Nearly 75% elderly were having one or more morbidities (77.33% among women and 71.51% among men). Average number of morbidities per elderly was 2.25 (score). The mean disability score (MDS)of study population was found to be (31.48 + 3.7), females were having higher MDS (28.6 + 3.5) than males (34.01 + 4.1) which was found statistically significant. MDS among elderly having none, 1-2, 3-4 and >4 morbidities was 24.76 ± 3.5, 29.15 ± 4.2, 33.41 ± 4.3 and 42.05± 5.8 respectively.

A cross-sectional study was carried out in two villages of Kalo Majra block, district Patiala, Punjab. Majority of participants (51.9%) belonged to the age group of 60- 64 years. In the present study 30.5% were males and 69.5% were females and showed a high percentage (63.1%) of illiteracy. About 86.9% of the elderly were found to be suffering from anemia. BMI was found to be higher in women than men i.e. 21.3 ± 1.94 and 19.3± 5.5, respectively (Kalia *et al.*, 2014).

Mahesh (2014) studied the health status of elderly in Vimala Terminial, Mysore. Out of 30 respondents, 47per cent were between the age group of 65-70 years, 27 per cent were between the age group of 75-80 years and rest 23per cent were between the age group of 60-65 years. Fifty one per cent of them are getting monthly pension. Remaining 49 per cent respondents doesn't have any form of source of income which shows their economic dependence. Most of the respondents 43 per cent are destitute and 57 per cent are physically disabled respectively. More than half (53%) of the respondents were suffering from various physical ailment such as blood pressure (27%), Diabetes (17%), blindness (10%) and remaining respondents (47%) are suffering from joint pain. Most of the respondents were suffering from visual problems and pain in joints is more prevalent among the female respondents.

Singh and Singh (2014) assessed the burden of various health problems and gender wise differences in 290 rural elderly subjects residing in Varanasi district of eastern Uttar Pradesh. Age related health problems were observed in both the genders. One third elderly suffered with cough and cold, 66.20 % elderly had the problem of vision and 63.10% had joint pain. More than half (54.10%) had the problems of forgetting/ dementia. Maximum study subjects had the problems of co-morbidities.

Dietary habits, clinical signs and symptoms and existing ailments of the selected elderly people of rural areas of Allahabad were studied by Khushboo *et al.* (2015). Two villages from Chaka block namely Dabhaon and Bagbana, of Allahabad district was purposively selected for the study. A sample of 150 respondents out of which 75 male and 75 female aged 60 years and above were selected. The pretested schedule was used to collect the data regarding the socio-demographic profile, anthropomatric measurements, food habits, dietary pattern and clinical sign and symptoms of the respondents Height (cm) and weight (kg) were measured with the help of weighing machine and measuring tape. Digital heart rate monitor was used to measure the Blood Pressure. Among most of the respondents the daily nutrient intake of calorie, fat, protein, carbohydrate, calcium, vitamin C and iron were less than RDA. It was concluded that mostly respondents were mildly underweight (47.33 %) followed by moderately underweight (28.67%), severely underweight (16.67%) whereas 7.33 percent respondents were normal and only 4.00 per cent were pre-obese in rural areas of Allahabad. Smoking, alcohol consumption, and excessive use of medication were mainly cause of malnutrition in males.

Bartwal *et al.* (2016) studied 440 elderly aged 60 years and above in rural areas of Haldwani was done over a period of one year. Most (59.54%) of the elderly belongs to 60-69 years of age, females (57.5%) outnumbered males. Majority of the aged were living in joint families (92.5%), illiterate (60%), not working (78.64%) and belonging to class III socio-economic status (59.09%). Overall, 51.36per cent of the elderly were non vegetarian. The

difference in dietary habits of male and female elderly was found statistically significant ($\chi 2=21.4$, $p=0.001$). The difference in BMI of elderly males and females were found statistically significant ($\chi 2=10.0$, $p=0.019$). BMI decreases with increase in age and this was found statistically significant ($\chi 2=13.6$, $p=0.034$).

Prevalence of under-nutrition and its associated factors among elderly, in rural Puducherry, south India was determined by Kalaiselvi *et al.* (2016). Of total 296 elderly in the study setting, 271 (92%) participated in the study. The prevalence of under nutrition among the elderly was 24.8% (95% CI: 19.7–30.3). More than half of the elderly (58.7%) perceived their nutritional status as poor; of them 28.9% were actually under-nourished. Mean (SD) BMI scores were higher for elderly women compared to that of men [elderly women vs men: 22 (4.6) kg/m2 vs 21 (3.8) kg/m2, p = 0.03]. In multivariate analysis, being an elderly male, age more than 70 years and per capita income less than 1000 INR were found to be significantly associated with under-nutrition.

Kaur *et al.* (2016) studied that Quality of Life (QoL) of elderly women (n=157), particularly in border areas, of Punjab near India- Pakistan border line for understanding and improving their quality of life. The mean age of respondents was 68 year with mean household size 8.6 belonging to mostly farming (46%) and labourers (45%) families. A very high proportion of these women suffered from weak eyesight, joint pain, hypertension and headache. Quality of Life scores do not differ much for family occupations (agriculture and labour) as agricultural holdings are very small.

Health and social problems of 213 elderly patients (60 years old and above) who attended the outreach clinics in Manglore district, Karnatka India, were studied by Lena *et al.* (2017). Around 73% of the patients belonged to the age group of 60-69 years old. Nearly half of the respondents were illiterate. Around 48% felt they were not happy in life. A majority of them had health problems such as hypertension followed by arthritis, diabetes, asthma, cataract, and anemia. About 68% of the patients were of opinion that the attitude of people towards the elderly was that of neglect

This community based cross sectional study was carried out by Leyanna *et al.* (2017) in six rural villages of Raichur District, Karnataka, India of which 230 elderly were selected randomly. The prevalence of morbidity was 91.7% with an average of 3/person. Females (58.9%) had more morbidities than males (41.1%). The 3 most common morbidities were orthopedic (50.5%), cataract (50.4%), and respiratory infections (31.3%). The 26.6% suffered from gastrointestinal morbidities while 23.9% had dental problems. The prevalence of hypertension was observed almost same (20.9%) in both females and males. About 17.4% were diabetics with majority being women. The prevalence of central nervous system morbidities were 14.2% while 9.6% suffered from hearing loss and varicose veins. 8.2% had genitourinary urinary morbidities and urinary incontinence (1.7%) was common among both

females and males. Depression (71.1%) and dermatological morbidities (4.7%) were prevalent among women. Only 3.5% suffered from cardiac morbidity and 0.4% from cancer. Significant ($p<0.01$) association was found between age and morbidity and also between socioeconomic class and morbidity pattern.

2.5 Development and Sensory Evaluation Value Added of Food Products

Organoleptic (sensory) evaluation is the basic and confirmatory test of food product and assesses the acceptability of food product from consumer's view point.

Organoleptic acceptability and effect of processing on proximate composition of *Laddoo* prepared from chickpea and field pea flour was studied and it was found that *Laddoo* was found organoleptically acceptable. A non-significant difference was observed in crude protein, fat, ash and crude fiber content, while significant differences in total carbohydrate and moisture contents of *Laddoo* were noticed (Gupta, 2003).

Rajbala (2010) prepared various value added products like *laddoo, burfi, matthi, chapati, halwa* from pearl millet flour, green gram flour/ bengal gram flour, gingelly seed, groundnut, carrot / spinach / papaya / pumpkin powder and found to be acceptable in their colour, texture, taste, appearance and overall acceptability. Rajbala (2010) prepared various value added products like *chapati, halwa* from pearl millet flour, green gram flour/ bengal gram flour, gingelly seeds which were found to be acceptable in their color, texture, taste, appearance and overall acceptability. Johari (2013) prepared *Dalia, Parantha, Khichari, chapati and upma* in with varying ratios of pearl millet and rice along with addition of amaranthus grains and all the products were organoleptically acceptable.

Dalia, Parantha, Khichari, roti and upma prepared in varying ratios of Maize and rice along with addition of amaranthus grains by Kataria (2014) and all the products were organoleptically acceptable.

2.5 Proximate composition of organolepticaly acceptable food products

Hooda and Jood (2005) reported that biscuits prepared from the blends containing different proportions (0, 5, 10, 15 and 20%) of raw, soaked and germinated fenugreek seed flour were evaluate for nutritional characteristics. Addition of raw, soaked and germinated fenugreek flour to wheat flour increased the contents of protein (10.5, 10.4 and 11.0%), lysine (2.15, 2.20 and 2.25 g/100g protein), dietary fibre (12.7, 11.3 and 10.9%), total calcium (58.3, 57.1 and 57.7 mg/100g) and total iron 7.40, 7.26 ad 7.36 mg/100g), respectively, at 10 per cent level of substitution.

Mundra *et al.* (2010) also reported that protein, crude fibre, amylose and total dietary fibre contents had been increased remarkably from 12.48 to 16.32 per cent, 0.20 to 1.31 per cent, 19.46 to 26.19 per cent, 10.10 to 22.05 per cent, respectively, in case of the designed *chapatti* containing bengal gram and herb mix when compared to dicoccum wheat *chapatti*.

Nicole *et al.* (2010) studied the characterization of ready-to-eat composite porridge flours made by soy-maize-sorghum-wheat extrusion cooking process. Two composite flours were formulated sorghum-maize-soy I (SMS1) and sorghum-maize-soy II (SMS2). SMS II had higher content ($p<0.05$) of zinc, magnesium and phosphorus than SMS I. SMS I and SMS II had protein content of 23.87 and 17.95 per cent weight, respectively, with energy value of 1694.89 and 1 540.88 Kilojoule/100g, respectively while *In vitro* protein digestibility was found at 72.32 and 68.85 per cent weight, respectively.

Mamata *et al.* (2012) reported dietary fibre content of green gram seed coat incorporated *chapatti* to be 19-24 g/100g and whole wheat flour *chapatti* contained 12.5 g/100g of total dietary fibre. High fibre *chapatti* provided 14-15 g protein, 2 g fat, 6 mg iron and 109-148 mg calcium per 100 g.

Development and evaluation of composite flour for *missi roti* / *chapati* was carried out by Kadam *et al.* (2012). Four types of blends in different ratio viz; 'A' wheat flour: chickpea flour (80:20). 'B' wheat flour: full fat soy flour (90:10) 'C' wheat flour: chickpea flour: soy flour (80:10:10) and 'D' wheat flour: chickpea flour: soy flour*: methi* leaves powder (75: 10: 10: 05). They contained proteins (11.8 to 15.37%), fat (1.53 to 3.45%), fibre (1.24 to 2.05%), ash (2.08 to 2.70%) and carbohydrates (65.99 to 74.2%). All these blended flours were found to have good sensory quality characteristics of products as control.

Eneche (2007) developed biscuits using millet flour and pigeon pea meal in different proportions and found that all the blended biscuits were acceptable but biscuits prepared using millet flour and pigeon pea flour in ratio 65:35 were most acceptable in terms of flavour, texture and overall acceptability.

Anu *et al.* (2003) analyzed four type of sweet and salty biscuits prepared from blanched pearl millet flour, refined wheat flour and green gram flour type-I (40% BPMF + 50% RWF + 10% GGF), type-II (60% BPMF (blanched pearl millet flour) + 30% RWF(refined wheat flour) + 10% GGF(green gram flour)), type-III (80% BPMF + 10% RWF + 10% GGF) and type-IV (100% BPMF). Results showed that type-I and type-II were 'liked very much'.

Banakar *et al*. (2005) developed supplementary foods using roasted or malted sorghum, finger millet, green gram and roasted rice, soybean and peanuts. To enhance the micro-nutrients powdered amaranth leaves were added. When analysed for nutritional quality, roasted food contained significantly higher amount of protein (16.88%), fat (4.27%) and ash (2.97%) compared to malted (15.96, 3.89 and 2.86%, respectively) while, malted food contained significantly higher amounts of moisture (5.93%), crude fibre (2.52%) and total carbohydrates (68.84%) compared to that of roasted (5.89, 2.43 and 67.56%, respectively).The energy value of roasted and malted foods was 376 and 374 Kcal, respectively. Every 100 gram of malted mix had comparatively higher amounts of calcium

(430.50 mg), iron (11.18mg), zinc (4.5mg) and copper (3.48 mg) than roasted (4.27, 10.97, 4.28 and 3.39mg, respectively).

Various value added products, i.e. *khichri, halwa, dhokla* etc. using green gram and reported that all the products were organoleptically acceptable. Moisture, crude protein, fat, ash and crude fiber content of *halwa* were 50.16, 24.50, 36.10, 3.43, 1.33 per cent, respectively (Grewal, 2003). Organoleptic acceptability and effect of processing on proximate composition of *laddoo* prepared from chickpea and field pea flour was studied and it was found that *laddoo* was found organoleptically acceptable. A non-significant difference was observed in crude protein, fat, ash and crude fiber content, while significant differences in total carbohydrate and moisture contents of *laddoo* were noticed (Gupta, 2003).

Germinated brown rice *porridge* was developed by Adenike *et al.* (2008) and compared with white rice porridge; germinated rice porridge had higher ash content 0.86g/100g, 8.03g/100g crude fiber, 1.74g/100g protein, 0.17g/100g fat compared to 0.81g/100g ash, 4.84 g/100g crude fiber, 0.04g/100g fat in white rice porridge. Higher ash content in germinated brown rice porridge is correlated with higher content of calcium, and other minerals in germinated brown rice porridge.

CHAPTER -III

MATERIALS AND METHODS

This chapter deals with the procedure adopted for conducting the present investigation. The detailed outlines of the methodological plan followed are under the following heads and sub-heads:

3.1 Locale of the study

3.2 Sampling procedure

3.3 Variables and their measurement

3.3.1 Independent variables

3.3.2 Dependent variables

3.4 Assessment of Nutritional status

3.4.1 Dietary Survey

3.4.2 Anthropometric Measurements

3.5 Construction of questionnaire-cum-interview schedule and Collection of data

3.6 Development of value added food products

3.7 Sensory evaluation of value added food products

3.8 Proximate composition of orgenoleptically acceptable food products

3.9 Statistical analysis of the data

3.1 Locale of the study

The research was carried out in rural and urban area of Sirsa district of Haryana state.

3.2 Sampling procedure

3.2.1 Selection of the villages

Haryana state consists of 22 districts. Out of these districts, Sirsa district was selected purposively. Sirsa town is district headquarter. The two blocks i.e. Sirsa rural and Sirsa urban in Sirsa district, were selected purposively. Out of these, four villages viz. Darbi, Moriwala, Rasulpur and Sikanderpur from Sirsa Rural block and Farm Colony, Hari Vishnu Colony Khairpur, MC Colony and Shah Satnam Colony area from Sirsa urban block were selected randomly.

3.2.2 Selection of the Respondents

The present study was conducted on geriatric population in the age group of above 60 years. Three hundred elderly respondents (above 60 years) were selected randomly from Sirsa district. To draw a sample of both urban and rural areas, 150 respondents from urban and 150 respondents from rural area were selected.

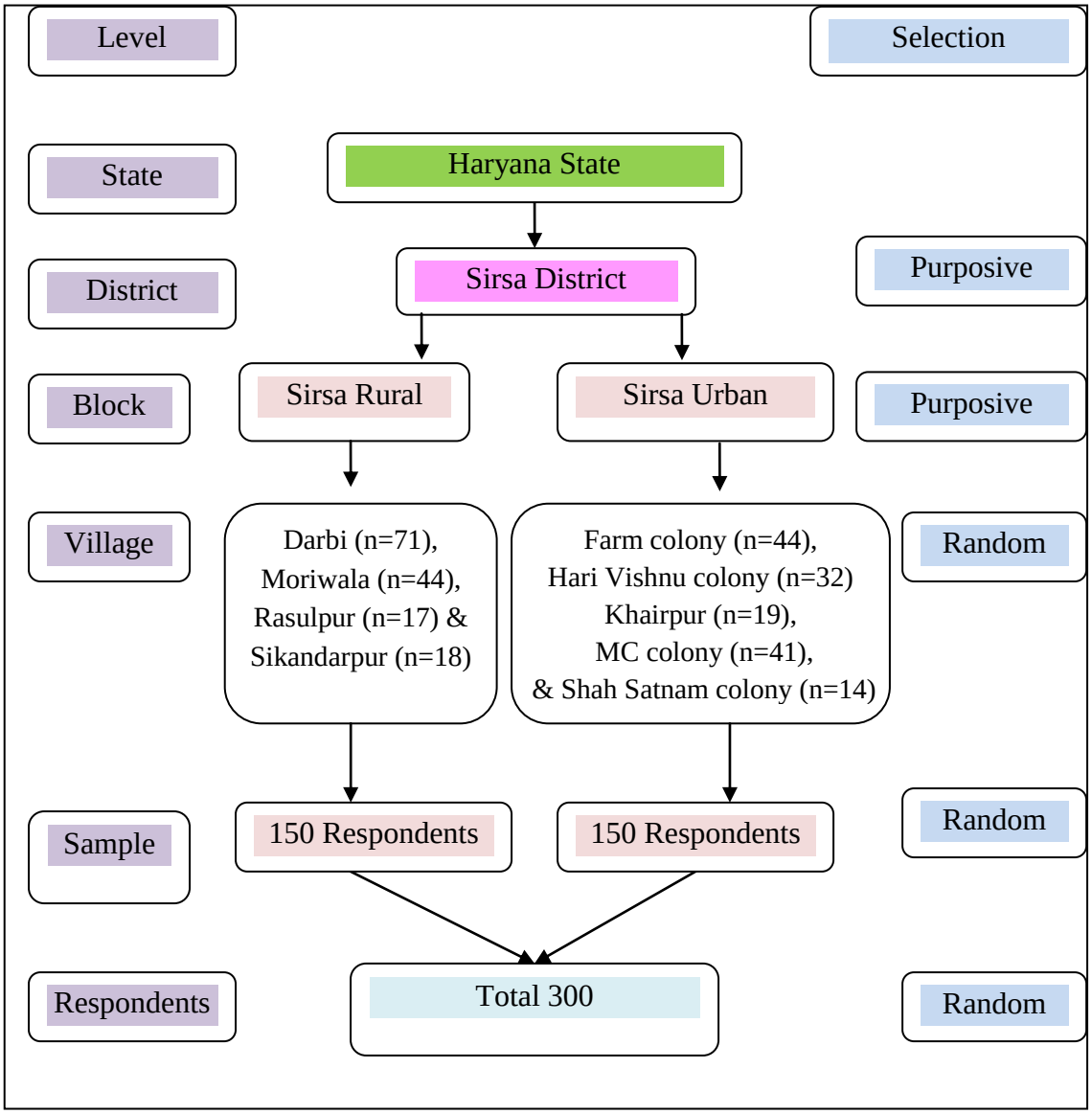

Fig. 3.1: Sampling procedure

3.3 Variables and their measurements

A variable is a set of value that forms a classification. A value is anything which can be predicted. Considering ability of the variables in accordance with the objectives of the study, a series of independent and dependent variables were included for the present investigation.

3.3.1 Independent variables

The age, sex, size of family, type of family, education of respondents, education of respondent's spouse, respondent's occupation, land holdings, monthly income of the family, daily activity, number of milch animals, recreational activity, knowledge of respondent about daily diet were measured as the independent variables.

Age- Age was measured as the chronological age of the respondents at the time of interview. Respondents above 60 years were selected.

Age	Code
61-70 years	1
71-80 years	2
81-90 years	3

Sex- Respondents were categorized into two groups. Codes given to different groups were as follows:

Category	Code
Male	1
Female	2

Type of Family- Type of family refers, whether the family is nuclear or joint. A nuclear family is composed of only one married couple and their off springs, while a joint family refers to one which is constituted by two or more brother's families. Extended family means nuclear family and parents living together (Trivedi's modified scale 1963). It is the family where socialization of every member takes place. Type of family determines the nature and extent to which an individual can take decision on his/ her own and can act as a major decision maker regarding household activities. Following codes were assigned:

Category	Code
Nuclear	1
Joint	2

Size of family- It indicates the total number of members in the respondent's family at the time of data collection. The assumption is that larger the family size, higher will be the pressure on the resources supply which in turn will create demands for resources in larger proportions and also for alternate sources. Trivedi's modified scale (1963) was used to quantify the size of the family. Codes given to different categories were as follows:

Category	Code
Small (upto 4 members)	1
Medium (5-8 members)	2
Large (9 members & above)	3

Type of House- This refers to the type of house in which the respondent lives, the codes assigned to each category were as follows:

Category	Code
Kachcha	1
Partial pucca	2
Pucca	3

Type of Living Arrangement- This refers to the type of living arrangement viz. living alone or within family in which the respondent lives, the codes assigned to each category were as follows:

Category	Code
Living alone	1
Living with Family	2

Educational status of Respondents- Education helps to create a favourable mental atmosphere for acceptance of new practices as it helps an individual in his/ her thinking process. Education was operationalised as the number of years of formal education obtained by selected respondents. Scores assigned were as follows:

Category	Code
Illiterate	1
Can read and write	2
Primary	3
Middle	4
High school	5
Senior Secondary	6
Graduate	7
Post Graduate	8

Educational status of Respondent's Spouse - Education was operationalised as the number of years of formal education obtained by selected respondent's spouse. Scores assigned were as follows:

Category	Code
Illiterate	1
Can read and write	2
Primary	3
Middle	4
High school	5
Senior Secondary	6
Graduate	7
Post Graduate	8

Occupation of Respondent- The source from which family derives maximum income was used as the main occupation of the family. Occupation means a specific work, which a person does to earn livelihood. Using these criteria, the occupation was classified and scores assigned were as follows:

Occupation	Code
Labourer	1
Caste occupation	2
Business	3
Agriculture	4
Ex-Service	5
None	6

Land holding- Land holding refers to land possessed and operated by the respondent.

Category	Code
Landless (Nil)	1
<2.5	2
5-10	3
>10	4

Family income- The total income of the family in a month from all the available resources was taken into consideration and different categories were made. The total income of families was divided into five categories as given under:

Category (Rs./month)	Code
Upto Rs. 12000	1
Rs. 12001-24000	2
Rs. 24001 -36000	3
Rs. 36001- 48000	4
Rs. 48001- 60000	5

Milch Animals – Milch animals also called 'Milk yielding animals'. The milch animals are kept for the production of milk, consist of cows and buffaloes. The total number of milch animals was divided into four categories as given under:

Category (no. of animals)	Code
Nil	1
1-2	2
2-4	3
4 & above	4

Time spent on daily activities – Activities of daily living are routine activities people do every day with or without assistance. These are household work, animal husbandry, agricultural work, occupational work and other activities. The performance of these activities determines the health status, level of physical fitness and care he/she requires with ageing. Following scores were assigned:

Time (no. of hours)	Code
<1 Hrs.	1
1-2 Hrs.	2
2-4 Hrs.	3
4-6 Hrs.	4
6-8 Hrs.	5

Recreational activity- The 'Need to do something for recreation' is an essential element of human biology and psychology. Recreation is an activity of leisure, often done for enjoyment, amusement or pleasure. While one perception is that leisure is just 'spare time' which is not consumed by the necessities of living. The total time devoted to recreational activities was divided into five categories as given under:

Time (Minutes)	Code
Nil	1
1-20 Min	2
20-40 Min	3
40-60 Min	4
60 & above Min	5

3.3.2 Dependent variables

The dependent variables of the present study included nutritional status in terms of various parameters like dietary assessment and anthropometry assessment.

3.4 Nutritional Status assessment:

Nutritional status may be defined as the condition of health as influenced by the intake and utilization of nutrients (Caleindo, 1979). Methods used in assessment of nutritional status were dietary assessment and anthropometry assessment.

3.4.1 Dietary Survey

Questionnaire-cum- interview schedule was used to study the food consumption pattern. The questionnaire was pre-tested and modified to make it more functional. Food intake of elderly respondents (above 60 years) was assessed. Each respondent was asked about different foods he/she is eating on daily, alternate day, weekly, fortnightly and rarely basis in the diet. Dietary intake of 300 respondents was recorded using 24 hours recall method for three consecutive days. Food groups included were cereals, pulses, fruits, green leafy vegetables, roots and tubers, other vegetables, milk & milk products, sugar and jaggery and fats and oils. Standard measures including spoons, bowls, glasses and cups were shown to respondents so as to help them in telling the amount of food consumed by them. Food intake was recorded in terms of standard sized utensils and weight of *chapaties*, *paranthas*, vegetables, fruits etc. was taken. Information collected from respondents about the

consistency of cooked vegetables and pulses, the raw ingredients used and methods of cooking used by them for cooking a particular food. All this was done to get more accuracy in the calculations. Food consumed was converted into their raw equivalents. Mean food intake was calculated by taking mean of three days intake and compared with Dietary Guidelines for Indians, NIN (2010).

The per cent of Recommended Dietary Allowances for each food stuff was calculated using the formula:

$$\text{RDI \%} = \frac{\text{Intake of food stuff}}{\text{RDI}} \times 100$$

Food adequacy ratio

The mean daily food intake of the respondents was compared with the Dietary Guidelines for Indians, NIN (2010). The Food Adequacy Ratio (FAR) was calculated by using given formula:

$$\text{Food adequacy ratio (FAR)} = \frac{\text{Food Intake}}{\text{Food Requirements}} \times 100$$

Nutrient adequacy ratio

Nutrient intake was calculated from 24 hour dietary recall data for three consecutive days using Dietcal software (Gurdeep Kaur, 2017). Protein, fat, energy, iron, calcium, thiamine, riboflavin, niacin, Vitamin B_{12}, folic acid, Vitamin C and β-carotene intake was calculated. Average daily nutrient intake was compared with the Dietary Guidelines for Indians, NIN (2010). Nutrient Adequacy Ratio (NAR) was calculated by using given formula:

$$\text{Nutrient adequacy ratio (NAR)} = \frac{\text{Nutrient intake}}{\text{Nutrients Requirements}} \times 100$$

For the purpose of present study the adequacy of food and nutrient intakes of the respondents were categorized as categories framed by Sangwan, 1997 follows:

Recommended level (%RDI/RDA)	**Category**
100% and above	I (Adequate)
75-99.9%	II (Marginally adequate)
50-74.9%	III (Marginally inadequate)
Below 50%	IV(Inadequate)

Recommended Dietary Allowance for elderly people:

Energy: Energy requirements decline with increasing age but it is essential that the nutrient density of the diet remains the same. An energy intake reduced to less than the energy needs of the older person can result in poor nutritional status. Every person has specific energy requirements according to their body weight.

Energy requirements of elderly people of different weights:

Sex	Body weight (kg)	Sedentary work (Kcal)	Moderate work (Kcal)
Males	45	1590	1870
	50	1688	1985
	55	1786	2101
	60	1883	2216
	65	1981	2331
	70	2079	2446
	75	2177	2565
Females	40	1477	1737
	45	1553	1627
	50	1630	1917
	55	1706	2007
	60	1782	2097
	65	1860	2187
	70	1936	2277

Source: Nutrient Requirements and Recommended Dietary Allowances for Indians, ICMR (2010)

Protein The recommended intake is difficult to apply to all older people but a figure of 0.83g of protein per kilogram of body weight should meet all requirements (ICMR, 2010). It is essential that any older patient with a medical condition requiring an increase in protein is provided with an adequate intake. Since, all elderly under study were active and on certain medications, 0.83 kg/body weight protein was taken as reference.

For calculating Iron, Fat, Vitamin B1, Vitamin B2, Vitamin B3, Vitamin B12,β-carotene, Vitamin C etc. for elderly people RDA of Adults was used (ICMR, 2010).

3.4.2 Anthropomatric measurements

The process of normal growth and development depends on an adequate and timely supply of nutrients. Under nutrition is reflected in impairment of growth and therefore, anthropomatric measurements are useful to understand the dynamics of malnutrition. Nutritional anthropometry is concerned with the measurement of the variation of physical dimensions and gross composition of human body at different age levels and degree of nutrition (Jelliffe, 1966). The various measurements taken for the present study are as under:

Height (cm): The height of an individual which is made up of sum of the four components, i.e. legs, pelvis, spine, and skull is affected by long term nutritional deprivation and considered as an index of chronic or long duration malnutrition (WHO, 2006).

Height of respondents was measured by method described by Jelliffe (1966). A vertical measuring rod calibrated in centimeters made by Western surgical manufacturer was placed on plain floor. The bare footed respondent was made to stand erect on platform with feet parallel and with heel, buttocks and shoulders and back of head touching the wall. The

head was held comfortably erect with the lower border of the orbit in the same horizontal plane. The arms were hanging at the sides in the natural manner and height was measured. Same procedures for height measurement were repeated three times for each individual and then mean was taken.

Weight (kg): Weight is a good indicator of present nutritional status and concerned with determining degree of underweight principally resulting from varying levels of protein energy malnutrition (Jelliffe 1966). Indian made weighing balance calibrated in kilogram and gram was used for taking weight of respondents as per the method described by Jelliffe (1966). Weighing balance was kept on a flat surface and adjusted to zero. The subject was then asked to remove footwear and extra clothing. He/she was then asked to stand on the machine platform without any support and the reading was recorded. Weights were recorded three times and then mean was taken.

Body Mass Index (kg/m^2) : The body mass index was calculated using the equation given by Garrow (1981).

$$\text{BMI (kg/m}^2\text{)} = \frac{\text{Weight (kg)}}{\text{Height (m}^2\text{)}}$$

3.5 Construction of questionnaire-cum-interview schedule and Collection of data

A well-structured interview schedule was prepared in accordance with the methodological procedure keeping in view the objectives of the investigation. The interview schedule was pretested and based on the responses obtained and suggestions given by ten experts of COHS, CCS Haryana Agricultural University, Hisar and suitable modifications were made to make it more functional (Annexure I).

The selected villages and urban areas were visited after taking permission from concerned authorities. The objectives of the study were told and respondents were motivated to be a part of study.

3.6 Development of value added food products

3.6.1 *Chapati*

S. No.	Ingredients	Control	Types	
			I	II
1.	Wheat flour (g)	100	60	40
2.	Bengal gram flour (g)	-	40	20
3.	Pearl millet flour (g)	-	-	20
4.	Maize flour (g)	-	-	10
5.	Green gram flour (g)	-	-	10
6.	Salt(g)	½ tsp		

Method

- Added salt in flour and mixed thoroughly.
- Prepared soft dough of flour with addition of water.
- Divided dough into equal portions, made into small balls and rolled out with the help of rolling pin.
- Cooked *Chapati* on a hot *tawa* from both the sides until brown.

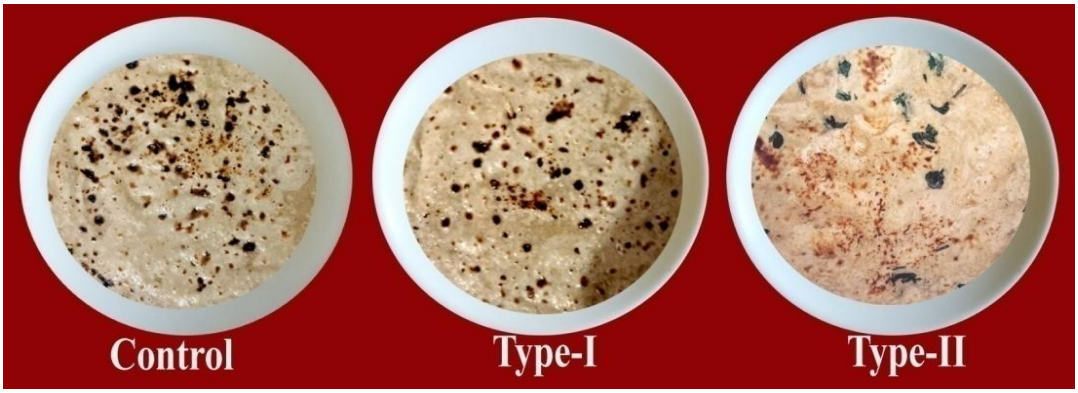

Plate 1: *Chapati*

Control = Wheat flour (WF) (100)
Type I = Wheat flour: Bengal gram flour (WF: BGF) (60:40)
Type II = Wheat flour: Bengal gram flour: Maize flour: Pearl millet flour: Green gram flour (WF: BGF: MF: PMF: GGF) (40:20:20:10:10)

3.6.2 *Parantha*

Sr. No.	Ingredients	Control	Types	
			I	II
1.	Wheat flour(g)	100	40	40
2.	Bengal gram flour (g)	-	20	20
3.	Maize flour (g)	-	20	20
4.	Pearl millet flour (g)	-	20	-
5.	Carrot (g)	-	-	10
6.	Bottle gourd (g)	-	-	10
7.	Salt	½ tsp	½ tsp	½ tsp
8.	Ghee (g)	For shallow frying		

Method

- Sieved the flour, added salt in flours and mixed thoroughly and prepare dough with water.
- Divided dough into equal portions, made into small balls and rolled out with the help of rolling pin.
- Cooked *Parantha* on a hot *tawa* from both the sides until brown, using ghee.

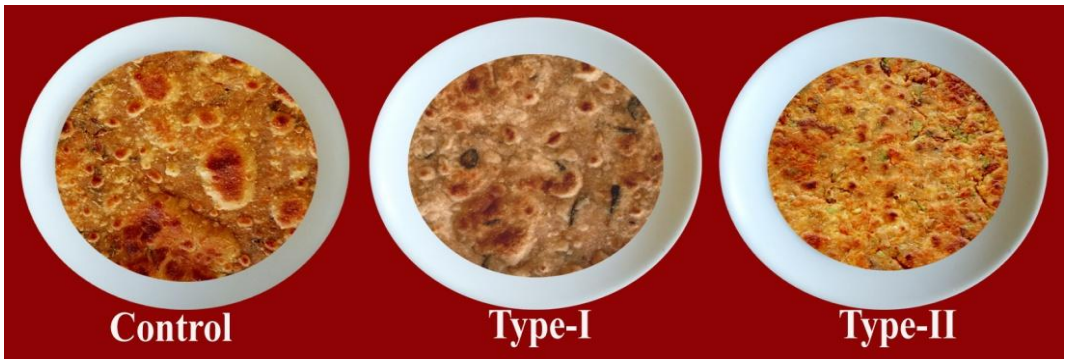

Plate 2: *Parantha*

Control = Wheat flour (WF) (100)
Type I = Wheat flour: Bengal gram flour : Maize flour: Pearl millet flour (WF:BGF:MF:PMF) (40:20:20:20)
Type II = Wheat flour: Maize flour: Bengal gram flour: Bottle gourd: Carrot (WF:MF:BMF: BG:C) (40:20:20:10:10)

3.6.3 *Kasaar*

S. No.	Ingredients	Control	Types	
			I	II
1.	Wheat flour (g)	100	60	40
2.	Bengal gram flour (g)	-	40	20
3.	Maize flour (g)	-	-	20
4.	Pearl millet flour (g)	-	-	15
5.	Sesame seeds (g)	-	-	05
6.	*Desi khand (g)*	50	50	50
7.	Salt	½ tsp		
8.	*Desi* Ghee	Additional		

Method

- Sieved all types of flours and roasted separately and allowed to cool
- Added *desi khand* and mixed thoroughly.
- Mixed *desi* ghee and served.

Plate 3: *Kasaar*

Control = Wheat flour (WF) (100)
Type I = Wheat flour: Bengal gram flour (WF: BGF) (60:40)
Type II = Wheat flour: Bengal gram flour: Maize flour: Pearl millet flour: Sesame seeds (WF: BGF: MF: PMF: SS) (40:20:20:15:5)

3.6.4 *Lapsi*

Sr. No.	Ingredients	Control	Types	
			I	II
1.	Wheat flour (g)	100	60	40
2.	Bengal gram flour (g)	-	40	20
3.	Maize flour (g)	-	-	20
4.	Pearl millet flour (g)	-	-	20
5.	Jaggery (g)	40	40	40
6.	Ghee	Additional		

Method

- Sieved all types of flours and roasted separately
- Prepared syrup of jaggery by adding water.
- Stirred the syrup with ladle while adding roasted flour slowly on slow flame.
- Cooked till done and served hot.

Plate 4: *Lapsi*

Control = Wheat flour (WF) (100)
Type I = Wheat flour: Bengal gram flour (WF: BGF) (60:40)
Type II = Wheat flour: Bengal gram flour: Maize flour: Pearl millet flour (WF: BGF: MF: PMF) (40:20:20:10:10)

3.6.5 Porridge

Sr. No.	Ingredients	Control	Types	
			I	II
1.	Wheat grits(g)	100	60	40
2.	Rice gram grits (g)	-	40	15
3.	Maize grits (g)	-	-	20
4.	Bengal gram grits(g)	-	-	20
5.	Sesame seeds(g)	-	-	5
6.	Jaggery (g)	45	45	45
7.	Milk (ml)	250	300	300

Method

- Roasted all the raw materials separately (maize grits, pearl millet grits, rice grits, and sesame seeds)
- Added roasted sesame seeds
- Took ghee in pressure cooker, added roasted ingredients, milk and pressure cooked for 5 minutes.
- Added jaggery and cooked for few minutes and served hot.

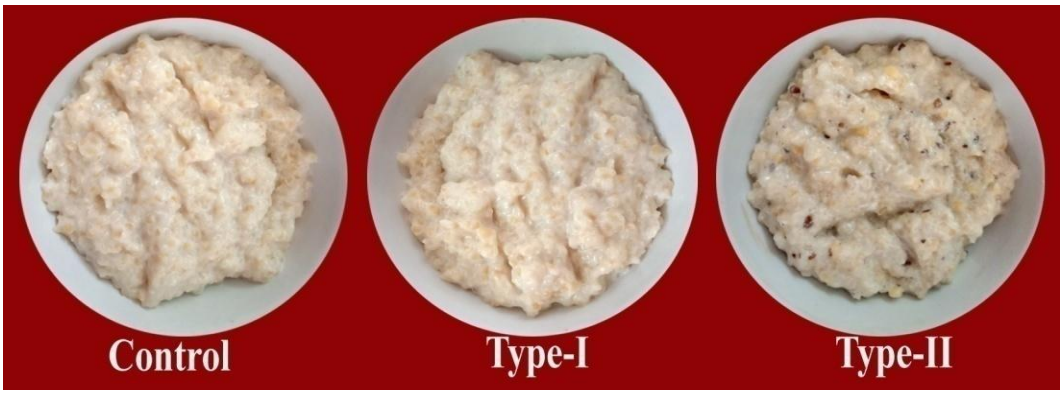

Plate 5: Porridge

Control = Wheat grits (WG) (100)
Type I = Wheat grits: Rice grits (WG: RG) (60:40)
Type II = Wheat grits: Rice grits: Maize grits: Bengal gram flour: Sesame seeds (WG: RG: MG: BGG: SS) (40:20:20:15:5)

3.6.6 *Khichari*

Sr. No.	Ingredients	Control	Types	
			I	II
1.	Rice (g)	50	30	20
2.	Maize (g)		20	20
3.	Green gram (g)	50	30	20
4.	Bengal gram (g)	-	20	15
5.	Carrot (g)	-	-	10
6.	Peas (g)	-	-	10
7.	Fenugreek leaves dried (g)	-	-	5
8.	Salt(g)	½ tsp		
9.	Water(ml)	280	320	350

Method

- Cleaned and washed grains to remove dust and other foreign particles.
- Pounded grains adding little water to remove husk.
- Removed husk by suspending in cold water.
- Washed rice and green gram in water.

- Heated ghee in a pan and added cumin seeds to it when they splittered.
- Added pounded grains, vegetables and water.
- Cooked on slow fire till grains became soft and well cooked.
- Served hot.

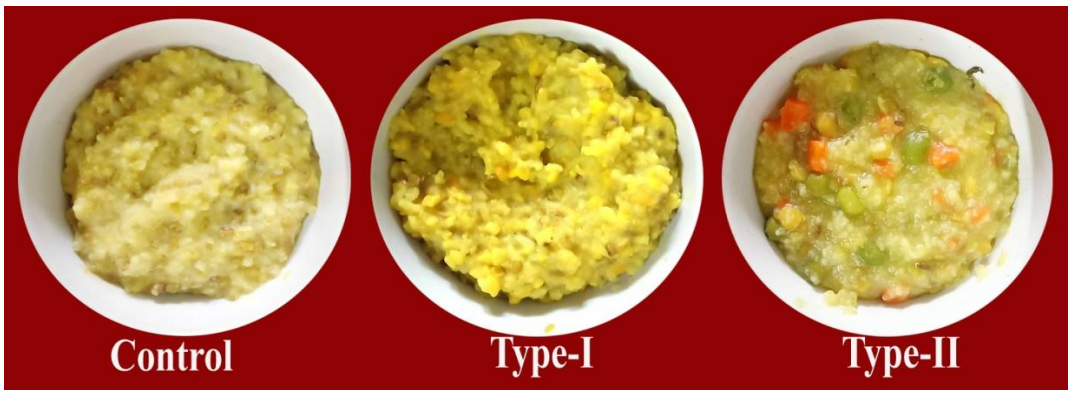

Plate 6: *Khichari*

Control = Rice: Green gram (R: GG) (100)
Type I = Rice: Maize: Green gram: Bengal gram (R: M: GG: BG) (30:20:30:20)
Type II = Rice: Maize: Green gram: Bengal gram: Carrot: Peas: Fenugreek leaves (R: M: GG: BG: C: P: FL) (20:20:20:15:10:10:5)

3.6.7 *Cheela*

S. No.	Ingredients	Control	Variants	
			II	II
1.	Bengal gram flour (g)	100	60	40
2.	Wheat flour (g)		40	20
3.	Maize flour (g)	-		20
4.	Pearl millet flour (g)	-		15
5.	Sesame seeds (g)	-	-	5
6.	Green Chillies (g)	5	5	5
7.	Salt(g)	½ tsp		
8.	Oil (ml)	For frying		

Method

- Washed and chopped coriander leaves and green chillies finely.
- Added all the spices onion, coriander leaves and green chillies to flour
- Added water to the flour to make batter of pouring consistency.
- Applied oil onto a hot griddle
- Poured a laddle full of batter on the hot griddle and spread into thin round layer like dosa and shallow fried from both sides until golden brown.
- Served hot

Plate 7: *Cheela*

Control = Bengal gram flour (BGF) (100)
Type I = Bengal gram flour: Wheat flour (BGF: WF) (60:40)
Type II = Bengal gram flour: Wheat flour: Maize flour: Pearl millet flour (BGF: WF: MF: PMF) (40:20:20:20)

3.6.8 *Kheer*

Sr. No.	Ingredients	Control	Variants	
			I	II
1.	Milk (ml)	500	500	500
2.	Rice (g)	30	-	-
3.	Maize Grits (g)	-	15	-
4.	Fox Nut popped (Makhana)	-	15	-
5.	Carrot (g)	-	-	30
6.	Jaggery (g)	50	50	50
7.	Cardamom (no.)	1	1	1

Method

- Cleaned rice and maize grits and grated carrot
- Boiled milk and added rice grits/ maize grits/ popped fox nut popped and carrot.
- Stirred continuously till done
- Added jagger, mixed well and served hot.

Plate 8: *Kheer*

Control = Rice (30)
Type I = Maize grits: Fox Nut popped (MG: FN) (15:15)
Type II = Carrot (30)

3.7 Sensory evaluation of value added food products

All the products prepared were subjected to sensory evaluation by a panel of ten judges using 9-point hedonic scale as given in Annexure 1. The judges were selected from I.C. College of Home Science, CCS Haryana Agricultural University, Hisar and ten respondents from study area of Sirsa district.

3.8 Proximate composition of products

Proximate composition

All the raw ingredients were cleaned, washed well under running tap water to get rid of all the dirt, soil, and foreign matter prior to product development. All ingredients were washed using distilled water. Green leaves were trimmed in order to remove any dead or spoiled part. Raw materials were then dried and stored in air tight containers (Food grade)**.** The dry powder of all the samples was analysed for moisture, crude protein, ash, fat and crude fiber content using standard methods of AOAC (2000).

3.8.1 Moisture content

Moisture in the samples was calculated by employing the standard methods of analysis (AOAC, 2000).

Five gram sample was weighed in a petri dish and dried in an oven at 60^{o}C for six hours or till a constant weight was obtained. The dish with dried sample was taken out of oven and transferred to desiccator and cooled to room temperature. The dish was then weighed .The loss in weight was calculated and expressed as moisture per cent.

$$\text{Moisture (\%)} = \frac{W_1 - W_2}{W} \times 100$$

Where,

W = Weight of sample (g)

W_1 = Weight of sample + moisture dish (g)

W_2 = Weight of dried sample + moisture dish (g)

3.8.2 Crude protein

Crude protein was estimated by MicroKjeldahl method (AOAC, 2000) using Automatic KEL-PLUS CLASSIC-DX apparatus with slight modifications.

Reagents

i) Hydrocholoric acid - N/10

ii) Sulphuric acid (concentrated)

iii) Boric acid - 4 %

iv) Mixed indicator solution: Took 0.3 g bromocresol green and 0.2 g methyl red and dissolved in 400 ml 90 per cent ethanol

v) Sodium hydroxide - 40 %

vi) Digestion mixture: Potassium sulphate (10g) and copper sulphate (2g) were mixed together

Procedure

Moisture free sample (200 mg) was transferred to the digestion tube. Ten 10 ml of concentrated sulphuric acid and 3 g of digestion mixture were added to the sample. Digestion tubes were loaded into the digester and heated the block at 420°C. Digestion was carried out for about one hour and forty minutes till the contents of tubes became colourless or light green or sky blue in colour. The digested samples were cooled to room temperature and distilled in CLASSIC-DX. During distillation the digested samples were heated by passing stream and the ammonia liberated due to the addition of 40% of sodium hydroxide was dissolved in 4% boric acid containing mixed indicator solution. The boric acid consisting of ammonia was titrated against 0.1N HCl till the end point was indicated by change of colour to light pink. Titration volume of a blank solution of boric acid and mixed indicator was also determined. Per cent Nitrogen was calculated by the following formula:

$$\text{Nitrogen per cent} = \frac{14 \times \text{sample titer-Blank titer} \times \text{N of HCl}}{\text{Sample (g)} \times 1000} \times 100$$

Protein % = N % × 6.25

3.8.3 Fat

Crude fat was estimated by the standard method of analysis (AOAC, 2000) using the KEL PLUS soxhlet extraction apparatus.

Washed the beakers thoroughly and dried it in hot air oven at 60°C. Took the weight of empty beaker. Two grams of moisture free sample was weighed and transferred into cellulose thimble. The thimble holder along with thimble was kept into the beaker. Poured required quantity of solvent (petroleum ether, boiling point 60°-80°C) into the beaker. Loaded the beakers into the system and set the temperature (90°C according to boiling point of solvent). The extraction was carried out for one hour at 90°C. After the completion of extraction period, the temperature was raised to 110°C. Closed the stoppers in order to collect the solvent in the solvent compartment. Removed the beakers along with the fat and kept in hot air oven at 60°C temperature, to remove traces of the solvent. The beakers were weighed after cooling in a dessicator.

$$\text{Fat (\%)} = \frac{W_2 - W_1}{W} \times 100$$

Where,

W = Weight of sample (g)

W_1 = Weight of empty beaker (g)

W_2 = Weight of beaker with fat (g)

3.8.4 Crude fiber

Crude fiber was determined by employing standard method of analysis (AOAC 2000).

Reagents

i) Sulphuric acid stock solution (10 %, w/v): 55 ml conc. H_2SO_4 was diluted to one litre of stock solution.

ii) Sulphuric acid working solution (1.25 %): 125 ml of the stock solution was diluted to one litre.

iii) Sodium hydroxide stock solution (10 %, w/v): 100 g NaOH was dissolved in water and diluted to one litre.

iv) Sodium hydroxide working solution (1.25 %): 125 ml of the stock solution was diluted to one litre.

Procedure

One gram of fat free dried sample was weighed in one litre tall beaker and 200 ml of 1.25 % H_2SO_4 was added. It brought to boiling for 30 minutes under bulb condenser. Beaker was rotated occasionally to mix the contents and removed the particles from the side. The contents of the beaker were filtered through muslin cloth and washed the sample back into the tall beaker with 200 ml 1.25 % sodium hydroxide. It was again brought to boiling and was kept for boiling exactly for 30 minutes under bulb condenser. All insoluble matter was transferred to the sintered crucible by means of boiling water till acid free and washed twice with alcohol, followed by three washings with acetone. The matter was dried at 100° C till constant weight was achieved. The crucible was put in muffle furnace at 550° C for 1 h The crucible was cooled in a desiccator, reweighed and the per centage of crude fibre in the samples was calculated.

$$\text{Crude fibre (\%)} = \frac{W_1}{W_2} \times 100$$

Where,

W_1 = loss of weight on ignition (g)

W_2 = weight of sample (g)

3.8.5 Total ash

Ash in the sample was estimated by employing the standard method of analysis (AOAC 2000).

Five grams of sample was weighed in a pre-weighed silica crucible, dried at 100º C. It was ignited till no charred particles remained in the crucible. The crucible was then transferred to muffle furnace maintained at 550 ± 5º C for 5 - 6 h till white ash was obtained. Then the crucible was cooled in a desiccator and weighed. The loss in the weight represented the organic matter and residue being the ash content.

3.9 Statistical analysis

The qualitative data were quantified according to the standard methods. The qualitative and quantitative data were tabulated to draw meaningful inferences. The data was analysed with the help of percentage, mean and standard deviation, analysis of variance by using complete randomised design, z- test and t- test.

Z-test: The Z-test was used to test the differences in mean scores of a random sample with that of the recommended daily allowance/reference value when the sample size was more than 30.

$$Z\,Cal = \frac{\overline{X} - \mu}{\sigma / \sqrt{n}}$$

Where,

$\overline{X}$ = Mean of sample's observation .

μ = The recommended daily allowance/reference value

n = The sample size

σ = The standard deviation of the sample.

Z-distribution test : The test was used to test the difference of the mean of the two samples.

$$Z = \frac{\overline{X} - \overline{Y}}{\sqrt{\sigma_1^2 / n_1 + \sigma_2^2 / n_2}}$$

Where,

$\overline{X}$ = Mean of first sample

$\overline{Y}$ = Mean of second sample

n_1 = No. of observations of first sample

n_2 = No. of observations of second sample

σ_1 = Standard deviation of first sample

σ_2 = Standard deviation of second sample

ANOVA test

This test was used to analyze the data of three samples.

Paired 't' test

In order to find out the different gain in knowledge between pre-exposure, post-exposure and retention scores of the messages when the group was considered as its own control, test applied was as follows :

$$t = \frac{\overline{d}}{sd\sqrt{n}}$$

Where,

$$sd = \frac{\Sigma(d_i - \overline{d})^2}{n - 1}$$

Where,

$\overline{d}$ = Mean of differences

n = Sample size

sd = Standard deviation

d_i = the i^{th} difference

CHAPTER -IV

RESULTS

The present study was conducted to determine the nutritional status of geriatric population (above 60 years). Nutritional status of geriatric population (n=300) selected from Sirsa district was assessed in terms of dietary intake and anthropomatric measurements. Value added food products were prepared and evaluated for organoleptic and proximate composition. The data was collected in accordance with the research methodology to achieve the specific objectives of the study. Results are presented in the following sub-section as given below:

4.1 Socio-economic profile of geriatric respondents

4.2 Assessment of nutritional status of geriatric respondents

4.3 Health problems among geriatric respondents

4.4 Development and organoleptic evaluation of value added food products

4.5 Proximate composition of organoleptically acceptable food products

4.1 Socio economic profile of geriatric population

4.1.1 Area covered under study

Two blocks of Sirsa district namely Sirsa urban and Sirsa rural were selected to study the nutritional status of the geriatric population above 60 years of age. One hundred and fifty respondents from urban and 150 respondents from rural area were selected. In rural block out of 150 respondents majority of the respondents were from Darbi village (23.67%) followed by Moriwala (14.67%), Sikanderpur (6.00%) and Rasulpur (5.67%) village, respectively. Among urban respondents 14.67 per cent were from Farm Colony, 10.67 per cent were from Hari Vishnu Colony, 6.33 per cent were from Khairpur Colony, 13.67 per cent were from MC Colony and 4.67 per cent were from Shah Satnam Colony.

Table 4.1: Area covered under study

(N=300)

SN	Area of study	Village /Urban area	No. of Respondents	Percent (%)
I.	Sirsa Rural	1. Darbi	71	23.67
		2. Moriwala	44	14.67
		3. Rasulpur	17	5.67
		4. Sikandarpur	18	6.00
II.	Sirsa Urban	1. Farm colony	44	14.67
		2. Hari Vishnu colony	32	10.67
		3. Khairpur	19	6.33
		4. MC colony	41	13.67
		5. Shah Satnam colony	14	4.67
	Total		**300**	**100.00**

4.1.2 Personal and socio-economic profile of geriatric respondents

Socio-economic profile of geriatric population (above 60 years) has been presented in Table 4.2. Out of 300 respondents surveyed, 50 per cent were from rural area and 50 per cent from urban area; 50 per cent were male and 50 per cent were female. One hundred eighty five (61.67%) respondents were in age group of 61 to 70 years; 84 (28.00%) in the age group of 71 to 80 and 31(10.33%) in age group of 81 to 90 years.

It has been shown in the Table 4.2 that 96.67 per cent rural and 95.33 per cent urban respondents were living with family while 3.33 per cent rural and 4.00 per cent urban respondents were living alone. Among the geriatric population 89.33 per cent rural and 84.00 per cent urban respondents lived in joint family whereas 10.67 per cent rural and 16.00 per cent lived in nuclear family set ups. Out of 300 respondents, 94 (62.67%) of rural and 87 (58.00%) of urban belonged to medium sized family followed by 34 (22.67%) rural, 43 (28.67%) urban respondents small family and 22 (14.67%) rural and 20 (13.33%) urban respondents large family. Majority of the respondents (63.67%) were living in pucca houses (63.33% rural and 64.00% urban) followed by partial pucca houses (34.67%; 36.00% rural and 33.33% urban) and kachha houses (5.00%; 2.67% rural and 0.67% urban). Preference for health facility, 54.00 per cent rural, 59.33 per cent urban respondents consulted to private hospital, 28.00 per cent rural respondents, 27.33 per cent urban respondents consulted to PHC, 12 per cent rural and 17.33 per cent urban respondents consulted to charitable source of health facility. Only 0.67 per cent elderly preferred to consult CHC for health facilities.

Data presented in Table 4.2 revealed that 103 (68.67%) rural and 44 (29.33%) urban respondents were illiterate and 5 (3.33) rural and 13(8.67%) urban respondents can read and write. Out of 300 respondents, 50 respondents (17 rural and 33 urban) had primary education, 22 respondents (5 rural and 17 urban) had middle education, 31 respondents (12 rural and 19 urban) respondents had matric, 6 respondents had senior secondary (1 rural and 5 urban), 20 respondents (6 rural and 14 urban) had graduation and 6 respondents (1 rural and 5 urban) had post-graduation. In regards of Spouse's education, majority of respondent's spouse (54.67%) were in category of illiterate followed by educated up to primary (12.67%), can read and write (11.33%), middle (9.33%), matric (9.33%), senior secondary school (2.00 %), graduate (8.26 %) and post graduate (1.00%).

Out of 300 respondents, 26 (8 rural and 18 urban) were labourer; 3 (1.00%) respondents were indulged in caste occupation; 22 (2 rural and 20 urban) respondents were business person; 66 (447 rural and 19 urban) respondents were ex-service person and 134 (114 rural and 20 urban) respondents were indulged in any other occupation. Table 4.2 depicted that 168 (56%) of respondents (79 rural and 89 urban) have no lands.

Table 4.2: Personal and socio-economic profile of geriatric respondents

(N=300)

SN	Characteristics	Class	Rural (n-150)	Urban (n=150)	Total (n=300)
1.	Age (years)	61-70	81 (54.00)	104(69.33)	185 (61.67)
		71-80	48 (32.00)	36 (24.00)	84 (28.00)
		81-90	21(14.00%)	10 (6.67)	31 (10.33)
2.	Gender	Male	75 (50.00)	75 (50.00)	150 (50.00)
		Female	75 (50.00)	75 (50.00)	150 (50.00)
3.	Education	Illiterate	103 (68.67)	44 (29.33)	147 (49.00)
		Can read and write	5 (3.33)	13 (8.66)	18 (6.00)
		Primary	17 (11.33)	33 (22.00)	50 (16.67)
		Middle	5 (3.33)	17 (11.33)	22 (7.33)
		Matric	12 (8.00)	19 (12.67)	31 (10.33)
		Senior secondary	1 (0.67)	5 (1.67)	6 (2.00)
		Graduate	6 (2.00)	14 (4.67)	20 (6.67)
		Post graduate	1 (0.33)	5 (3.33)	6 (2.00)
4.	Education (spouse)	Illiterate	34 (22.67)	103 (68.67)	137 (54.67)
		Can read and write	22 (14.67)	12 (8.00)	34 (11.33)
		Primary	25 (16.67)	13 (8.67)	38 (12.67)
		Middle	21 (14.00)	7 (4.67)	28 (9.33)
		Matric	19 (12.67)	9 (6.00)	28 (9.33)
		Senior secondary	5 (3.33)	1 (0.67)	6 (2.00)
		Graduate	21 (14.00)	5 (3.33)	26 (8.67)
		Post graduate	3 (2.00)	-	3 (1.00)
5.	Living arrangement	Living alone	5 (3.33)	7 (14.67)	12 (4.00)
		Living with family	145 (96.67)	143 (95.33)	288 (96.00)
6.	Type of family	Nuclear	16 (5.33)	24 (8.00)	40 (13.33)
		Joint	134 (85.33)	126 (84.00)	260 (86.67)
7.	Size of family	Small	34 (22.67)	43 (28.67)	77 (25.67)
		Medium	94 (62.67)	87 (58.00)	181 (60.33)
		Large	22 (14.67)	20 (13.33)	42 (14.00)
8.	Type of house	Kachcha	1 (0.67)	4 (2.67)	5 (1.67)
		Partially pucca	54 (36.00)	50 (33.33)	104 (34.67)
		Pucca	95 (63.33)	96 (64.00)	191 (63.67)
9.	Health facility	C.H.C	1 (0.67)	2 (0.67)	3 (1.00)
		P.H.C	42 (28.00)	41 (54.67)	83 (27.67)
		Private hospital	89 (59.33)	81 (54.00)	170 (56.67)
		Charitable hospital	18 (12.00)	26 (17.33)	44 (14.67)

SN	Characteristics	Class	Rural (n-150)	Urban (n=150)	Total (n=300)
10.	Occupation	Labourer	8 (5.33)	18 (12.00)	26 (8.67)
		Caste occupation	-	3 (2.00)	3 (1.00)
		Business	2 (1.33)	20 (26.67)	22 (7.33)
		Agriculture	7 (4.67)	42 (28.00)	49 (16.33)
		Service/Ex-service	19 (6.33)	47 (15.67)	66 (22.00)
		None	114 (38.00)	20 (13.33)	134 (44.67)
11.	Income of the family (Rs.) (Monthly)	Below 12,000	22 (14.67)	22 (14.67)	44 (14.66)
		12,001-24,000	58 (38.67)	70 (46.67)	128 (42.66)
		24,001 to 36,000	43 (28.67)	31 (20.67)	74 (24.66)
		36,001 to 48,000	27 (18.00)	25 (16.67)	52 (17.33)
		48,001 to 60,000	-	2 (1.33)	2 (0.67)
12.	Landholding	Landless (Nil)	89 (59.33)	79 (52.67)	168 (56.00)
		<2.5 acres	14 (9.33)	16 (8.67)	30 (10.00)
		2.5-5 acres	13 (8.67)	20 (13.33)	33 (11.00)
		5-10 acres	10 (6.67)	14 (9.33)	24 (8.00)
		>10 acres	24 (16.00)	21 (14.00)	45 (15.00)
13.	No. of milch animal	Nil	59 (39.33)	137 (91.33)	196 (65.33)
		1-2	73 (48.67)	11 (7.33)	84 (28.00)
		2-4	13 (8.67)	2(1.33)	15 (5.00)
		>4	5 (3.33)	-	5 (1.67)
14.	Food habits	Vegetarian	142 (94.67)	113 (75.33)	255 (85.00)
		Non-vegetarian	8 (5.33)	37 (24.67)	45 (15.00)

Values in parentheses indicate percentage

It was found that 14.67 per cent respondents had total family income below Rs. 12000 per month while 0.67 per cent respondents had total family income Rs. 48001 to 60,000 per month. One hundred twenty eight (58 rural and 7 urban), 74 respondents (43 rural and 31 urban) and 52 respondents (27 rural and 25 urban) had total family income Rs. 12001 to 24000, Rs.24001 to 36000 and Rs.36001 to 48000 per month, respectively. Thirty respondents (16 rural and 14 urban) were farmers having <2.5 acres; 33 respondents (20 rural and 13 urban) were farmers having 2.5 to 5 acres; 24 respondents (14 rural and 10 urban) were farmers having 5 to 10 acres and 45 respondents (24 and 21 urban) were farmers having more than 10 acres of lands.

Table 4.2 illustrated that 65.33 per cent respondents (39.33 % rural and 91.33% urban) have no milch animal while 28 per cent respondents (48.67% rural and 7.33 % urban) have 1 to 2 milch animals. It was found that 5.00 per cent respondents (8.67% rural and 1.33% urban) have 2 to 4 milch animals while only 1.67 per cent respondents (3.33% rural)

have more than 4 animals. Majority of the respondents (85.00%) were vegetarian (94.67 % rural and 75.33% urban) whereas 15 per cent respondents (5.33% rural and 24.67% urban) were non- vegetarian.

4.1.3 Time spent by the geriatric respondents in various activities

Major household activities include dusting, sweeping, cooking, feeding, cleaning, shopping and other maintenance chores. Data in the Table 4.3 revealed that majority of the elderly (161 respondents (53.67%) used to spend 1 to 2 hours in household activities, out of that 64.00 per cent were rural and 43.33 per cent were urban respondents. Only 3.33 per cent respondents (6.00% rural and 0.67% urban) worked for 4 to 6 hours and 11.33 per cent respondents (21.33 rural and 3.33% urban) respondents were working for 2 to 4 hours. Ninety four respondents (31.33; 8.67% rural and 54.00% urban) spending less than 1 hour in household work whereas 0.33 per cent (0.67% rural) working for more than 6 to 8 hours.

Table 4.3: Time spent by the geriatric respondents in various activities

(N=300)

Activity	Time (h)	Rural (n=150)	Urban (n=150)	Total (n=300)
I. Household	Less than 1	13 (8.67)	81 (54.00)	94 (31.33)
	1-2	96 (64.00)	65 (43.33)	161 (53.67)
	2-4	32 (21.33)	2 (1.33)	34 (11.33)
	4-6	9 (6.00)	1 (0.67)	10 (3.33)
	6-8	-	1 (0.67)	1 (0.033)
II. Animal husbandry	Less than 1	130 (86.67)	132 (88.00)	262 (87.33)
	1-2	15 (10.00)	15 (11.33)	32 (10.67)
	2-4	2 (1.33)	3 (2.00)	5 (1.67)
	4-6	1 (0.67)	-	1 (0.33)
	6-8	-	-	-
III. Agricultural	Less than 1	94 (62.67)	138 (92.00)	232 (77.33)
	1-2	29 (19.33)	8 (5.33)	37 (12.33)
	2-4	8 (5.33)	4 (2.67)	12 (4.00)
	4-6	18 (12.00)	-	18 (6.00)
	6-8	1 (0.67)	-	1 (0.33)
IV. Recreational	Less than 1	145 (96.67)	142(94.67)	287(95.65)
	1-2	5 (3.33)	8 (5.33)	13 (4.33)
	2-4	-	-	-
	4-6	-	-	-
	6-8	-	-	-
V. Religious	Less than 1	119 (79.33)	138(92.00)	257(84.33)
	1-2	53 (28.67)	12(8.00)	65(21.67)
	2-4	-	-	-
	4-6	-	-	-
	6-8	-	-	-

Values in parentheses indicate percentage

Animal husbandry aspects consist mostly of feeding, breeding, milking, cleaning, care of calves and sick animals, handling of animal produce, arrange the supply of feed and fodder for the cattle and marketing of animal products. The majority of the respondents (87.33%; 86.67 % rural and 88.00% urban) used to spend less than 1 hour in animal husbandry followed by 10.67 per cent (10.00% rural and 11.67% urban), 1.67 per cent (1.33% rural and 2.00% urban) and 0.33 per cent (0.67% rural) respondents who were spending 1 to 2 hours, 2 to 4 hours and 6 to 8 hours in animal husbandry activities, respectively (Table 4.3).

Agricultural activities include soil preparation, sowing, manuring, irrigation, weeding, harvesting, cleaning storage, drying, fumigation and other maintenance chores. The majority of the respondents (77.33%; 62.67% rural and 92.00% urban) were spending less than1 hour in agricultural activities, 12.33 per cent respondents (19.33 rural and 5.33urban) spending 1 to 2 hours in , 4.00 per cent respondents (5.33% and 2.67%) spending 2 to 4 hours 6.00 per cent respondents (12.00% rural) spending 4 to 6 hours in agricultural activities. Only 0.33 per cent respondents (0.67% rural) were working 6 to 8 hours in agricultural activities (Table 4.3).

Recreation is an activity of leisure, being discretionary time. Recreation is the essential part of human life and finds many different forms which are shaped naturally by individual interests but also by the surrounding social construction. It was observed that majority of respondents (95.67%; 96.67% rural and 94.67% urban) spent less than 1 hour in recreational activities while 4.33 per cent respondents (3.33% rural and 5.33% urban) spent 1 to 2 hours in recreational activities daily. Elderly people used to go to temple or *gurudwara* for religious activities. It was observed that 85.67 per cent respondents (79.33% rural and 92.00% urban) spent less than one hour in religious activities whereas 21.67 per cent respondents (28.67% rural and 8.00% urban) spent 1 to 2 hours in religious activities.

4.2 Nutritional status of geriatric respondents

4.2.1 Frequency of food consumption of geriatric respondents

Data on food frequency of selected elderly people of Sirsa district have been presented in Table 4.4. The data was collected from January to June. In India cereals are the staple food of our daily diets. Among the cereals, wheat was consumed by all the respondents daily. Rice was consumed by 3.33 per cent, 7.67 per cent, 59.33 per cent, 27.67 per cent and 3.67 per cent respondents on daily , alternatively, weekly, fortnightly and rarely basis, respectively. Pearl millet was consumed fortnightly by majority of respondents (50.00%) while 3.67 per cent and 7.00 per cent of respondents were consuming it on weekly and rarely basis, respectively. Maize was consumed by 10.00 per cent, 37.00 per cent, 16.33 per cent and 19.67 per cent respondents on alternatively, weekly, fortnightly and rarely basis, respectively. Majority of the respondents (8.33%) consumed barley rarely and only 1.33 per cent respondents consumed it fortnightly while 6.67 per cent respondents consumed oats rarely.

Pulses are the major source of protein in Indian vegetarian diets. In the families studied, green gram dal and Bengal gram dal were consumed commonly. Sixty two per cent respondents consumed Bengal gram dal weekly basis followed by 17.33 per cent, 17.00 per cent and 2.67 per cent on alternatively, fortnightly and rarely basis, respectively. Majority of the respondents (75.67%) consumed green gram dal on alternate days followed by 20.00 per cent, 1.67 per cent, 1.33 per cent and 0.67 per cent who consumed it on weekly, daily, fortnightly and rarely basis, respectively. Sixty nine per cent of the respondents consumed black dal on rarely basis followed by 9.67 per cent and 3.00 per cent fortnightly and weekly, respectively. Regarding moth bean dal 47.00 per cent of respondents consumed it rarely followed by 35.67 per cent and 1.33 per cent on fortnightly and weekly basis, respectively. Lentil was consumed rarely by 50.33 per cent elderly while 9.00 per cent and 0.67 per cent on fortnightly and weekly basis, respectively. Seventeen per cent elderly consumed soybean rarely while 5 per cent elderly consumed it fortnightly. Seventy eight per cent respondents were not consuming soybean. It was observed that 8 per cent respondents were consuming *rajmah* dal rarely whereas 92.00 per cent respondents were not consuming *rajmah* dal.

Data regarding food consumption pattern of green leafy vegetables revealed that amaranths was consumed on fortnightly, rarely and weekly basis by 75.33 per cent, 15.33 per cent and 8.33 per cent respondents, respectively. Seventy four per cent respondents consumed *bathu* leaves weekly and 21.67 per cent respondents consumed it fortnightly basis. Coriander leaves were consumed by 26.67 per cent respondents followed by 23.67 per cent, 17.67 per cent, 15.67 per cent and 15.00per cent respondents on alternatively, weekly, rarely and fortnightly basis, respectively. Eighty four per cent respondents consumed fenugreek leaves weekly while 9.33 per cent and 5.33 per cent respondents consumed it on fortnightly and alternate days, respectively. Majority of the respondents (71.00%) consumed Bengal gram leaves on weekly basis; 22.33 per cent and 6.00 per cent respondents consumed it on fortnightly and rarely basis, respectively. Two seventy one respondents (90.67%) consumed mustard leaves weekly whereas only 24 (8.00%) and 3 (1.00%) respondents consumed it fortnightly and rarely basis, respectively. Forty five per cent respondents consumed mint leaves rarely followed by 9.67 per cent and 3.33 per cent on fortnightly and weekly basis, respectively while 42.00 per cent respondents didn't consumed it. Spinach was consumed by majority of the respondents (58.00%) on fortnightly; 29.67 per cent and 11.00 per cent respondents consumed it weekly and rarely basis, respectively. Radish leaves were consumed by 11.67 per cent, 2.00per cent and 1.33 per cent respondents at rarely, fortnightly and weekly basis.

Table 4.4: Frequency of food consumption of geriatric respondents

(N=300)

Food Stuffs	Daily	Alternatively	Weekly	Fortnightly	Rarely	Not consumed
Cereals and millets						
Wheat	299 (99.67)	1 (0.33)	-	-	-	
Rice	10 (3.33)	27 (7.67)	178 (59.33)	71 (27.67)	11 (3.67)	7 (2.33)
Pearl millet	-	-	11 (3.67)	150 (50.00)	21 (7.00)	118 (39.33)
Maize	-	30 (10.00)	111 (37.00)	49 (16.33)	59 (19.67)	21 (7.00)
Barley	-	-	-	4 (1.33)	25 (8.33)	231 (3.67)
Oats	-	-	-	-	20 (6.67)	280 (93.33)
Pulses						
Bengal Gram	-	52 (17.33)	186 (62.00)	51 (17.00)	8 (2.67)	3 (1.00)
Black Gram	-	-	9 (3.00)	29 (9.67)	207 (69.00)	55 (18.33)
Green Gram	5 (1.67)	227 (75.67)	60 (20.00)	4 (1.33)	2 (0.67)	2 (0.67)
Moth Bean	-	-	4 (1.33)	107 (35.67)	141 (47.00)	48 (16.00)
Lentil	-	-	2 (0.67)	27 (9.00)	151 (50.33)	120 (40.00)
Soya bean	-	-	-	15 (5.00)	51 (17.00)	234 (78.00)
Rajmah	-	-	-	-	24 (8.00)	276 (92.00)
Green Leafy vegetables						
Amaranth	-	-	25 (8.33)	266 (75.33)	46 (15.33)	3 (1.00)
Bathua	1 (0.33)	2 (0.67)	222 (74.00)	65 (21.67)	12 (3.33)	-
Coriander	80 (26.67)	71 (23.67)	53 (17.67)	45 (15.00)	47 (15.67)	4 (1.33)
Fenugreek leaves	-	16 (5.33)	252 (84.00)	28 (9.33)	4 (1.33)	-
Bengal gram leaves	-	-	213 (71.00)	64 (22.33)	18 (6.00)	5 (1.67)
Mustard	-	-	271 (90.67)	24 (8.00)	3 (1.00)	1 (0.33)
Mint	-	-	10 (3.33)	29 (9.67)	135 (45.00)	126 (42.00)
Spinach	-	-	89 (29.67)	174 (58.00)	33 (11.00)	4 (1.33)
Radish leaves	-	-	4 (1.33)	6 (2.00)	35 (11.67)	255 (85.00)
Roots and Tubers						
Carrot	-	-	271 (90.67)	8 (2.67)	4 (1.33)	12 (4.00)
Radish	-	-	11 (3.67)	221 (74.00)	64 (21.33)	3 (1.00)

Potato	15 (5.00)	265 (88.33)	13 (4.33)	3 (1.00)	2 (0.67)	2 (0.67)
Onion	260 (86.00)	14 (4.67)	13 (4.33)	1 (0.33)	4 (1.33)	8 (2.67)
Colocassia	-	-	-	69 (23.00)	206 (68.67)	25 (8.33)
Ginger	212 (71.67)	24 (8.00)	37 (12.33)	20 (6.67)	2 (0.67)	2 (0.67)
Garlic	207 (69.00)	-	20 (6.67)	-	-	60 (20.00)
Turnip	-	-	-	34 (11.33)	126 (42.00)	140 (46.67)
Sweet potato	-	-	251 (83.67)	30 (10.00)	13 (4.33)	4 (1.33)
Other Vegetables						
Brinjal	-	-	144 (48.00)	62 (20.67)	58 (19.33)	36 (12.00)
Tomato	201 (67.00)	6 (2.00)	40 (13.33)	-	53 (17.67)	-
Cauliflower	-	-	4 (1.33)	230 (76.67)	20 (6.67))	46 (15.33)
Cabbage	-	-	60 (20.00)	102 (34.00)	110 (36.67)	28 (9.33)
Green chilies	142 (47.33)	101 (33.67)	34 (11.33)	23 (7.67)	-	-
Lady finger	-	-	204 (68.00)	60 (20.00)	36 (12.00)	-
Peas (Green)		265 (88.00)	60 (20.00)	8 (2.67)	5 (1.67)	2 (0.67)
Bottle gourd	-	146 (48.67)	134 (44.67)	13 (4.33)	6 (2.00)	-
Ridge gourd	-	192 (64.00)	46 (15.33)	45 (15.00)	17 (5.67)	
Fruits						
Guava	-	2 (0.67)	207 (69.00)	75 (25.00)	11 (3.67)	5 (1.67)
Apple	3 (1.00)	56 (18.67)	187 (62.33)	39 (13.00)	15 (5.00)	-
Banana	-	10 (3.33)	115 (38.33)	134 (44.67)	39 (13.00)	1 (0.33)
Ber			40 (13.33)	64 (21.33)	185 (61.67)	11 (3.67)
Lemon	3 (1.00)	4 (1.33)	29 (9.67)	163 (54.67)	94 (31.33)	7 (2.33)
Orange	-	-	40 (13.33)	233 (77.67)	24 (8.00)	3 (1.00)
Plum	-	-	1 (0.33)	6 (2.00)	253 (84.33)	40 (13.33)
Peach	-	-	8 (2.67)	29 (9.67)	229 (76.33)	34 (11.33)
Kinow	4 (1.33)	182 (60.67)	63 (21.00)	31 (10.33)	18 (6.00)	2 (0.67)
Papaya		2 (0.67)	205 (68.33)	58 (19.67)	27 (7.00)	7 (2.33)
Dates	-	-	7 (2.33)	27 (7.00)	118 (39.33)	148 (49.33)
Amla	-	1 (0.33)	3 (1.00)	5 (1.67)	53 (17.67)	238 (79.33)

Bael	-	-	1 (0.33)	7 (2.33)	47 (15.67)	245 (81.67)
Pears	-	-	3 (1.00)	46 (15.33)	224 (74.67)	27 (9.00)
Mango	-	--	15 (5.00)	164 (54.67)	110 (36.67)	11 (3.67)
Watermelon	-	-	114 (38.00)	115 (38.33)	68 (22.67)	3 (1.00)
Muskmelon	-	-	19 (6.33)	170 (56.67)	107 (35.67)	4 (1.33)
Lichi	-	-	4 (1.33)	24 (8.00)	187 (62.33)	85 (28.33)
Milk and Milk Products						
Cow's milk	38 (12.67)	10 (3.33)	32 (10.67)	56 (18.67)	156 (52.00)	8 (2.67)
Buffalo's milk	291 (97.00)	4 (1.33)	3 (1.00)	-	2 (0.67)	-
Goat's milk	1 (0.33)	1 (0.33)	-	-	5 (2.67)	293 (97.67)
Curd	131 (43.67)	109 (36.33)	54 (18.00)	1 (0.33)	2 (0.67)	3 (1.00)
Buttermilk	64 (21.33)	158 (52.67	41 (13.67)	22 (7.33)	14 (4.67)	1 (0.33)
Paneer	-	-	90 (30.00)	84 (28.00)	123 (41.00)	3 (1.00)
Sweets (ladoo, jalebi, burfi, pera)	2 (0.67)	5 (1.67)	130 (43.33)	108 (36.00)	55 (18.33)	-
Fats and Edible oils						
Desi ghee	266 (88.67)	3 (1.00)	12 (4.00)	9 (3.00)	10 (3.33)	-
Hydrogenated fat	4 (1.33)	33 (11.00)	4 (1.33)	-	3 (1.00)	256 (85.33)
Refined oil (Brand)	87 (29.00)	49 (16.33)	42 (14.00)	23 (7.67)	42 (14.00)	57 (19.00)
Mustard oil	165 (55.00)	43 (14.33)	27 (9.00)	38 (12.67)	17 (5.67)	10 (3.33)
Butter	6 (2.00)	28 (9.33)	139 (46.33)	64 (21.33)	55 (18.33)	-

Values in parentheses indicate percentage of geriatric respondents

The consumption pattern of roots and tubers revealed that majority of the respondents (90.67%) consumed carrots at weekly basis and only 2.67 fortnightly per cent and 1.33 per cent respondents consumed it fortnightly and rarely basis, respectively (Table 4.4). Seventy four per cent respondents consumed radish fortnightly followed by 21.33 per cent and 3.67 per cent respondents at rarely and weekly basis, respectively. Majority (88.33%) of the respondents consumed potato on alternate days followed by daily (5.00%), weekly (4.33%), fortnightly (1.00%) and rarely (0.67%) basis. Eighty six per cent of the respondents consumed onion daily while 4.67 per cent, 4.33 per cent and 1.33 per cent respondents consumed it alternatively, weekly and rarely basis, respectively. Ginger was consumed by majority (71.67%) of the respondents followed by weekly (12.33%), alternatively (8.00%), fortnightly (6.67%) and rarely (0.67%) basis, respectively. Sixty nine per cent of the elderly consumed

garlic daily whereas only 6.67 per cent elderly consumed it weekly basis. Turnip was consumed by 42.00 per cent and 11.33 per cent of respondents on rarely and fortnightly basis, respectively. Majority (83.67%) of the respondents consumed sweet potato weekly while 10.00 per cent and 4.33 per cent respondents consumed it fortnightly and rarely basis, respectively. Twelve per cent geriatrics consumed any other kind of roots and tubers rarely followed by 2.00 per cent and 1.00 per cent geriatrics on fortnightly and weekly basis, respectively. Data regarding the consumption of other vegetables (Table4.4) reported that brinjal was consumed by majority of the respondents (48.00%) on weekly basis while 20.67 per cent and 19.33 per cent elderly were consuming it fortnightly and rarely, respectively. Sixty seven per cent respondents consumed tomato daily followed by rarely (17.67%), weekly (13.33%) and alternate day (2.00%), respectively. Cauliflower was consumed fortnightly by majority (76.67%) of the respondents while only 6.67 per cent and 1.33 per cent respondents consumed it rarely and weekly basis, respectively. Cabbage was consumed on weekly (20.00%), fortnightly (34.00%) and rarely (36.67%) basis by elderly respondents. Green chilies were consumed daily by majority of the respondents (47.33%); 33.67 per cent 11.33 per cent and 7.67 per cent respondents consumed it on alternate days, weekly and fortnightly, respectively. Sixty eight per cent, 20.00per cent and 12 per cent respondents consumed lady finger weekly, fortnightly and rarely basis, respectively. Eighty eight per cent respondents were consuming green peas on alternate days followed by 20.00 per cent (weekly), 2.67 per cent (fortnightly) and 1.67 per cent (rarely). Bottle gourd was consumed by 48.67per cent, 44.67 per cent, 4.33 per cent and 2.00 per cent on alternatively, weekly, fortnightly and rarely. It was found that 64.00 per cent respondents consumed ridge gourd on alternate days whereas 15.33 per cent, 15.00 per cent and 5.67 per cent respondents consumed it weekly, fortnightly and rarely basis, respectively.

Fruits are good source of vitamins, minerals, dietary fiber and electrolytes in daily diet. Table 4.4 illustrated that fruits were not consumed daily by the elderly. *Kinow*, apple and lemon was included in daily diet by 1.33 per cent, 1.00 per cent and 1.00 per cent respondents, respectively. Guava, apple, banana, lemon, *kinow*, papaya and *bael* was consumed on alternate days by 0.67 per cent, 18.67 per cent, 3.33 per cent, 1.33 per cent, 60.67 per cent, 0.67 per cent and 0.33 per cent respondents respectively. Guava (69.00%), apple (62.33%), papaya (68.33%) and watermelon (38.00%) were consumed weekly my majority of the respondents whereas banana (44.67%), lemon (54.67%), orange (77.67%) mango (54.67%) and muskmelon (56.67%) was consumed fortnightly. Ber (61.67%), peach (76.33%), plum (84.33%) and *lichi* (62.33%) were consumed rarely by most of the people. Dates, *amla* and *bael* were not consumed by most of the respondents (49.33%, 49.33% and 81.67% respectively).

Milk and milk products are excellent source of calcium and Vit D which are found deficient among geriatric's diet. Table 4.4 revealed that 12.67 per cent of respondents consuming cow's milk milk daily while 97.00 per cent respondents consumed buffalo's milk on daily basis. Curd was consumed by 43.67 per cent, 36.33 per cent, 18.00 per cent, 0.33 per cent and 0.67 per cent respondents on daily, alternatively, weekly, fortnightly and rarely basis, respectively. Buttermilk was consumed on daily, alternatively, weekly, fortnightly and rarely basis by 52.67 per cent, 21.33 per cent, 13.67 per cent 7.33 per cent and 14.33per cent, respectively. Geriatrics consumed *paneer* weekly (30.00%), fortnightly (28.00%) and rarely (41.00%) basis. Majority of elderly consumed sweets (*ladoo*/ *jalebi*/ *burfi*/ *pera*) weekly (43.33%) followed by fortnightly (36.00%), rarely (18.33%), alternatively (1.67%) and daily (0.67%) basis.

It was revealed from the Table 4.4 that most of the respondents (88.67%), consumed *desi* ghee. Twenty nine and 55.00 per cent of respondents consumed vegetable oil. Hydrogenated fat was not consumed by most of the respondents (85.33%). Vegetable oil and mustard oil is consumed by 16.33 per cent and 14.33 per cent respondents on alternate days; 14.00 per cent and 9.00 per cent respondents weekly; 7.67 per cent and 12.67 per cent respondents fortnightly and 14.00 per cent and 5,67 per cent respondents rarely basis, respectively. Majority of the respondents (46.33%) respondents consumed butter weekly followed by fortnightly (21.33%), rarely (18.33%), alternatively (9.33%) and daily (2.00%) basis, respectively.

4.2.2 Food preferences of geriatric respondents

The information regarding food preferences of geriatric respondent under study are presented in Table 4.5. It was found that all the geriatric respondents (100.00 %) preferred to consume *chapati* and milk. It was found that 98.67 per cent (97.33% rural and 100% urban), 97.00 per cent (94.00% rural and 100.00% urban), 94.67 per cent (92.00% rural and 97.33% urban), 94.00 per cent (94.67% rural and 93.33% urban) 91.67 per cent (92.00% rural and 91.33% urban) and 90.00 per cent (100.00% rural and 80.00% urban) geriatric respondents preferred to consume porridge, *khichari*, dal (split), *laapsi*, *desi* ghee and dehusked dal, respectively. It was observed that 85.67 per cent (82.67% rural and 88.00% urban) and 83.67 per cent (80.67% rural and 86.67% urban) respondents preferred to consume *kasaar* and *parantha* while 41.00 per cent (37.33% rural and 44.67% urban) and 66.00 per cent respondents (64.67% rural and 67.33% urban) liked to consume puree and *cheela*, respectively. Most of the geriatric respondents (75.67%, 73.67% and 70.33%) preferred to consume jaggery, butter and buttermilk, respectively.

Table 4.5: Food preferences of geriatric respondents

(N=300)

Sr. No.	Food Products	Rural (n=150)	Urban (n=150)	Total (n=300)
1	*Chapatti*	150 (100.00)	150 (100.00)	300 (100.00)
2.	*Parantha*	121 (80.67)	130 (86.67)	251 (83.67)
3	*Puri*	56 (37.33)	67 (44.67)	123 (41.00)
4	*Cheela*	97 (64.67)	101(67.33)	198 (66.00)
5	*Laapsi*	142 (94.67)	140 (93.33)	282 (94.00)
6	*Kasaar*	124 (82.67)	132 (88.00)	256 (85.33)
7	*Khichari*	141(94.00)	150 (100.00)	291(97.00)
8	Porridge	146 (97.33)	150 (100.00)	296 (98.67)
9	Plain rice	61 (40.67)	84 (56.00)	145 (48.33)
10	*Pulao*	85 (56.67)	96 (64.00)	181 (60.33)
11	Milk	150 (100.00)	150 (100.00)	300 (100)
12	Buttermilk	110 (73.33)	91(60.67)	211(70.33)
13	Sugar	80 (53.33)	84 (56.00)	164 (54.67)
14	Jaggery	135 (90.00)	141 (94.00)	226 (75.33)
15	*Desi* ghee	150 (100.00)	120 (80.00)	270 (90.00)
16	Butter	130 (86.67)	91 (60.67)	221(73.67)
17	Vanaspti ghee	4 (2.67)	6 (4.00)	10 (3.33)
18	Vegetable oil	86 (57.33)	102 (68.00)	188 (62.67)
19	Dehusked dal	138 (92.00)	137 (91.33)	275 (91.67)
20	Dal	138 (92.00)	146 (97.33)	284 (94.67)
21	Whole pulses	55 (36.67)	40 (26.67)	95 (31.67)
22	Processed vegetables	40 (26.67)	74 (49.33)	114 (38.00)
23	Processed fruits	25(16.67)	54 (36.00)	79 (26.67)
24	*Khoya ladoo*	77 (51.33)	59 (39.33)	136 (45.33)
25	Other *ladoo*	84 (56.00)	33 (22.00)	117 (39.00)

Values in parentheses indicate percentage

Food preferences of 48.33 per cent (40.67% rural and 56.00% urban), 60.33 per cent (56.67% rural and 64.00% urban) and 54.67 per cent (53.33% rural and 56.00% urban) were plain rice, *pulao* and sugar, respectively. Vanaspati ghee, vegetable oil, whole pulses, *khoya ladoo* and other *ladoo* were preferred by 3.33 per cent, 62.67 per cent, 45.33 per cent and 39.00 per cent respondents, respectively. It was found that processed fruits and vegetables were preferred by 38.00 per cent (16.67% rural and 36.00% urban) and 31.67 per cent (26.67) respondents among total number of respondents.

4.2.3 Food avoided by geriatric respondents

Various food items were avoided by geriatric respondents due to many reasons. It was observed that 30.33 per cent, 66.00 per cent, 68.33 per cent, 54.67 per cent and 85.00 per cent

geriatric respondents avoided consuming rice, black gram dal, *rajmah*, whole Bengal gram dal and sprouted pulses while 59.67 per cent, 34.00 per cent, 31.67 per cent, 45.33 per cent and 15.00 per cent, respectively not avoided them. Intake of vegetables i.e. brinjal, cauliflower, lady finger, potato, radish and spinach was avoided by 71.00 per cent, 74.33 per cent, 64.00 per cent, 69.00 per cent, 59.67 per cent and 66.00 per cent of respondents, respectively whereas 29.00 per cent, 25.67 per cent, 36.00 per cent, 31.00 per cent, 40.33 per cent and 34.00 per cent of respondents, respectively didn't avoided their intake for these vegetables, respectively.

Table 4.6: Food avoided by geriatric respondents

(N=300)

Sr. No.	Food Products	Avoided	Not avoided
1	Rice	91 (30.33)	199 (59.67)
2.	Black gram dhal	198 (66.00)	102 (34.00)
3	*Rajmah*	205 (68.33)	95 (31.67)
4	Whole Bengal gram	164 (54.67)	136 (45.33)
5	Sprouted pulses	255 (85.00)	45 (15.00)
6	Brinjal	213 (71.00)	87 (29.00)
7	Cauliflower	223(74.33)	77 (25.67)
8	Lady finger	192 (64.00)	108 (36.00)
9	Potato	207 (69.00)	93 (31.00)
10	Radish	179 (59.67)	121 (40.33)
11	Spinach	198 (66.00)	102 (34.00)
12	Banana	254 (84.67)	46 (15.33)
13	Orange	215 (71.67)	85 (28.33)
14	Curd	165 (55.00)	135 (45.00)
15	*Papad*	179 (59.67)	121 (40.33)
16	Pickle	201 (67.00)	99(33.00)
17	Spices	168 (56.00)	132 (44.00)
18	Cold drink	199 (66.33)	101 (33.67)
19	Coffee	241 (80.33)	59 (19.67)
20	Noodles	216(72.00)	84 (24.67)

Values in parentheses indicate percentage

Ageing brings about physiological changes which lead to onset of various diseases results in prohibition of some food items. Respondents stated that intake of black gram, rajmah, Bengal gram, sprouts, spice, *papad* and banana cause digestive disorders in them. Brinjal, spinach and lady finger increase the chances of stone formation. Rice, curd, potato, radish, pickles and cauliflower cause joint pain while orange and cold drinks cause tooth pain in elderly respondents. It was observed that curd, *papad*, pickles, spices, cold drinks, coffee and noodles were avoided by 55.00 per cent, 59.67 per cent, 67.00 per cent, 56.00 per cent, 66.333 per cent, 80.33 per cent and 72.00 per cent respondents, respectively and 45.00 per cent, 40.33 per

cent, 33.00 per cent, 44.00 per cent, 33.67 per cent, 19.67 per cent and 24.67 per cent respondents, respectively didn't avoid these food products.

4.2.4 Food consumption pattern of geriatric respondents

Food intake of selected geriatric respondents

The information regarding mean daily food intake of geriatric female has been depicted in the table.

Table 4.7: Mean daily food intake of geriatric female respondents

(n=150)

Food groups (g)	RDI	Rural (n=75)	Z-value (Z_1)	Urban (n=75)	Z-value (Z_2)	Total female (n=150)	Z-value (Z_3)
Cereals and millets	220	176.80±37.47	7.62**	155.78±40.79	11.51**	166.29±40.56	13.20**
Pulses	60	14.75±12.20	32.12**	18.23±24.85	21.68**	15.74±12.37	43.53**
Green leafy vegetables	100	33.80±24.17	20.13**	44.37±29.75	14.84**	39.49±27.71	23.62**
Other vegetables	150	45.79±29.83	43.25**	65.75±43.05	25.91**	55.70±38.19	44.55**
Fruits	100	29.03±17.27	64.91**	36.27±23.96	48.80**	32.96±21.37	75.80**
Roots and tubers	100	48.65±29.22	36.62**	40.99±22.96	41.55**	45.45±26.90	53.28**
Sugars	20	10.44±3.99	18.99**	8.51±3.40	23.98**	9.60±3.85	28.97**
Milk and milk products	300	218.77±106.02	6.64**	228.97±98.17	6.27**	223.87±101.95	9.15**
Fats and oils	20	14.42±5.94	8.14**	13.71±4.62	11.46**	14.07±5.33	13.40**

Values are Mean ±SD **Significant at 1% level *Significant at 5% level
RDI-Recommended Daily Intake (ICMR 2010) ^{NS} - Non-significant
Z_1-Rural v/s RDI Z_2-Urban v/s RDI Z_3-Total female v/s RDI

Cereals and millets: It was observed that mean intake of cereals and millets among the rural female and urban female was 176.80g and 155.78g respectively and was significantly lower than Recommended Daily Intake (RDI) among both groups. Mean daily intake of cereals and millets by geriatric female was 166.29 g, which was significantly ($p<0.01$) lower than RDI (220g).

Pulses: Data presented in the Table 4.7 revealed that pulses were consumed in the lower amount by rural female (14.75) and urban female (18.23) than Recommended dietary intake of (15.74) pulses by female was significantly ($p<0.001$) lower than RDI. It was observed that consumption of pulses was significantly lower than RDI (60g).

Green leafy vegetables: The data presented in Table 4.7 revealed that consumption of green leafy vegetables was higher among the urban female (44.37g) than that of rural female (33.80g). It was observed that consumption of green leafy vegetables was significantly ($p<0.01$) lower (39.49g) than RDI (100g) among the geriatric female of Sirsa district.

Roots and tubers: It is revealed from the data presented in the Table 4.7 revealed that mean intake of roots and tubers was significantly ($p<0.01$) lower among the rural female respondents (48.65g) than RDI and significantly lower among the urban female respondents (40.99g) than RDI. It was observed that consumption of roots and tubers was significantly ($p<0.01$) lower than that RDI (100g) among the elderly female respondents (45.45g) of Sirsa district.

Fruits: It was found that mean daily intake of fruits was 29.03 and 36.27g among the rural and urban female respondents, respectively. The mean daily intake of fruits was found to be significantly ($p<0.01$) lower (32.96g) than RDI (100g) among geriatric female.

Other vegetables: It was observed that mean daily intake of other vegetables among the rural female respondents was 45.79g and urban female respondents were 65.75g. Mean daily consumption of other vegetables among the geriatric female was significantly ($p<0.01$) lower (55.70g) lower than RDI (150g). The intake was significantly ($p<0.05$) lower than RDI given for female geriatric population.

Sugars: Intake of sugars by rural and urban geriatric female was 10.44g and 8.51g, respectively which were significantly ($p<0.001$) lower than RDI. It was revealed from the table that mean daily intake of sugars by geriatric female (9.60) was significantly ($p<0.01$) lower than RDI (20g).

Milk and milk products: Consumption of mean daily intake of milk and milk products of rural and urban female respondents was 218.77g and 228.97g respectively. Mean daily intake of milk and milk products was 223.87g. The mean daily intake of milk and milk products by geriatric female was found significantly ($p<0.01$) lower than RDI (300g).

Fats and oils: It was found that amount of fats and oils taken by rural female (14.42) was significantly lower ($p<0.01$) than RDI and similar trends were observed among urban female respondents (13.71g). Mean daily intake of fats and edibles oils by elderly female (14.07g) was significantly ($p<0.05$) lower than RDI (20g).

The information regarding mean daily food intake of geriatric male respondents has been depicted in Table 4.8.

Cereals and millets: Mean intake of cereals and millets by rural (259.45g) and (275.98g) urban respondents was significantly lower than RDI. It was found that the intake of cereals by urban respondents was higher than those of rural respondents. Mean daily intake of cereals and millets by geriatric male was 275.75g, which was significantly ($p<0.01$) lower than the RDI (275g).

Pulses: Pulses are the major source of protein in Indian diet. Comparing the means daily intake of rural and urban men to RDI, it was found that intake was 23.40g and 28.41g respectively .The mean daily intake of pulses was higher among urban respondents than rural respondents. Data presented in the Table 4.8 indicates that daily mean intake of pulses among geriatric men was 25.89g which was significantly ($p<0.01$) lower than RDI (75g).

Table 4.8: Mean daily food intake of geriatric male of respondents

(n=150)

Food groups (g)	RDI	Rural (n=75)	Z-value (Z_1)	Urban (n=75)	Z-value (Z_2)	Total male (n=150)	Z-value (Z_3)
Cereals and millets	280	259.45±68.07	3.25**	275.98±131.42	5.95**	267.75±104.63	2.02*
Pulses	75	23.40±18.21	23.88**	28.41±15.39	25.31**	25.89±16.99	34.31**
Green leafy vegetables	100	39.93±31.05	36.46**	52.62±31.77	35.33**	46.77±31.93	49.88**
Other vegetables	150	87.98±37.81	28.31**	99.55±57.26	75.19**	87.98±49.71	27.59**
Fruits	100	51.61±35.399	30.23**	71.86±48.23	19.26**	61.40±43.23	32.70**
Roots and tubers	100	44.56±20.87	47.09**	59.14±37.54	29.30**	53.67±32.67	45.11**
Sugars	20	11.01±4.34	14.29**	8.54±4.20	21.50**	9.77±4.42	25.02**
Milk and milk products	300	291.10±166.42	2. 69**	275.00±184.38	2.49*	283.53±176.48	1.99*
Fats and oils	25	18.39±6.10	5.42**	21.61±12.40	6.90**	23.85±16.23	13.01**

Values are Mean ±SD **Significant at 1% level *Significant at 5% level
RDI-Recommended Daily Intake (ICMR 2010) ^{NS} - Non-significant
Z_1-Rural v/s RDI Z_2-Urban v/s RDI Z_3-Total male v/s RDI

Green leafy vegetables: The data presented in Table 4.8 revealed that consumption of green leafy vegetables was significantly ($p<0.01$) higher among the urban male (52.32g) than that of rural male (39.93g). It was observed that consumption of green leafy vegetables was significantly ($p<0.01$) lower than RDI (100g) among the geriatric male of Sirsa district

Other vegetables: Data presented in the Table 4.8 reported that mean daily consumption of other vegetables among the geriatric men was significantly ($p<0.01$) lower (93.98g) lower than RDI (150g). It was observed that mean daily intake of other vegetables among the rural male respondents (87.98g) and urban male respondents (99.55g) was significantly ($p<0.05$) lower than RDI given for geriatrics.

Fruits: The mean daily intake of fruits was found to be significantly ($p<0.01$) lower (61.40g) than RDI (100g). It was found that mean daily intake of fruits was 51.61g and 71.86g among the rural and urban male respondents, respectively.

Roots and tubers: It is revealed from the data presented in the Table 4.8 that mean intake of roots & tubers was significantly ($p<0.01$) lower among the rural male respondents than RDI and significantly ($p<0.01$) lower among the urban male respondents to RDI. It was observed that consumption of roots & tubers was significantly ($p<0.01$) lower than that RDI (100g) among the elderly male respondents of Sirsa district.

Sugars: Intake of sugars among rural and urban male was 11.01g and 8.54g, respectively it was found to be significantly ($p<0.05$) lower than RDI. The intake of sugars was found to be significantly ($P<0.01$) lower than the RDI (20g) in elderly male which was 9.77g.

Milk and milk products: The mean daily intake of milk and milk products by geriatric male was found significantly ($p<0.01$) lower than RDI (300g).Consumption of mean daily intake of milk and milk products of rural and urban male was 291.10g and 275.00g respectively. Mean daily intake of milk and milk products was 283.53g.

Fats and edible oils: The consumption of fats & oils was 18.39g by rural and 21.61g urban male of Sirsa district. Comparing the mean daily intake with RDI, it was observed that intake of fat and oils was significantly ($p<0.01$) lower in rural male respondents than the urban elderly male respondents. Average daily intake of fats and edibles oils by the elderly male was 23.85g which was significantly ($p<0.01$) lower than RDI (25g)

4.2.5 Adequacy of food intake of geriatric respondents

It was observed that majority of female respondents (92.00%) consumed cereals 75 to 99.9 per cent of RDI, followed by 41.33 per cent, 12.67 per cent and 4.00 per cent who consumed 50 to 74.9 per cent, less than 50 per cent and 100 per cent and above the RDI, respectively (Table 4.9). Data related to adequacy of pulses revealed that 93.33 per cent of female respondents consumed pulses less than 50 per cent of RDI for pulses. Ninety four per cent of female respondents consumed less than 50 per cent of RDI while only 0.67 per cent female respondents consumed 100 per cent and above the RDI of green leafy vegetables in their daily diet. Majority of female respondents (99.33%) consumed less than 50 per cent of RDI of other vegetables. It was found that all the female respondents consumed less than 50 per cent of RDI given for fruits. Daily intake of roots and tubers of 1.33 per cent, 0.67 per cent and 8.63 per cent female respondents was 100 per cent and above, 75.00 to 99.9 per cent of RDI of roots and tubers. Ninety per cent of female respondents consumed less than 50 per cent of RDI of roots and tubers. Intake of sugars was found 75 to 99.9 per cent, 50 to 74.9 and less than 50 per cent of RDI in 12.63 per cent, 38.00 per cent and 49.33 per cent of respondents, respectively. The intake of milk and milk products was less than 50 per cent of RDI by 62.67 per cent female respondents whereas 20.67 per cent and 14.67 per cent of female respondents were consuming 50 to 74.9 per cent and 75 to 99.9 per cent of RDI given for milk and milk products, respectively. As far as consumption of fats and oils 2.00 per cent, 27.33 per cent, 31.33 per cent and 39.33 per cent female respondents are categorized in I, II, III and IV category of adequacy of food intake (Table 4.9, Fig.4.1).

Table 4.9: Adequacy of food intake by geriatric respondents

(N=300)

Food groups (g)	Female (n=150)				Male (n=150)			
	I	II	III	IV	I	II	III	IV
Cereals and pulses	6(4.00)	63(42.00)	62(41.33)	19(12.67)	6(4.00)	54(36.00)	29(19.33)	61(40.67)
Pulses	3(2.00)	1(0.67)	6(4.00)	140(93.33)	1(0.67)	11(7.33)	15(10.00)	123(82.00)
Green leafy vegetables	2(0.67)	3(2.00)	4(2.67)	141(94.00)	7(4.67)	11(7.33)	29(19.33)	103(68.67)
Other vegetables	-	-	1(0.67)	149(99.33)	3(2.00)	6(4.00)	18(12.00)	123(82.00)
Fruits	-	-	-	150(100.00)	3(2.00)	4(2.67)	10(6.67)	133(88.67)
Roots & tubers	2(1.33)	1(0.67)	13(8.67)	135(90.00)	-	1(0.67)	11(7.33)	138(92.00)
Sugars	-	19(12.67)	57(38.00)	74(49.33)	4(2.67)	19(12.67)	60(40.00)	67(44.67)
Milk and milk products	3(1.00)	22(14.67)	31(20.67)	94(62.67)	9(6.00)	11(7.33)	3(2.00)	127(84.67)
Fats and oils	3(2.00)	41(27.33)	47(31.33)	59(39.33)	7(4.67)	10(6.67)	11(7.33)	122(81.33)

I -100 per cent and above the RDI II -75 to 99.9 per cent of RDI
III -50 to 74.9 per cent of RDI IV-Less than 50 per cent of RDI
Values in parentheses indicate percentage

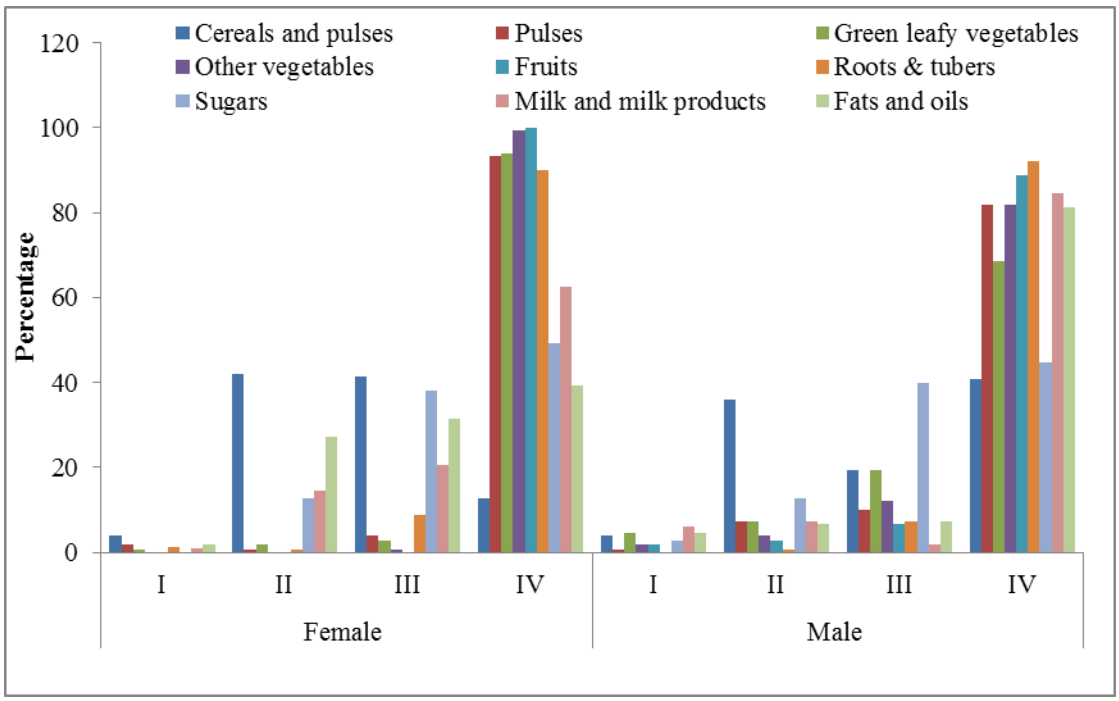

Fig. 4.1: Adequacy of food intake by geriatric respondents

It was observed that majority of male respondents (42.00%) consumed cereals less than 50 per cent of RDI, followed by 36.00 per cent, 19.33 per cent and 4.00 per cent who consumed 75 to 99.9 per cent, 50 to 74.9 per cent and 100 per cent and above the RDI, respectively(Table 4.9). Data related to adequacy of pulses revealed that 82.00 per cent of

male respondents consumed pulses less than 50 per cent of RDI for pulses whereas 7.33 per cent and 10.00 per cent of male respondents consumed 75 to 99.9 per cent, 50 to 74.9 of RDI of pulses, respectively. Majority of male respondents (68.67%) consumed less than 50 per cent of RDI while only 4.67 per cent male respondents consumed 100 per cent and above the RDI of green leafy vegetables in their daily diet. Eighty two per cent of male respondents consumed less than 50 per cent of RDI of other vegetables, 12.00 per cent respondents consumed 50 to 74.9 per cent, 4.00 per cent respondents consumed 75 to 99.9 per cent and 2.00 per cent respondents consumed 100 per cent and above of RDI of other vegetables. Intake of fruit was found 100.00 per cent and above, 75 to 99.9 per cent, 50 to 74.9 and less than 50 per cent of RDI in 2.00 per cent, 2.67 per cent, 6.67 per cent and 88.67 per cent, respectively. Ninety two per cent of female respondents consumed less than 50 per cent of RDI of roots and tubers and 7.33 per cent of male respondents consumed 50 to 74.9 per cent of RDI. Intake of sugar and jaggery was found 100 per cent and above, 75 to 99.9 per cent, 50 to 74.9 and less than 50 per cent of RDI in 2.67 per cent, 12.67 per cent, 40.00 per cent and 44.67 per cent respondents, respectively. The intake of milk and milk products was less than 50 per cent of RDI by 84.67 per cent male respondents whereas 6.00 per cent and 7.33 per cent of male respondents were consuming 100 per cent and above and 75 to 99.9 per cent of RDI given for milk and milk products, respectively. As far as consumption of fats and edible oils 4.67 per cent, 6.67 per cent, 7.33 per cent and 81.33 per cent male respondents are categorized in I, II, III and IV category of adequacy of food intake (Table 4.9).

4.2.6 Nutrient intake of geriatric respondents

The data on mean daily nutrient intake by the selected geriatric female respondents has been presented in Table 4.10, and 4.11.

Energy

Mean daily intake of energy of geriatric female has been represented according to body weight. It was observed that mean intake of energy in geriatric female of 40, 45, 50, 55, 60, 65 and 70 kg body weight (1094.69, 1055.35, 1128.99, 1164.69, 1152.96, 1133.98 and 1170.81kcal, respectively) was significantly ($p \leq 0.01$) lower than the RDA of energy recommended for respective group (1477, 1553, 1630, 1706, 1782, 1860 and 1936 kcal, respectively). The difference was highly significant ($p \leq 0.01$) in all the respondent of their respective body weight group.

Protein

Mean daily intake of protein in geriatric female was recommended (EAR- Estimated Average Requirement) according to body weight of the respondent. It was found that protein intake of geriatric female of 40, 45, 50, 55, 60, 65 and 70 kg body weight was 32.66, 33.36, 37.10, 36.88, 37.67, 35.90 and 38.45g, respectively. It was significantly ($p \leq 0.01$) lower than EAR 40.24, 45.27, 50.30, 55.33, 60.36, 65.39 and 70.42g, respectively for female

respondent's body weight. The differences were highly significant ($p \leq 0.01$) in all the respondent of their respective body weight group.

Table 4.10: Mean daily intake of energy and protein among female geriatric respondents (n=150)

Weight (kg)	RDA	Energy (kcal)	Z-value	EAR	Protein (g)	Z-value
40	1477	1094.69±156.82	10.05**	40.24	32.66±5.00	6.19**
45	1553	1055.35±186.09	11.35**	45.27	33.36±5.83	8.67**
50	1630	1128.99±145.47	15.01**	50.30	37.10±4.63	12.41**
55	17.6	1164.69±215.86	10.64**	55.33	36.88±6.97	11.23**
60	1782	1152.96±190.23	15.86**	60.36	37.67±7.91	13.76**
65	1860	1133.98±230.80	15.41**	65.39	35.90±6.94	20.82**
70	1936	1170.81±228.98	20.87**	70.42	38.45±7.98	25.01**

Values are Mean ±SD; **Significant at 1% level; *Significant at 5% level ^{NS} - Non-significant
RDI-Recommended Dietary Intake (ICMR 2010)
EAR-Estimated Average Requirement (ICMR 2010)
Z_1-Mean energy intake v/s RDA Z_2-Mean protein intake v/s EAR

Table 4.11: Mean daily nutrient intake of geriatric female of respondents

(n=150)

Nutrients	RDA	Rural (n=75)	Z-value (Z_1)	Urban (n=75)	Z-value (Z_2)	Total female (n=150)	Z-value (Z_3)
Fat (g)	20	15.45±8.93	4.45**	14.29±8.27	5.66**	14.27±8.77	7.16**
Calcium (mg)	800	551.63±135.63	15.86**	516.23±111.87	21.67**	533.93±125.17	26.03**
Phosphorus (mg)	800	676.27±171.69	3.20**	695.68±142.02	6.36**	735.97±162.15	4.84**
Iron (mg)	17	9.89±2.11	29.04**	9.74±2.25	27.92**	9.81±2.18	40.35**
Magnesium (mg)	310	278.65±64.40	4.86**	282.35±54.81	4.37**	280.50±59.62	6.06**
Zinc (mg)	10	6.07±1.35	25.22**	6.60±1.31	22.42**	6.33±1.35	33.17**
B-Carotene (µg)	4800	1824.39±224.98	7.43**	2544.51±292.78	8.29**	2187.20±154.55	14.25**
Thiamin(mg)	1.0	0.87±0.19	5.89**	0.97±0.19	1.43^{NS}	0.92±0.19	5.01**
Riboflavin (mg)	1.1	0.74±0.16	18.25**	0.74±0.14	22.06**	0.74±0.15	28.20**
Niacin (mg)	12	5.19±1.36	43.30**	5.29±1.28	63.98**	5.29±1.28	63.98**
Folic acid (µg)	200	142.52±33.40	14.68**	138.48±30.17	17.66**	140.50±32.04	22.74**
B_{12} (µg)	1.0	0.62±0.31	17.51**	0.71±0.18	12.94**	0.67±0.93	20.91**
Vitamin C (mg)	40	30.91±20.87	3.70**	21.23±17.79	9.04**	26.07±20.01	8.53**

Values are Mean ±SD **Significant at 1% level *Significant at 5% level
RDA-Recommended Dietary Allowances (ICMR 2010) ^{NS} - Non-significant
Z_1-Rural v/s RDA Z_2-Urban v/s RDA Z_3-Total female v/s RDA

Fat

The mean daily intake of fat by the geriatric rural female and urban female was significantly ($p \leq 0.0$ 1) lower (15.45 g and14.29 g, respectively) than RDA. The mean daily intake of fat in total geriatric female was found to be 14.27 g which was significantly ($p \leq 0.0$ 1) lower than the RDA.

Calcium

The calcium intake of rural and urban geriatric female was significantly ($p \leq 0.01$) lower (551.36mg and 516.23mg, respectively) than RDA for geriatric (800mg). The mean daily intake of calcium was 533.93 mg which was significantly ($p \leq 0.01$) lower than RDA in geriatric female.

Phosphorus

The phosphorus intake of rural and urban female respondents was significantly ($p \leq 0.01$) lower (676.27 mg and 695.68mg, respectively) than RDA of geriatric female respondents. The mean daily intake of phosphorus was 735.97 mg which was the significantly ($p \leq 0.01$) lower than RDA (800mg).

Magnesium

The magnesium intake of rural and urban female respondents was significantly ($p \leq 0.01$) lower (278.65 mg and 282.35 mg, respectively) than RDA of geriatric female respondents. The mean daily intake of magnesium was 280.50 mg which was the significantly ($p \leq 0.01$) lower than RDA (310mg).

Iron

It was found that the intake of iron was significantly ($p \leq 0.01$) lower in rural and urban female (9.89 mg and 9.74 mg, respectively) than RDA (17.00 mg). Mean daily intake of Iron in elderly female respondents was found to be 9.81 mg which was significantly ($p \leq 0.01$) lower than RDA in female respondents.

Zinc

Mean daily intake of zinc in pregnant female was found to be 6.33 mg which was significantly ($p \leq 0.01$) lower than RDA (10mg). It was found that the intake of zinc was significantly ($p \leq 0.01$) lower in rural and urban female respondents (6.07 mg and 6.60 mg, respectively) than RDA of zinc for geriatric female respondents.

β- Carotene

It was found that geriatric female of rural and urban area had significantly ($p \leq 0.01$) lower intake (1824.39μg and 2544.51μg) of β- carotene than RDA. The mean daily intake of β- carotene was 2187.20 μg in geriatric female respondent was significantly ($p \leq 0.01$) lower than the RDA (4800.00 μg).

Thiamine

The mean daily intake of thiamine by geriatric female (0.92mg) was significantly ($p \leq 0.01$) lower than the RDA. Comparison showed that the intake of thiamine was significantly ($p \leq 0.01$) lower in geriatric female respondents of rural and urban (0.87mg and 0.97mg, respectively) than RDA.

Riboflavin

The mean daily intake of riboflavin in pregnant female was 0.74 mg, which was significantly ($p \leq 0.01$) lower than the RDA. The intake of riboflavin is significantly ($p \leq 0.01$) lower in geriatric female respondents of rural and urban area (0.74 mg and 0.74mg, respectively) than RDA (1.1mg).

Niacin

The mean daily intake of Niacin was found to be 5.29 mg, which was significantly ($p \leq 0.01$) lower than the RDA (12.00mg). It was found that intake of niacin was significantly ($p \leq 0.01$) lower in rural and urban elderly female (5.19 mg and .29mg, respectively) than RDA of elderly female.

Folic Acid

The data depicted in table 4.10, revealed that the daily mean intake of folic acid in geriatric female respondents was significantly ($p \leq 0.01$) lower than the RDA i.e. 140.50 μg . Comparison showed that the mean daily intake of rural and urban female (142.52 μg and 138.48 μg, respectively) was lower than female RDA (200.00 μg).

Vitamin B_{12}

The mean daily intake of vitamin B_{12} in elderly female was 0.67 μg, which was significantly ($p \leq 0.01$) lower than RDA. The intake of vitamin B_{12} was significantly ($p \leq 0.01$) lower in rural and urban elderly female respondents (0.62 μg and 0.71 μg, respectively) than RDA (1.00 μg).

Vitamin C

On comparing the mean daily intake of vitamin C it was found that intake by geriatric female respondents of rural and urban area was significantly ($p \leq 0.01$) lower (30.91 mg and 21.23 mg, respectively) than the RDA of vitamin C. Mean nutrient intake showed that the mean daily intake of vitamin C was found to be 26.07 mg i.e. significantly ($p \leq 0.01$) lower than the RDA.

The data on mean daily nutrient intake by the selected geriatric male respondents has been presented in Table 4.12, and 4.13.

Energy

Mean daily intake of energy of geriatric male has been represented according to body weight. It was observed that mean intake of energy in geriatric male of 45, 50, 55, 60, 65, 70 and 75 kg body weight (1499.19, 1568.48, 1663.53, 1583.39, 1665.42, 1728.12 and 1690.20

kcal, respectively) was significantly ($p \leq 0.01$) lower than the RDA of energy recommended for respective group (1590, 1688, 1786, 1883, 1981, 2079 and 2177 kcal, respectively) except in the male respondents with 45 kg and 50 kg body weight (differed non-significantly).

Table 4.12: Mean daily intake of energy and protein among male geriatric

(n=150)

Weight (kg)	RDA	Energy (kcal)	Z-value (Z_1)	EAR (Protein)	Protein (g)	Z-value (Z_2)
45	1590	1499.19±149.22	1.83 ^{NS}	45.27	50.97±12.11	5.70**
50	1688	1568.48±305.42	1.41 ^{NS}	50.30	52.45±10.76	0.70 ^{NS}
55	1786	1663.53±333.91	2.42*	55.33	49.79±12.21	1.96*
60	1883	1583.39±285.81	4.45**	60.36	50.61±8.46	4.89**
65	1981	1665.42±802.18	1.98*	65.39	47.81±12.78	6.74**
70	2079	1728.12±291.43	5.24**	70.42	53.92±9.48	7.59**
75	2177	1690.20±374.16	9.01**	75.45	54.44±13.55	8.49**

Values are Mean ±SD; **Significant at 1% level; *Significant at 5% level ^{NS} - Non-significant
RDA-Recommended Dietary Allowances (ICMR 2010)
EAR-Eatimated Average Requirement (ICMR 2010)
Z_1-Mean energy intake v/s RDA Z_2-Mean protein intake v/s EAR

Protein

Mean daily intake of protein in geriatric female was recommended (EAR- Estimated Average Requirement) according to body weight of the respondent. It was found that protein intake of geriatric female of 45, 50, 55, 60, 65, 70 and 75 kg body weight (50.97, 52.45,49.79, 50.61, 47.81, 53.92 and 54.44g, respectively) was significantly ($p \leq 0.01$) lower than EAR (45.27, 50.30, 55.33, 60.36, 65.39, 70.42 and 75.45g, respectively) except in the male respondents with 45 kg and 50 kg body weight. It was observed that protein intake of male respondents with 45 kg body weight was significant ($p \leq 0.01$) higher (50.97g) than the EAR of male respondents for the respective group (45.27g). The difference was non-significant in male respondent with 50 kg body weight in their protein intake and EAR of protein for respective group.

Fat

While comparing the mean daily intake of fat by the geriatric rural male and urban female to RDA, it was found that intake of fat by geriatric male (24.43g) from rural area differed non-significantly ($p \leq 0.01$) while the intake of fat by geriatric male (24.43g) from urban area was significantly ($p \leq 0.01$) lower (21.99g) than the RDA. The mean daily intake of fat in total geriatric male was found to be 23.47 g which differed non-significantly ($p \leq 0.0\ 1$) than the RDA (25g).

Calcium

The calcium intake of rural and urban geriatric male was significantly ($p \leq 0.01$) lower (720.01mg and 674.09 mg, respectively) than RDA for geriatric (800mg). The mean daily intake of calcium was 697.05 mg which was significantly ($p \leq 0.01$) lower than RDA in geriatric male.

Table 4.13: Mean daily nutrient intake of geriatric male respondents

(n=150)

Nutrients	RDA	Rural (n=75)	Z-value (Z_1)	Urban (n=75)	Z-value (Z_2)	Total male (n=150)	Z-value (Z_3)
Fat (g)	25	24.43±8.26	1.59 ^{NS}	21.99±11.66	2.37*	23.47±12.06	0.46 ^{NS}
Calcium (mg)	800	720.01±167.05	4.15**	674.09±168.77	6.46**	697.05±168.25	7.45**
Phosphorus (mg)	800	762.61±248.79	1.30**	824.67±459.65	2.35*	793.64±377.20	1.42 ^{NS}
Magnesium (mg)	340	308.12±183.93	1.50 ^{NS}	255.39±90.04	8.14**	281.76±146.73	4.86**
Iron (mg)	17	14.38±3.60	6.28**	13.64±2.81	10.38**	14.01±3.24	11.29**
Zinc (mg)	12	9.65±2.50	8.12**	9.28±1.78	13.23**	9.47±2.17	14.28**
B-Carotene (µg)	4800	2473.51±212.78	8.29**	2971.57±242.74	7.43**	2817.20±104.55	14.25**
Thiamin(mg)	1.2	1.02±0.27	0.88 ^{NS}	1.03±0.30	1.46 ^{NS}	1.01±0.29	1.49 ^{NS}
Riboflavin (mg)	1.4	1.00±0.20	17.54**	1.14±0.29	7.48**	1.07±0.26	15.39**
Niacin (mg)	16	8.95±3.63	16.81**	8.09±1.93	35.57**	8.12±2.93	31.28**
Folic acid (µg)	200	185.28±38.48	3.31**	178.61±35.17	5.27**	181.95±36.89	5.99**
B_{12} (µg)	1.0	0.87±0.19	5.89**	0.97±0.19	1.43 ^{NS}	0.92±0.19	5.00**
Vitamin C (mg)	40	35.23±15.55	2.57**	31.38±5.55	8.45**	33.31±11.79	6.95**

Values are Mean ±SD **Significant at 1% level *Significant at 5% level
RDA-Recommended Dietary Allowances (ICMR 2010) ^{NS} -Non-significant
Z_1-Rural v/s RDA Z_2-Urban v/s RDA Z_3-Total male v/s RDA

Phosphorus

The phosphorus intake of rural male respondents was significantly ($p \leq 0.01$) lower (762.61 mg and 824.67 mg) than RDA whereas the phosphorus intake of urban male was significantly ($p \leq 0.05$) higher (824.67g) than RDA for geriatric male respondents. The mean daily intake of phosphorus was 793.97 mg which differed non- significantly ($p \leq 0.01$) to RDA (800mg).

Magnesium

The magnesium intake of rural and urban male respondents was significantly ($p \leq 0.01$) lower (305.12 mg and 255.39 mg, respectively) than RDA of geriatric male

respondents. The mean daily intake of magnesium was 281.76 mg which was the significantly ($p \leq 0.01$) lower than RDA (340mg).

Iron

Mean daily intake of Iron in elderly female respondents was found to be 14.01 mg which was significantly ($p \leq 0.01$) lower than RDA in geriatric male. It was found that the intake of iron was significantly ($p \leq 0.01$) lower in rural and urban male (14.38 mg and 13.64 mg, respectively) than RDA (17.00 mg).

Zinc

It was found that the intake of zinc was significantly ($p \leq 0.01$) lower in rural and urban male respondents (9.65 mg and 9.28 mg, respectively) than RDA of zinc for geriatric male respondents. Mean daily intake of Iron in pregnant female was found to be 9.47 mg which was significantly ($p \leq 0.01$) lower than RDA (12mg).

β- Carotene

It was found that geriatric male of rural and urban area had significantly ($p \leq 0.01$) lower intake (2473.51μg and 2971.57 μg) of β- carotene than RDA. The mean daily intake of β- carotene was 2817.20 μg in geriatric male respondent was significantly ($p \leq 0.01$) lower than the RDA (4800.00 μg).

Thiamine

The average intake of thiamine was lower in geriatric male respondents of rural and urban (1.02 mg and 1.03mg, respectively) than RDA of geriatric male but differed non-significantly. The mean daily intake of thiamine by geriatric male (1.01mg) was lower than the RDA (1.2 mg) and a non- significant difference was observed.

Riboflavin

The mean daily intake of riboflavin in pregnant female was 1.07 mg, which was significantly ($p \leq 0.01$) lower than the RDA (1.4mg). The intake of riboflavin is significantly ($p \leq 0.01$) lower in geriatric male respondents of rural and urban area (1.04 mg and 1.14mg, respectively) than RDA.

Niacin

The mean daily intake of Niacin was found to be 8.52 mg, which was significantly ($p \leq 0.01$) lower than the RDA (16.00mg). It was found that intake of niacin was significantly ($p \leq 0.01$) lower in rural and urban elderly female (8.95 mg and 8.09mg, respectively) than RDA of elderly male respondents.

Folic Acid

The data depicted in table 4.12, revealed that the daily mean intake of folic acid in geriatric female respondents was significantly ($p \leq 0.01$) lower than the RDA i.e. 181.95 μg . Comparison showed that the mean daily intake of rural and urban male (185.28 μg and 178.61 μg, respectively) was lower than RDA (200.00 μg).

Vitamin B_{12}

The intake of vitamin B_{12} was significantly ($p \leq 0.01$) lower in rural and urban elderly male respondents (0.87 µg and 0.97 µg, respectively) than RDA (1.00 µg). The mean daily intake of vitamin B_{12} in elderly female was 0.92 µg, which was significantly ($p \leq 0.01$) lower than RDA.

Vitamin C

It was observed that vitamin C intake by geriatric male respondents of rural and urban area was significantly ($p \leq 0.01$) lower (35.23 mg and 31.38mg, respectively) than the RDA of vitamin C. The mean daily intake of vitamin C was found to be 33.31 mg i.e. significantly ($p \leq 0.01$) lower than the RDA (40g).

4.2.7 Adequacy of nutrient intake geriatric respondents

The results regarding adequacy of nutrient intake of geriatric respondents have been depicted in Table 4.14. The adequacy of different nutrients as compared to their respective RDAs has been discussed individually.

Perusal of results showed that energy intake of 28.00 per cent, 22.00 per cent and 50 per cent of geriatric female was 75 to 99.9 per cent, 50 to 74.9 per cent and less than 50 per cent of RDA. Adequacy of protein revealed that majority of female respondents (59.33%) were taking less than 50 per cent of EAR of protein while 38.00 per cent of female were in the rage of 50 to 74.9 per cent and 2.67 per cent of female were in the rage of 75 to 99.9 per cent of EAR of protein for geriatric female respondents. It was observed that most of the female geriatric respondents (60.00%) were taking less than 50 per cent of RDA, followed by 30.00 per cent and 10.00 per cent female respondents those were taking 50 to 74.9 per cent and 75 to 99.9 per cent of fat in their daily diet. Ninety two per cent of geriatric female respondents were consuming less than 50 per cent of RDA of calcium whereas 8.00 per cent female were consuming 50 to 74.9 per cent of RDA given for geriatric female, respectively. As many as 72.00 per cent of elderly female respondents consumed fat less than 50 per cent of the RDA while 16.67 per cent and 31.33 per cent of respondents were consuming 50 to 74.9 per cent and 75 to 99.9 per cent of RDA of phosphorus given for geriatric female respondents, respectively.

It was found that intake of iron in majority of the respondents (90.00 %) was less than 50 per cent while 10.00 per cent respondents were taking 50 to 74.9 per cent of RDA of iron given for geriatric female respondents. Adequacy of zinc intake revealed that most of geriatric female respondents (98.00%) consumed less than 50 per cent of RDA and 2.00 per cent geriatric female respondents consumed 50 to 74.9 per cent of RDA of zinc recommended for them. All the geriatric female respondents (100.00%) were consuming less than 50 per cent of RDA of β- carotene. Most of the respondents (90.67%) were taking less than 50 per cent of RDA of vitamin C followed by 8.00 per cent and 1.00 per cent respondents who consumed 50

to 74.9 per cent and 75 to 99.9 per cent of RDA of vitamin C, respectively. Thiamin was consumed in the range of 75 to 99.9 per cent, 50 to 74.9 per cent and less than 50 per cent of RDA by 3.33 per cent, 10.67 per cent and 86.00 per cent of geriatric female respondents, respectively. Majority of the respondents (82.00% and 72.67%) consumed less than 50 per cent of RDA of riboflavin and niacin while 18.00 per cent and 27.33 per cent respondents consumed 50 to 74.9 per cent of RDA of riboflavin and niacin, respectively. Ninety per cent of geriatric female respondents were taking less than 50 per cent of RDA of folic acid while 0.67 per cent and 2.67 per cent of geriatric female respondents were taking 75 to 99.9 per cent and 50 to 74.9 per cent of RDA of folic acid, respectively. Vitamin B_{12} was consumed less than 50 per cent of RDA by all the geriatric female respondents.

Table 4.14: Adequacy of nutrient intake by geriatric respondents

(N=300)

Nutrients	Female (n=150)				Male (n=150)			
	I	II	III	IV	I	II	III	IV
Energy (kcal)	-	42(28.00)	33(22.00)	75(50.00)	5(3.33)	8(5.33)	70(46.67)	67(44.67)
Protein (g)	-	4 (2.67)	57(38.00)	89(59.33)	2(1.33)	12(8.00)	65(43.33)	71(47.33)
Fat (g)	-	15(10.00)	45(30.00)	90(60.00)	7(4.67)	12(8.00)	73(48.67)	58(38.67)
Calcium (mg)	-	-	12(8.00)	138(92.00)	5(3.33)	15(10.00)	93(62.00)	37(24.67)
Phosphorus (mg)	-	17(31.33)	25(16.67)	108(72.00)	11(7.33)	13(8.67)	102(68.00)	24(16.00)
Magnesium (mg)	-	2(1.33)	25(1667)	123(82.0)	-	8(5.33)	27(18.00)	115(76.67)
Iron (mg)	-	-	15(10.00)	135(90.00)	-	5(3.33)	57(38.00)	88(59.00)
Zinc (mg)	-	-	3(2.00)	147(98.00)	2(1.33)	4 (2.67)	33(22.00)	111(74.00)
B-Carotene (µg)	-	-	-	150(100.00)	-	-	14 (9.33)	136(90.67)
Thiamin(mg)	-	5(3.33)	16(10.67)	129(86.00)	2(1.33)	4 (2.67)	57(38.00)	87(58.0)
Riboflavin (mg)	-	-	27(18.00)	123(82.00))	-	1(0.67)	41(27.33)	108(72.00)
Niacin (mg)	-	-	41(27.33)	109(72.67)	-	-	57(38.00)	93(62.00)
Folic acid (µg)	-	1(0.67)	4(2.67)	135(90.00)	1(0.67)	13(8.67)	65(43.33)	71(47.33)
B_{12}(µg)	-	-	-	150(100.00)	-	3(2.00)	11(7.33)	136(90.67)
Vitamin C (mg)	-	2(1.33)	12 (8.00)	136(90.67)	-	3(2.00)	30(20.00)	117(58.00)

I 100 per cent and above the RDI II 75 to 99.9 per cent of RDI
III 50 to 74.9 per cent of RDI IV Less than 50 per cent of RDI
Values in parentheses indicate percentage

It is evident from the data in Table 4.14 that the majority of male geriatric respondents (46.67%) were consuming 50 to 74.9 per cent of RDA and 44.67 per cent were consuming less than 50 per cent per cent of RDA and 5.33 per cent of respondents consumed 75 to 99.9 per cent of RDA and 3.33 per cent of respondents were consuming 100 per cent and above of RDA of energy. Protein intake was lying in the category I, II, III and IV of EAR

by 1.33 per cent, 8.00 per cent, 43.33 per cent and 47.33 per cent of male geriatric respondents, respectively. It was observed that 4.67 per cent, 8.00 per cent, 48.67 per cent and 38.67 per cent of male geriatric respondents consumed 100 per cent and above, 75 to 99.9 per cent, 50 to 74.9 per cent and less than 50 per cent of RDA of fat recommended for male geriatric respondents, respectively. Majority of the respondents (62.00%) consumed less than 50 per cent of RDA of calcium followed by 24.67 per cent, 10.00 per cent and 3.33 per cent of respondents who consumed 50 to 74.9 per cent, 75 to 99.9 per cent and 100 per cent and above of RDA, respectively. It was observed that phosphorus intake was lying in the rage of 100 per cent and above, 75 to 99.9 per cent, 50 to 74.9 per cent and less than 50 per cent of RDA by 7.33 per cent, 8.67 per cent, 16.00 per cent and 68.00per cent of male geriatric respondents, respectively. Majority of the male geriatric respondents (76.67% and 59.00%) were consuming less than 50 per cent of RDA of magnesium and iron, followed by 18.00 per cent and 38.00 per cent who consumed 50 to 74.9 per cent of RDA and 5.33 per cent and 3.33 per cent of male respondents who were consuming 75 to 99.9 per cent of RDA of magnesium and iron, respectively. Intake of zinc was laying in the category of adequacy I, II, III, and IV by 1.33 per cent, 2.67 per cent, 22.00 per cent and 74.00 per cent of male geriatric respondents, respectively. Majority of male geriatric respondents (90.67%) consumed less than 50 per cent of RDA of β- carotene while 9.33 per cent male geriatric respondents consumed 50 to 74.9 per cent of RDA of β- carotene. Fifty eight per cent of respondents consumed less than 50 per cent of RDA of vitamin C, 20.00 per cent respondents consumed 50 to 74.9 per cent and 2.00 per cent respondents consumed 75 to 99.9 per cent of RDA of vitamin C, respectively. It was observed that 1.33 per cent, 2.67 per cent, 38.00 per cent and 58.00 per cent of male geriatric respondents consumed thiamin 100 per cent and above, 75 to 99.9 per cent, 50 to 74.9 per cent and less than 50 per cent of RDA, respectively. Seventy two per cent of respondents consumed riboflavin less than 50 per cent of RDA, followed by 27.33 per cent and 0.67 per cent respondents who consumed riboflavin 50 to 74.9 per cent and 75 to 99.9 per cent of RDA, respectively. Majority of the respondents (62.00%) consumed niacin less than 50 per cent of RDA whereas 38.00 per cent of respondents consumed niacin 50 to 74.9 per cent of RDA. It was evident from the data in Table 4.14 that intake of folic acid was 100 per cent and above, 75 to 99.9 per cent, 50 to 74.9 per cent and less than 50 per cent of RDA in 0.67 per cent, 8.67 per cent, 43.33 per cent and 47.33 per cent of male geriatric respondents, respectively. Two per cent respondents consumed 75 to 99.9 per cent of RDA, 7.33 per cent respondents consumed 50 to 74.9 per cent of RDA and 90.67 per cent respondents consumed less than 50 per cent of RDA of vitamin B_{12}, respectively.

4.2.8 Association of socio-economic variables with food consumption and nutrient intake of geriatric respondents

The data on association of socio economic variables with food and nutrient intake of selected geriatric respondents has been presented in Tables 4.15 to 4.41.

4.2.8.1 Association of food intake with socio-economic variables:

Family arrangement

Table 4.15 (Fig. 4.2) illustrated that mean daily intake of geriatric female of cereals and millets was found to be significantly (P<0.01) higher among the respondents those were living in nuclear (160.72g) and joint families (166.95g) than those living alone (158.00).

Table 4.15: Association of family arrangement with mean daily food intake of geriatric female respondents (n=150)

Food groups (g)	Mean daily intake		
	Alone (n=5)	Nuclear (n=11)	Joint (n=134)
Cereals and millets	158.00±24.25 [a]	160.72±24.61 [b]	166.95±22.41 [b]
Pulses	15.67±4.36 [a]	16.25±6.45 [a]	16.68±4.45 [a]
Green leafy vegetables	39.57±17.94 [b]	21.33±10.00 [a]	41.37±18.70 [b]
Other vegetables	34.58±8.95 [a]	35.89±13.41 [a]	58.21±13.84 [b]
Fruits	15.56±1.96 [a]	28.14±9.59 [b]	33.47±11.59 [b]
Roots & tubers	44.26±15.67 [a]	47.67±13.17 [a]	46.20±17.40 [a]
Sugars	9.53±1.04 [a]	9.79±3.94 [a]	9.58±3.85 [a]
Milk & milk products	188.67±3521 [a]	204.58±85.07 [a]	241.02±52.71 [b]
Fat and oils	12.80±4.38 [a]	15.23±4.82 [b]	14.42±4.18 [b]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

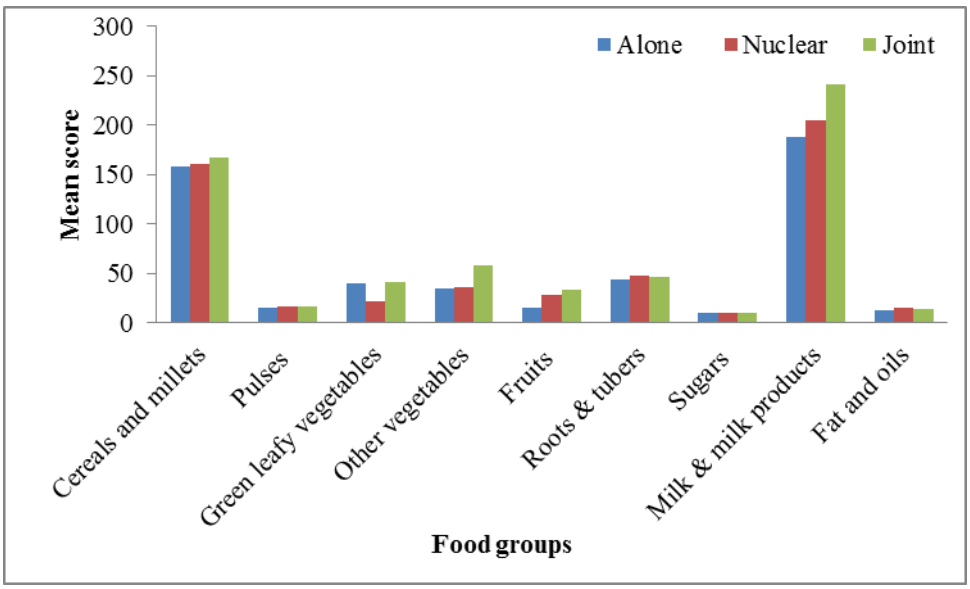

Fig. 4.2: Association of family arrangement with mean daily food intake of geriatric female respondents

It was observed that consumption of pulses was 15.67g, 16.25g and 16.68 g in respondents living alone, nuclear families and joint families, respectively. Average intake of green leafy vegetables was significantly ($p<0.01$) higher among the respondents living alone (39.57g) and living in joint families (41.37g) than that of living in nuclear families (21.33g). Female respondents from joint families were taking significantly ($p<0.01$) higher amount (58.21g) of other vegetables than those respondents living alone (34.58g) and living in nuclear families (35.89g). Mean daily intake of fruits was significantly ($p<0.01$) high among the respondents living in nuclear families (28.14g) and living in joint families (33.47g) than that of living alone (15.56g). Table 4.15 showed that mean daily intake of roots and tubers ranged from 44.26g to 47.67g among the female respondents. A narrow range of variation was observed among the female respondents for mean daily intake of sugars (9.53g to 9.78g). It was found that mean daily intake of milk and milk product was significantly ($p<0.01$) higher among the female respondents living in joint families (241.02g) than that of living alone (188.67g) and living in nuclear families (204.58g). Mean daily intake of fats and oils was significantly ($p<0.01$) higher among the female respondents from nuclear families (15.23g) and joint families (14.42g) than that of female respondents living alone (12.80g)

Table 4.16: Association of family arrangement with mean daily food intake of geriatric male respondents (n=150)

Food groups (g)	Mean daily intake		
	Alone (n=6)	Nuclear (n=17)	Joint (n=127)
Cereals and millets	242.75±60.39 [a]	240.28±63.10 [a]	252.38±94.44 [a]
Pulses	21.69±8.38 [a]	19.89±4.34 [a]	22.21±6.94 [a]
Green leafy vegetables	35.01±20.13 [a]	36.66±6.67 [a]	47.89±3.04 [b]
Other vegetables	82.30±19.77 [a]	86.94±22.82 [a]	86.96±20.57 [a]
Fruits	53.67±20.15 [a]	58.75±12.71 [a]	52.13±14.32 [a]
Roots and tubers	58.97±13.43 [a]	60.00±16.55 [a]	61.32±14.79 [a]
Sugars	9.35±3.40 [a]	8.91±2.32 [a]	10.01±3.56 [a]
Milk & milk products	260.15±56.07 [a]	288.74±103.60 [b]	288.93±94.38 [b]
Fat and oils	15.14±6.70 [a]	18.72±4.13 [a]	16.41±3.23 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Data in Table 4.16 (Fig. 4.3) depicts the association of family arrangement with mean food intake of male geriatric respondents. The mean daily intake of cereals was significantly ($p<0.05$) higher among the male respondents from joint families (262.38g) than that of respondents living alone (242.75g) and respondents nuclear family respondents (240.28g) but the difference was non-significant. Average intake of pulses was highest (22.21 g) in respondents from joint families and lowest (19.89 g) in respondents from nuclear families.

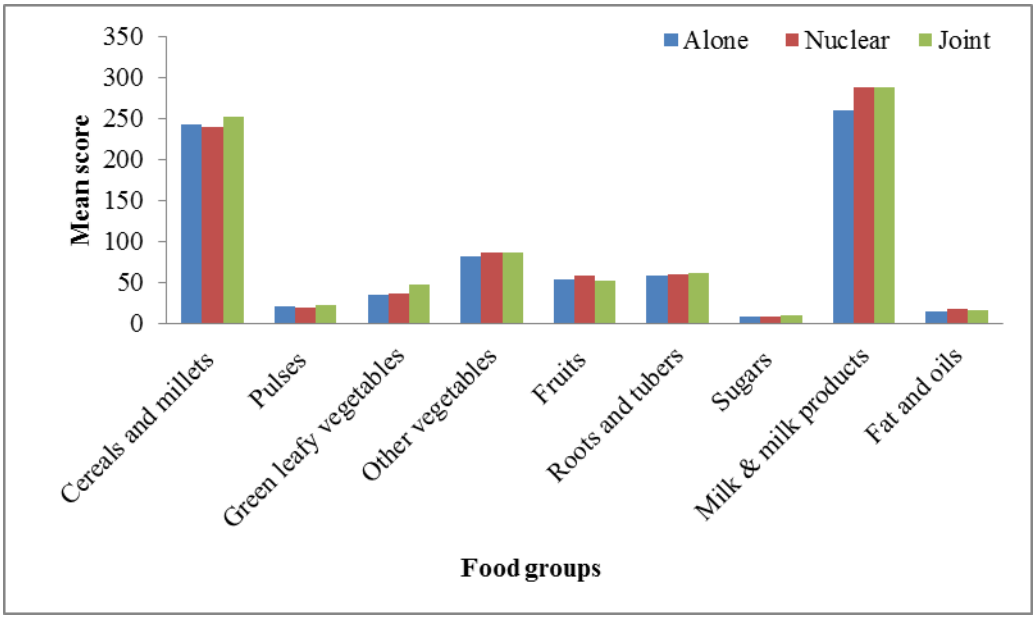

Fig. 4.3: Association of family arrangement with mean daily food intake of geriatric male respondents

Mean daily intake of green leafy vegetables was significantly ($p<0.01$) higher among the male respondents living in joint families than that of those living alone and living in nuclear families (35.01g and 36.66g, respectively). The mean daily intake of other vegetables among male respondents ranged from 82.30 g (living alone) to 86.96g (joint families). The mean daily intake of fruits was 53.67g, 58.75g and 52.13g in the male respondents living alone, living in nuclear families and living in joint families, respectively. A narrow range of variation was found for the intake of roots and tubers (58.97g-61.32g), sugars (8.91g to 10.01g) and fats and oils (15.14g -18.72g). Mean daily intake of milk and milk products was significantly ($p<0.01$) higher among the respondents from nuclear families (288.74g) and joint families (288.93g) than that of respondents living in nuclear families (260.15g).

Family size

The association of family size and food intake has been depicted in Table 4.17 (Fig. 4.4). Results showed that mean daily intake of pulses (17.67 g), fats and edible oils (14.19 g), sugar and jaggery (9.50 g) and other vegetables (58.17g) was highest among female geriatric respondents belonging to medium sized families but differed non- significantly from small sized and large sized families whereas cereals (170.15g) and fruits (33.97g) were highest in large sized and small sized families, respectively.

Table 4.17: Association of family size with mean daily food intake of geriatric female respondents (n=150)

Food groups (g)	Mean daily intake		
	Small (n=29)	Medium (n=94)	Large(n=22)
Cereals and millets	166.62±26.33 [a]	166.34±31.71 [a]	170.15±36.15 [a]
Pulses	14.35±8.71 [a]	17.67±6.31 [a]	15.07±6.71 [a]
Green leafy vegetables	36.78±8.80 [a]	43.30±15.17 [b]	39.66±12.53 [a]
Other vegetables	51.85±20.58 [a]	58.17±16.79 [a]	50.75±19.50 [a]
Fruits	33.97±9.88 [a]	33.63±8.70 [a]	28.20±10.09 [a]
Roots & tubers	49.73±20.19 [b]	48.32±13.45 [b]	30.33±16.04 [a]
Sugars	9.47±3.40 [a]	9.50±3.46 [a]	7.46±4.15 [a]
Milk and milk products	277.04±94.63 [a]	308.89±101.95 [b]	288.69±96.04 [a]
Fat and oils	13.06±3.61 [a]	14.19±5.20 [a]	14.07±4.03 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

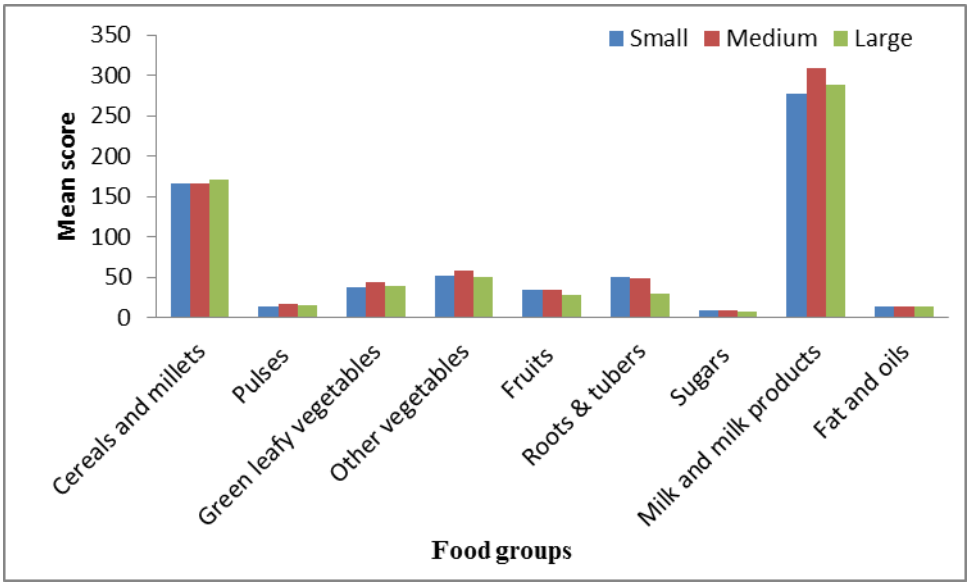

Fig. 4.4: Association of family size with mean daily food intake of geriatric female respondents

It was observed that intake of milk and milk products (308.89g) and green leafy vegetables (48.32g) was significantly ($p<0.01$) higher in medium sized family respondents than respondents belonging to small sized families (277.04g and 36.78g) and large sized families (288.69g and 39.66g). Roots and tubers were consumed in significantly ($p<0.01$) higher amount by the female respondents of small sized families (49.73g) than large sized female respondents (30.33g) but non- significantly than medium sized family respondents (48.32g).

The results in Table 4.18 (Fig. 4.5) revealed that the intake of cereals (277.04g) was significantly ($p<0.01$) higher in male respondents from large families than small sized

(252.21g) but differed non- significantly ($p<0.01$) from medium sized family respondents (271.14g). Average intake of pulses (29.68g) was significantly ($p<0.01$) higher among the small sized families than the large sized families (22.66g) but did not differed significantly from medium sized families (25.36g).

Table 4.18: Association of family size with mean daily food intake of geriatric male of respondents (n=150)

Food groups (g)	Mean daily intake		
	Small (n=37)	Medium (n=87)	Large(n=20)
Cereals and millets	252.21±57.23 [a]	271.14±23.46 [b]	277.04±42.23 [b]
Pulses	28.68±7.62 [b]	25.36±6.98 [ab]	22.66±5.64 [a]
Green leafy vegetables	48.30±16.32 [a]	47.36±13.14 [a]	42.30±15.15 [a]
Other vegetables	90.74±20.00 [a]	87.97±21.17 [a]	85.76±23.14 [a]
Fruits	47.93±19.67 [a]	67.83±17.91 [b]	46.80±20.08 [a]
Roots & tubers	50.09±30.04 [a]	57.08±20.15 [b]	45.83±27.63 [a]
Sugars	9.57±4.07 [a]	9.57±4.40 [a]	11.46±2.25 [a]
Milk and milk products	286.24±139.71 [a]	302.30±160.710 [b]	279.76±117.40 [a]
Fat and oils	17.80±3.72 [a]	18.66±5.35 [a]	18.18±4.63 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

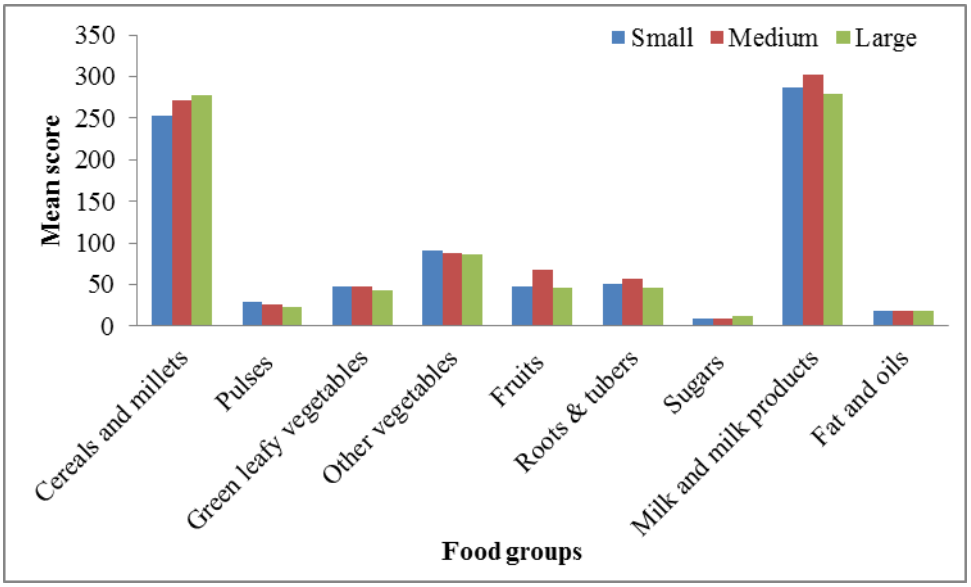

Fig. 4.5: Association of family size with mean daily food intake of geriatric male of respondents

Milk and milk products, roots and tubers and fruits were consumed in significantly ($p<0.01$) higher (302.20g, 57.08g and 67.83g) by the male respondents belonging to medium size than the small sized families (286.24 g, 50.09g and 47.93g) and large sized families (279.76g, 45.83g and 46.80g). A non-significant difference was observed in the intake of fats and edible oils, sugar and jaggery, green leafy vegetables and other vegetables among the respondents from small, medium and large sized families.

Educational status of respondents

The geriatric female those were educated up to matric level had significantly ($p<0.01$) higher intake of pulses (20.03 g) and milk and milk products (260.65g) (Table 4.19) whereas intake of fruits was significantly ($p<0.01$) higher among the respondents those were post graduate (51.89g) than the rest of respondents those were illiterate (43.91g), can read and write (45.58g), primary (40.41g), middle (45.26g), matric (37.35g), senior secondary (40.36g) and graduate (44.31g). The intake of cereals (173.78g), fats and edible oils (17.07g) and sugar and jaggery (10.55 g) was highest in those female respondents who were educated upto senior secondary level whereas intake of green leafy vegetables (40.11g), roots and tubers (50.88g) and other vegetables (68.18g) was highest in those female respondents who were educated up to post graduate level. However, the differences in intake of these food stuff were non-significant.

Table 4.20 revealed that geriatric male those were educated up to matric level had significantly ($p<0.01$) higher intake of cereals (286.67 g) than those were illiterate (244.56) and graduate (238.00g) but did not significantly ($p<0.01$) higher than those can read and write (275.51g), primary (282.57g), middle (271.37g), senior secondary (253.92g) and post graduate (267.72g) . Milk and milk products consumption was significantly ($p<0.01$) higher in the respondents those were educated upto matric level (308.17g) than those were illiterate (268.81g) and can read and write (266.41g) but did not differed significantly to those educated upto primary (296.51g) , middle (299.66g), senior secondary (297.08g) graduate (305.66g) and post graduate (299.67g). Intake of green leafy vegetables and fruits was significantly ($p<0.01$) higher in the respondent those were post graduate (52.37g and 82.05g) than those were illiterate (42.17g and 44.911g), can read and write (42.50g and 58.89g), primary (49.51g and 51.11g) and middle (40.67g and 63.60g) but did not differed significantly to those educated upto , matric (50.72g and 68.60g), senior secondary senior secondary (50.00g and 77.27g) and graduate (52.22g and 71.06g). Roots and tubers and other vegetables were consumed in significantly ($p<0.01$) higher amount (56.67g and 85.79g) by the male respondents those were graduate than those were illiterate (45.17g and 72.11g), primary (49.53g and 81.11g) and matric (47.08g and 78.g) but did not differed significantly to those can read and write (51.45g and 87.83g) middle (51.30 g and 81.76 g), senior secondary (55.10g and 83.68g) and post graduate (54.45g and 80.95g). Mean daily intake of pulses, fats and edible oils and sugars and jaggery was not affected by the education level of male respondents at significant level.

Educational status of respondent's spouse

Table 4.21 depicted the association of female respondent's spouse education with food intake. The data revealed that the respondent's spouse who was educated upto post graduate level those female respondents (274.g) had significantly ($p<0.01$) higher intake of milk and milk products than those with illiterate (179.80g), can read and write (174.75g), primary (168.58g) and middle level spouse (174.60g) but did not differed significantly to

those respondents whose spouse were educated upto matric (261.17g), senior secondary (230.12g) graduate (188.95g). Green leafy vegetables were consumed in significantly ($p<0.01$) higher amount (43.38g) by the female respondents those with graduate spouse than those were educated upto illiterate (29.11g), can read and write (33.97g) and middle level spouse (35.33g) but did not differed significantly to those whose spouse were educated upto primary (38.70g) matric (39.09g) senior secondary (40.38g) and post graduate (40.07g) level. It was found that intake of cereals, pulses, fat and edible oils, sugar and jaggery, roots and tubers, other vegetables and fruit was not affected by the educational status of respondent's spouse among female geriatric respondents.

Table 4.22 depicted the association of male respondent's spouse education with food intake. The data revealed that the respondent's spouse who was educated upto senior secondary level those male respondents (300.00g) had significantly ($p<0.01$) higher intake of milk and milk products than those respondents whose spouse can read and write (274.93g), primary (256.67g) and middle level spouse (263.33g) but did not differed significantly to those respondents whose spouse were illiterate (295.67g), matric (278.24 g) and graduate level (290.68g). Fruits were consumed in significantly ($p<0.01$) higher amount (88.48g) by the male respondents those with graduate spouse than those respondents whose spouse were illiterate (49.05g), can read and write (49.00g) and primary level (55.20g) but did not differed significantly to those whose spouse were educated upto middle (60.33g) matric (86.67g) and senior secondary (88.33g). It was found that intake of cereals, pulses, fat and edible oils, sugar and jaggery, green leafy vegetables, roots and tubers and other vegetables was not affected by the educational status of respondent's spouse among male geriatric respondents.

Occupation of respondents

Data presented in the Table 4.23 illustrated that occupation of geriatric respondents was classified into six categories. It was reported that consumption of pulses (34.00), milk and milk products (256.67) other vegetables (71.76g) and fruits (43.75g) was maximum among the female respondents those occupation was categorized as business, agriculture, ex-service, none and agriculture respectively. Mean daily intake of cereals, fats and edible oils, sugars and jaggery, green leafy vegetables and roots and tubers was not affected by the occupation of female geriatric respondents.

Data presented in the Table 4.24 revealed that mean daily intake of pulses (31.23g) milk and milk products (294.91g), other vegetables (95.91g) and fruits (75.74g) was highest (significantly, $p<0.01$) among the male elders those occupation was categorized into business, ex-service, none and business group, respectively .It was observed that consumption of cereals, fats & edibles oils sugars and jaggery, green leafy vegetables and roots and tubers was not affected by the occupation of male elderly respondents.

Table 4.19: Association of education with mean daily food intake of geriatric female respondents (n=150)

Food group (g)	Mean daily intake							
	Illiterate (n=103)	Can read and write (n=5)	Primary (n=17)	Middle (n=5)	Matric (n=12)	Senior secondary (n=1)	Graduate (n=6)	Post graduate (n=1)
Cereals and millets	167.25±31.32 [a]	165.25±31.25 [a]	173.00±21.02 [a]	161.17±26.39[a]	160.00±19.55 [a]	173.78±0.00 [a]	168.67±20.07 [a]	166.29±0.00 [a]
Pulses	14.88±8.87 [a]	18.33±5.27[ab]	19.84±6.80[ab]	18.86±5.51[ab]	20.03±0.00[b]	15.28±6.58 [a]	15.28±6.58 [a]	16.36.±0.00 [a]
Green leafy vegetables	31.23±10.34 [a]	31.07±12.27 [a]	44.21±12.99 [a]	36.32±15.65 [a]	40.01±15.00 [a]	37.58±15.79 [a]	38.53±14.55 [a]	40.11±13.99 [a]
Other vegetables	55.05±20.01 [a]	60.67±17.88 [a]	66.89±16.67 [a]	50.71±20.04 [a]	55.87±25.71 [a]	60.55±21.05 [a]	61.42±23.78 [a]	68.18±23.89 [a]
Fruits	43.91±16.05[ab]	45.58±21.31[ab]	40.41±23.35 [a]	45.26±12.99[ab]	37.35±10.49 [a]	40.36±9.36[ab]	44.31±16.21[ab]	51.89±21.01[b]
Roots and tubers	45.21±15.49 [a]	42 .23±13.71 [a]	48.03±18.59 [a]	50.23±16.01 [a]	47.28±18.56 [a]	50.15±16.03 [a]	48.02±14.89 [a]	51.88±15.46 [a]
Sugars	9.57±2.80 [a]	10.25±2.69 [a]	9.29±3.33 [a]	10.50±2.88 [a]	9.94±2.87 [a]	10.55±0.00 [a]	9.60±2.84 [a]	8.91±0.00 [a]
Milk and milk products	182.67±57.60 [a]	231.87±88.42[ab]	212.74±30.80[ab]	243.33±65.90[b]	260.65±65.87[b]	238.88±0.00[ab]	255.31±54.95[b]	180.71±0.00 [a]
Fat and oils	13.66±3.35 [a]	15.77±3.70 [a]	14.93±3.53 [a]	15.00±3.38 [a]	14.00±2.89 [a]	17.07±0.00 [a]	14.07±3.58 [a]	10.00±0.00 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.20: Association of education with mean daily food intake of geriatric male respondents (n=150)

Food group (g)	Mean daily intake							
	Illiterate (n=44)	Can read and write(n=13)	Primary (n=33)	Middle (n=17)	Matric (n=19)	Senior secondary (n=5)	Graduate (n=14)	Post graduate (n=5)
Cereals and millets	244.56±76.03[a]	275. 51±56.58 [ab]	282.57±73.90 [b]	271.37±66.81[ab]	286.67±64.05 [b]	253.92±61.39[ab]	238.00±43.20 [a]	267.72±74.63[ab]
Pulses	22.0±6.41 [a]	24.27±4.04 [a]	21.03±12.84 [a]	25.67±5.05 [a]	27.97±8.04 [a]	28.67±6.84 [a]	27.43±12.08 [a]	30.00±18.85 [a]
Green leafy vegetables	42.17±13.86 [a]	42.50±18.31 [a]	49.51±27.03[ab]	40.67±18.27 [a]	50.72±28.45 [b]	50.00±19.42 [b]	52.22±22.50 [b]	50.17±24.56 [b]
Other vegetables	72.11±25.63 [a]	87.83±25.52[ab]	80.37±30.52[a]	81.76±31.71 [b]	78.12±57.23[a]	83.68±23.55 [b]	85.79±33.15 [b]	80.95±53[b]
Fruits	44.91±12.91 [a]	58.89±18.84 [a]	51.11±20.07 [a]	63.60±16.53[a]	68.60±26.082[b]	77.27±36.04 [b]	74.06±24.68[b]	82.5±27.65 [b]
Roots and tubers	45.17±23.00 [a]	51.45±28.37[ab]	49.53±26.74 [a]	51.30±15.28[b]	47.08±23.60 [a]	55.10±13.70 [b]	56.67±23.17 [b]	54.45±23.85 [b]
Sugars	10.28±2.89 [a]	10.00±2.50 [a]	10.69±3.39 [a]	9.00±3.09 [a]	9.38±2.98 [a]	9.23±2.88 [a]	9.76±2.42 [a]	8.95±2.38 [a]
Milk and milk products	268.81±53.45 [a]	266±94.02 [a]	296.51±93.81 [b]	299.66±117.14[b]	308.17±104.78 [b]	297.08±91.09 [b]	305.66±89.38 [b]	299.67±85.46 [b]
Fat and oils	17.23±3.71 [a]	19.33±3.2 [a]	18.32±3.74 [a]	13.25±3.33 [a]	17.97±3.29 [a]	18.39±3.09 [a]	20.33±2.99 [a]	19.33±3.20 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.21: Association of spouse education with mean daily food intake geriatric female respondents (n=150)

Food group (g)	Mean daily intake							
	Illiterate (n=34)	Can read and write (n=22)	Primary (n=25)	Middle (n=21)	Matric (n=19)	Senior secondary (n=5)	Graduate (n=21)	Post graduate (n=3)
Cereals and millets	174.48±30.2[ab]	174.96± 39.43[a]	160.64±47.29 [a]	182.46±49.55[a]	190.26±51.55[a]	172.66±33.94 [a]	183.73±64.06[a]	177.74±57.99[a]
Pulses	15.98±8.49 [a]	14.17±7.95 [a]	16.88±6.90 [a]	17.88±8.70 [a]	16.84±6.15 [a]	18.57±11.29 [a]	16.33±8.39 [a]	17.99±5.06 [a]
Green leafy vegetables	29.11±15.30 [a]	33.97±13.70[a]	38.70±32.89[ab]	35.33±17.71 [a]	39.09±14.79[ab]	40.38±16.07[b]	43.83±12.70[b]	38.07±16.71[ab]
Other vegetables	56.75±25.01 [a]	61.76±18.26 [a]	67.13±20.89 [a]	49.51±25.99 [a]	56.67±31.11 [a]	67.78±25.88 [a]	62.36±41.45 [a]	69.28±26.27 [a]
Fruits	33.00±19.98 [a]	34.08±18.08 [a]	44.30±22.72 [a]	38.46±12.92 [a]	37.35±19.49 [a]	36.63±2.36 [a]	43.29±17.00 [a]	51.66±23.76 [a]
Roots & tubers	49.36±12.03 [a]	41 .41±16.43 [a]	50.67±28.26 [a]	49.11±13.29 [a]	48.89±21.69 [a]	49.35±17.48 [a]	48.89±14.17 [a]	49.71±16.31 [a]
Sugars	8.16±2.91 [a]	10.82±2.39 [a]	9.31±3.41 [a]	9.10±3.45 [a]	9.33±2.80 [a]	9.25±2.50 [a]	10.00±3.50 [a]	9.00±2.92 [a]
Milk and milk products	179.80±21.07[a]	174.75±18.81 [a]	168.58±18.55 [a]	174.60±91.59[a]	261.17±52.02[b]	230.12±46.70[b]	188.95±58.15[ab]	274.00±94.06[b]
Fat and oils	13.88±3.06 [a]	1360±3.91 [a]	15.30±3.52 [a]	15.41±3.69 [a]	16.62±2.64 [a]	13.00±1.73 [a]	15.49±3.95 [a]	14.95±3.54 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.22: Association of spouse education with mean daily food intake geriatric male respondents (n=150)

Food group (g)	Mean daily intake							
	Illiterate (n=103)	Can read and write (n=12)	Primary (n=13)	Middle (n=7)	Matric (n=9)	Senior secondary (n=1)	Graduate (n=5)	Post graduate (n=0)
Cereals and millets	286.97±98.42[a]	277.18±92.77[a]	224.28±77.38 [a]	254.26±79.38[a]	266.67±30.45[a]	231.71±0.00 [a]	270.30±28.61[a]	-
Pulses	24.51±14.67 [a]	31.00±16.72 [a]	30.64±12.31 [a]	34.00±16.39 [a]	31.67±8.98 [a]	27.00±0.00 [a]	32.33±9.25 [a]	-
Green leafy vegetables	47.78±23.14 [a]	47.67±29.18 [a]	42.50±21.72 [a]	46.67±27.53 [a]	38.33±7.08 [a]	33.24±0.00 [a]	47.09±25.17 [a]	-
Other vegetables	83.98±24.98 [a]	85.90±20.18 [a]	80.51±32.24 [a]	94.76±34.29 [a]	95.09±41.06 [a]	86.67±0.00 [a]	97.67±47.73 [a]	-
Fruits	49.05±22.50 [a]	49.00±11.52 [a]	55.20±17.52[a]	60.33±36.51[ab]	86.67±25.93[b]	88.33±0.00[b]	88.48±28.27[b]	-
Roots and tubers	54.02±23.53 [a]	56.19±22.39 [a]	53.33±23.28 [a]	56.00±28.81 [a]	61.07±31.48 [a]	54.45±0.00 [a]	50.00±22.84 [a]	-
Sugars	10.46±3.21 [a]	9.22±3.52 [a]	10.20±2.90 [a]	9.57±2.16 [a]	9.42±3.47 [a]	8.42±0.00 [a]	9.77±3.42 [a]	-
Milk and milk products	295.67±92.41[ab]	274.93±72.05[a]	256.67±95.76 [a]	263.33±84.07[a]	278.24±68.23[ab]	300.00±0.00[b]	290.68±84.71[ab]	-
Fat and oils	17.77±3.11 [a]	18.19±3.79 [a]	16.19±3.29 [a]	20.90±3.78 [a]	19.41±3.86 [a]	15.08±00 [a]	16.39±4.57 [a]	-

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.23: Association of occupation with mean daily food intake of geriatric female respondents (n=150)

Food groups (g)	Mean daily intake					
	Labourer (n=8)	Caste occupation (n=0)	Business (n=2)	Agriculture (n=7)	Ex-service (n=19)	None (n=114)
Cereals and millets	189.17±36.12[a]	-	183.33±47.71[a]	190.47±49.16[a]	175.04±37.26[a]	165.47±39.13[a]
Pulses	17.73±8.16[a]	-	34.00±10.76[b]	25.95±3.17[ab]	18.98±10.90[a]	15.96±8.26[a]
Green leafy vegetables	41.94±28.35[a]	-	39.66±12.71[a]	32.77±20.53[a]	40.91±17.80[a]	40.16±27.83[a]
Other vegetables	55.69±23.36	-	45.00±0.00[a]	44.28±17.68[a]	71.76±33.23[ab]	53.70±27.68[ab]
Fruits	20.00±10.34[a]	-	27.33±12.52[a]	43.75±16.52[c]	32.99±14.52[ab]	31.12±17.39[ab]
Roots and tubers	53.3±27.13[ab]	-	52.00±11.78[a]	46.66±24.03[a]	44.44±17.13[a]	44.76±16.09[a]
Sugars	12.57±1.81[a]	-	10.67±0.95[a]	9.83±3.48[a]	9.71±3.25[a]	9.60±4.91[a]
Milk and milk products	194.78±37.09[a]	-	214.00±30.78[ab]	256.67±60.89[b]	236.21±63.33[b]	198.22±47.33[a]
Fat and oils	15.00±5.25[a]	-	12.50±4.36[a]	15.19±5.28[a]	13.98±4.81[a]	13.98±5.33[a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.24: Association of occupation with mean daily food intake of geriatric male respondents (n=150)

Food groups (g)	Mean daily intake					
	Labourer (n=18)	Caste occupation (n=3)	Business (n=20)	Agriculture (n=42)	Ex-service (n=47)	None (n=20)
Cereals and millets	274.96±104.04[a]	252.83±60.29[a]	252.13±57.61[a]	263.37±57.61[a]	260.44±100.72[a]	264.38±80.94[a]
Pulses	18.12±10.42[a]	25.56±10.8[ab]	31.23±8.56[b]	23.28±9.04[a]	30.88±6.99[b]	25.89±9.23[ab]
Green leafy vegetables	48.42±15.61[a]	42.30±15.01[a]	40.31±13.74[a]	47.36±10.53[a]	42.30±18.97[a]	48.30±16.3[a]
Other vegetables	72.54±20.78[a]	65.56±17.82[a]	87.50±29.42[ab]	87.50±20.70[ab]	89.18±20.33[b]	95.91±35.98[b]
Fruits	48.52±27.71[ab]	36.67±6.15[a]	75.74±28.23[c]	48.27±19.56[ab]	67.90±21.81[bc]	50.32±11.37[b]
Roots and tubers	55.77±27.58[a]	45.00±7.07[a]	58.33±18.87[a]	52.88±26.12[a]	51.88±20.95[a]	45.55±23.85[a]
Sugars	10.17±4.89[a]	8.42±3.05[a]	9.39±3.19[a]	11.04±3.15[a]	9.68±2..42[a]	9.67±3.20[a]
Milk and milk products	259.07±105.01a[b]	244.56±64.91[a]	264.50±108.89[ab]	283.51±100.37[b]	294.91±114.02[c]	290.86±102.58[bc]
Fat and oils	19.15±3.25[a]	17.81±6.16[a]	19.43±6.27[a]	18.12±5.66[a]	18.39±6.09[a]	18.11±6.34[a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Family income

Table 4.25 (Fig. 4.6) depicts the values on association of family income of female respondents with mean daily food intake of female respondents on mean daily food intake .it was observed that consumption of pulses (23.09 g) milk & milk products (285.86g) green leafy vegetables (43.19 g), roots & tubers (48.80 g) other vegetables (61.13 g) and fruits (35.65 g) was significantly ($p<0.01$) higher among the female respondents whose income was above Rs. 36000 per month than those income was below Rs. 12000, Rs. 12001to 2400 and Rs. 24001 to 36000 per month. Mean daily intake of cereals, fats & edibles oils and sugars and jaggery was not affected by the family income of female respondents.

Table 4.25: Association of family income with mean daily food intake of geriatric female respondents (n=150)

Food groups (g)	Mean daily intake			
	<12000 (n=22)	12001-24000 (n=58)	24001-36000 (n=47)	>36000 (n=23)
Cereals and millets	166.71±24.76[a]	168.93±24.73[a]	170.00±37.53[a]	162.71±47.76[a]
Pulses	13.52±4.50 [a]	14.36±6.33 [a]	14.36±6.75 [a]	25.09±6.57 [b]
Other vegetables	52.18±10.78[a]	53.80±15.78[a]	58.87±20.30[ab]	61.13±20.33[b]
Fruits	25.65±10.33[a]	31.28±13.68 [b]	34.64±11.78[ab]	35.65±19.41[b]
Roots & tubers	42.14±13.33[a]	41.14±10.00[a]	45.09±6.07[ab]	48.80±6.96[b]
Sugars	8.22±4.07 [a]	8.70±4.07 [a]	9.40±3.55[a]	9.40±4.25[a]
Milk and milk products	231.45±49.95[a]	246.59±93.38[a]	261.21±71.32[b]	285.86±80.57[b]
Fat and oils	12.42±5.91[a]	14.11±5.25[a]	14.37±5.58[a]	14.46±4.76[a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

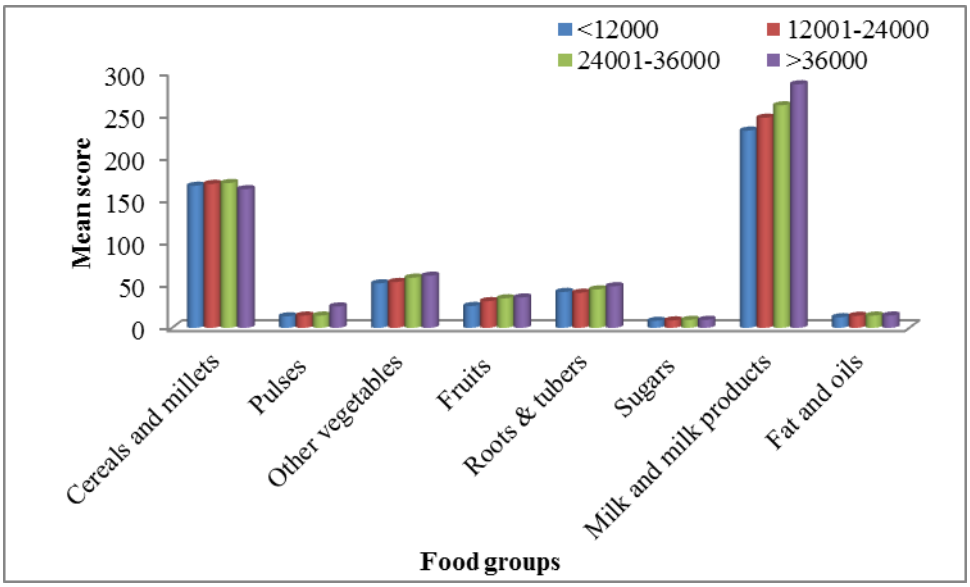

Fig. 4.6: Association of family income with mean daily food intake of geriatric female respondents

The association of family income and food intake of male respondents has been presented in the Table 4.26 (Fig. 4.7). It was found that intake of cereals (291.95g) was significantly ($p<0.01$) higher among those male respondents income was above than Rs. 12000 than those income was Rs. 24001 to 36000 and above Rs.36000 per month but not significantly ($p<0.01$) higher than those income was Rs. 12001 to 24000 per month.

Table 4.26: Association of family income with mean daily food intake of geriatric male respondents (n=150)

Food groups	Mean daily intake			
	<12000 (n=22)	12001-24000 (n=70)	24001-36000 (n=31)	>36000 (n=27)
Cereals and millets	291.95±67.11^{b}	271.54±83.02^{ab}	254.44±61.11^{a}	241.46±81.04^{a}
Pulses	21.66±7.70^{a}	25.36±6.73^{b}	25.89±11.12^{b}	30.41±9.33^{c}
Green leafy vegetables	44.28±17.55^{a}	49.22±12.22^{a}	60.79 ±16.67^{b}	78.75±18.73^{c}
Other vegetables	44.01±10.25^{a}	41.23±16.58^{a}	52.41±18.96^{b}	59.47±18.40^{b}
Fruits	33.33±12.73^{a}	45.03±16.24^{a}	58.52±21.14^{b}	74.52±17.26^{c}
Roots and tubers	81.30±30.04^{a}	90.68±24.08^{a}	104.62±18.03^{b}	110.67±10.97^{c}
Sugar s	9.14±3.41^{a}	9.96±2.34^{a}	9.92±3.39^{a}	9.78±3.41^{a}
Milk and milk products	272.13±11.78^{a}	271.67±14.09^{a}	306.19±22.70^{b}	307.64±44.71^{b}
Fats and oils	18.61±6.20 ^{a}	18.84 ±5.61 ^{a}	18.93±6.47 ^{a}	16.93±5.28 ^{a}

Values are Mean ± SD Row Means with the same superscript do not differ significantly

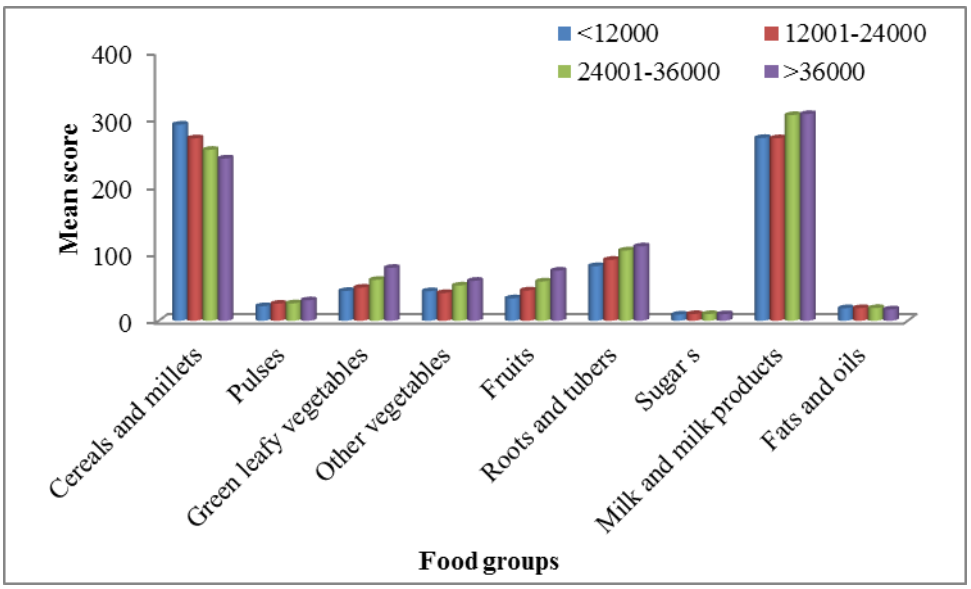

Fig. 4.7: Effect of family income on mean daily food intake of geriatric male respondents

It was observed that consumption of milk & milk products (307.64), green leafy vegetables (78.75g) roots and tubers (110.67g) other vegetables (59.47g) and fruits (74.52g) was significantly ($p<0.01$) higher among the male respondents those income was above Rs. 36000 than those income was less than Rs. 12000 per month (272.13g, 44.28g, 81.30g, 44.01g and 33.33g respectively) and Rs. 12001 to Rs. 24000 per month (71.67g, 49.22g, 90.68g 41.23g and 45.03g, respectively) but did not differ significantly to those male respondents whose

income was Rs. 24001 to 36000 per month (306.19g, 60.79g, 104.62g, 52.41g and 58.52g, respectively). Mean daily intake of fats and edible oils and sugar and jaggery was not affected by income level of male respondents.

4.2.8.2 Association of nutrient intake with socio-economic variables:

Family arrangement

Table 4.27 depicts the association of family arrangement with daily nutrient intake of female geriatric respondents. The respondents who were living in joint families had significantly ($p<0.01$) higher intake of energy (1141.32 kcal), than those respondents were living alone (1063.53kcal) and in living in nuclear families (1064.28 kcal). Intake of fat was significantly ($p<0.01$) higher among the female respondents those were living in nuclear families (15.10g) and joint families (15.02g) than those female respondents who were living alone (12.79g). The intake of calcium was significantly ($p<0.01$) higher among the female respondents living in joint families (540.99 mg) and nuclear families (474.78 mg) than female respondents those were living alone (382.14mg) whereas intake of calcium differed significantly ($p<0.01$) from the respondents of joint families to respondents of nuclear families. Intake of phosphorus, magnesium and iron was significantly ($p<0.01$) higher among the female respondents belonged to joint families (685.54 mg, 282.11 mg and 10.90 mg, respectively) than that of female respondents living alone (618.81 mg, 271.89 mg and 9.01 mg, respectively) and living in nuclear families (622.12 mg, 267.02 mg and 9.05 mg, respectively).

Table 4.27: Association of family arrangement with mean daily nutrient intake of geriatric female respondents (n=150)

Nutrients	Mean daily intake		
	Alone (n=5)	Nuclear (n=11)	Joint (n=134)
Energy (Kcal)	1063.53±126.89 [a]	1064.28±101.45 [a]	1141.32±75.28 [b]
Protein (g)	34.53±5.67 [a]	35.77±6.53 [a]	36.72±6.96 [a]
Fat (g)	12.79±2.72 [a]	15.10±6.23 [b]	15.02±4.75 [b]
Calcium (mg)	382.14±77.15 [a]	474.78±12.43 [b]	540.99±124.06 [c]
Phosphorus (mg)	618.81±8 [a]	622.12±105.49 [a]	685.54±127.17 [b]
Magnesium (mg)	271.89±28. 36 [a]	267.02±48.65 [a]	282.11±50.75 [b]
Iron (mg)	9.01±2.01 [a]	9.05±1.90 [a]	10.90±2.19 [b]
Zinc (mg)	6.23±1.43 [a]	6.15±1.31 [a]	6.36±1.36 [a]
β-Carotene (µg)	1894.53±155.68[a]	1937.13±244.67 [b]	2215.49±143.83 [c]
Thiamin(mg)	0.88±0.22 [a]	0.90±0.19 [a]	1.08±0.19 [b]
Riboflavin (mg)	0.69±0.14 [a]	0.69±0.13 [a]	1.05±0.15 [b]
Niacin (mg)	5.12±1.48 [a]	5.23±1.61 [a]	5.29±1.24 [a]
Folic acid (µg)	140.38±30.18 [a]	137.13±22.65 [a]	141.74±21.84 [a]
B_{12}(µg)	0.66±0.22 [a]	0.65±0.19 [a]	0.67±0.19 [a]
Vitamin C(mg)	21.08±6.69 [a]	23.83±3.13 [a]	28.33±4.87 [b]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

The intake of β-Carotene was significantly ($p<0.01$) higher among the female respondents living in joint families (2215.49 µg) and nuclear families (1937.13µg) than female respondents those were living alone (1894.53 µg) whereas intake of β-Carotene differed significantly ($p<0.01$) from the respondents of joint families to respondents of nuclear families. Mean intake of thiamine, riboflavin and vitamin C was significantly ($p<0.01$) higher among the female respondents belonged to joint families (1.08 mg, 1.05 mg and 28.33 mg, respectively) than that of female respondents living alone (0.88 mg, 0.69 mg and 21.08 mg, respectively) and living in nuclear families (0.90 mg, 0.69 mg and 23.83 mg, respectively). Mean intake of protein (36.72g), zinc (6.36 mg) niacin (5.29 mg), folic acid (141.74µg) and vitamin B_{12} (0.67µg) was highest among the female respondents from joint families and lowest among the respondents from nuclear families (zinc-6.15mg folic acid-137µg and vitamin B_{12} -0.65µg) and respondents living alone (protein-34.53 g and niacin-5.12mg) however, statistically the differences in intake of different nutrients were non-significant.

Table 4.28: Association of family arrangement with mean daily nutrient intake of geriatric male respondents (n=150)

Nutrients	Mean daily intake		
	Alone (n=6)	Nuclear (n=17)	Joint (n=127)
Energy (kcal)	1525.22±205.91 [a]	1472.12±360.10 [a]	1676.70±356.40 [b]
Protein (g)	50.53±9.85 [a]	49.37±13.07 [a]	56.19±5.17 [b]
Fat (g)	21.53±5.92 [a]	20.86±7.71 [a]	23.07±6.13 [a]
Calcium (mg)	615.61±112.02 [a]	647.07±108. 17 [b]	652.36±15.56 [a]
Phosphorus (mg)	688.00±189.04 [a]	771.04±148.68 [b]	786.79±114.39 [b]
Magnesium (mg)	266.67±96.11 [a]	279.93±65.73 [b]	290.54±53.19 [b]
Iron (mg)	12.22±3.14 [a]	15.23±3.58 [b]	16.28±5.56 [b]
Zinc (mg)	8.51±2.23 [a]	8.73±2.45 [a]	9.21±2.11 [a]
β-Carotene (µg)	2801.20±147.79 [b]	2939.32±43.17 [b]	2722.65±237.38 [a]
Thiamin(mg)	1.35±0.34 [a]	1.31±0.14 [a]	1.38±0.09 [a]
Riboflavin (mg)	1.02±0.19 [a]	0.95±0.12 [a]	1.05±0.36 [a]
Niacin (mg)	7.46±1.98 [a]	7.56±2.33 [a]	8.15±3.07 [a]
Folic acid (µg)	176.95±18.99 [a]	170.68±19.63 [a]	182.04±21.01 [a]
B_{12}(µg)	0.96±0.15 [a]	0.93±0.22 [a]	1.03±1.09 [a]
Vitamin C(mg)	46.26±5.54 [a]	46.81±3.34 [a]	43.52±4.70 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.28 illustrated the association of family arrangement on daily nutrient intake of male geriatric respondents. The respondents who were living in joint families had significantly ($p<0.01$) higher intake of energy (1676.70 Kcal) and protein (56.19 g) than those respondents were living alone (1525.22kcal and 50.53g) and living in nuclear families (1472.12 kcal and 49.37 g). Intake of calcium, phosphorus, magnesium and iron was significantly higher among the female respondents belonged to joint families (652.36 mg, 786.79 mg, 290.54 mg and 16.28 mg, respectively) than that of female respondents living alone (615.61 mg, 688.00mg, 266.67 mg and 12.22 mg, respectively) but was not fond significantly higher than those living in nuclear families (647.07mg, 771.04 mg, 279.93 mg and 15.23 mg, respectively). The intake of β-Carotene was significantly ($p<0.05$) higher among the female respondents living in alone families (2801.20 µg) and nuclear families (2939.43) than male respondents those were living in joint families (2722.65 µg) whereas intake of β-Carotene did not differed significantly ($p<0.05$) from the respondents living alone to respondents of nuclear families. Mean intake of Zinc (9.15 mg) thiamine (1.38 mg), riboflavin (1.05 mg) niacin (8.15 mg), folic acid (182.04µg), vitamin B_{12} (1.03) was highest among the female respondents from joint families and lowest among the respondents from nuclear families (folic acid-170µg, thiamine-1.31 mg, riboflavin -0.95mg and riboflavin-0.93µg) and respondents living alone (zinc-8.51 mg and niacin- 7.46 mg) however, statistically the differences in intake of different nutrients were non significant. A narrow range of variation was observed for the intake of fat (20.86 mg to 23.07 mg) and vitamin C (43.52 mg to 46.81 mg) among the male respondent from different family arrangements.

Family size

The association of family size and food intake has been depicted in Table 4.29. Results showed that mean daily intake of calcium (481.771 mg), phosphorus (651.97 mg), magnesium (279.14 mg) iron (10.94 mg), β-carotene (2405.53µg), vitamin C (33.59 mg) and folic acid (152.25 µg) was significantly ($p<0.01$) among the respondents from medium families than the respondents from small and large sized families. Intake of fat (15.60g) riboflavin (0.74 mg) and vitamin B_{-12} (0.68 µg) was highest among the respondents belonging to medium sized families while intake of protein (37.12 g), zinc (6.37 mg) and niacin (5.24 mg) was highest among the respondents belonging to small sized families. However the differences were found to be non significant. Mean daily intake of thiamin was found to be in similar amount (0.92 mg) among the respondents belonging to different family size i.e. small, medium and large.

Table 4.29: Association of family size with mean daily nutrient intake of geriatric female respondents (n=150)

Nutrients	Mean daily intake		
	Small (n=29)	Medium (n=94)	Large(n=22)
Energy (Kcal)	1118.40±191.23 [a]	1132.93±180.08 [a]	1146.73±169.34 [a]
Protein (g)	37.12±5.46 [a]	35.44±5.23 [a]	28.45±6.20 [a]
Fat (g)	12.90±6.94 [a]	15.60±7.78 [a]	14.17±9.08 [a]
Calcium (mg)	448.06±125.17 [a]	481.71±123.57 [b]	446.30±109.59 [a]
Phosphorus (mg)	562.42±113.50 [a]	651.97±117.32 [b]	602.43±107.23 [a]
Magnesium (mg)	245.67±57.13 [a]	279.14±48.36 [b]	252.17±52.07 [a]
Iron (mg)	9.00±2.17 [a]	10.94±2.20 [b]	9.08±1.90 [a]
Zinc (mg)	6.37±1.22 [a]	6.35±1.20 [a]	6.21±1.35 [a]
β-Carotene (µg)	2086.27±99.17 [a]	2405.53±102.96 [b]	1979.72±161.73 [a]
Thiamin(mg)	0.92±0.12 [a]	0.92±0.17 [a]	0.92±0.15 [a]
Riboflavin (mg)	0.71±0.12 [a]	0.74±0.10 [a]	0.70±0.15 [a]
Niacin (mg)	5.34±1.31 [a]	5.21±1.36 [a]	5.20±1.00 [a]
Folic acid (µg)	140.25±26.33 [a]	152.25±31.89 [b]	136.24±32.04 [a]
B_{12}(µg)	0.67±0.10 [a]	0.68±0.08 [a]	0.65±0.06 [a]
Vitamin C(mg)	25.73±3.89 [a]	33.59±6.78 [b]	26.10±3.89 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Data in Table 4.30 depicted association of family size to mean nutrient intake of male geriatric respondents. Intake of energy was significantly ($p<0.01$) higher in medium sized family respondents (1699.20 Kcal) than small sized family respondents (1541.97 kcal) but was not significantly ($p<0.01$) higher than large sized family respondents (1652.50 kcal). Mean daily intake of protein was significantly ($p<0.01$) higher in small sized family respondents (38.12 g) than large sized family respondents (28.67 g) but was not significantly ($p<0.01$) higher than medium sized family respondents (35.36 g). There was a significant ($p<0.01$) difference in the intake of calcium (599.78 mg), phosphorus (715.98 mg) magnesium (351.76 mg) β-carotene (3019.88 µg), vitamin C (39.28 mg), thiamine (1.45 mg) and folic acid (194.33 µg) between the respondents living in medium sized families to the respondents living in small and large families. Mean daily intake of fats (24.27g), riboflavin (1.08mg) and vitamin B_{12} (194.33 µg) was highest among the female respondents living in medium sized families than that of male respondent living in small and large sized families.

Table 4.30: Association of family size with mean daily nutrient intake of geriatric male respondents (n=150)

Nutrients	Mean daily intake		
	Small (n=37)	Medium (n=87)	Large(n=20)
Energy (Kcal)	1541.97±179.05 [a]	1699.20±132.06 [b]	1652.50±153.99 [b]
Protein (g)	38.12±10.72 [b]	35.36±8.76 [b]	28.67±6.67 [a]
Fat (g)	21.03±8.27 [a]	24.27±11.45 [a]	22..48±12.67 [a]
Calcium (mg)	516.32±123.02 [a]	599.78±147.05 [b]	515.55±104.85 [a]
Phosphorus (mg)	685.68±112.67 [a]	715.98±169.06 [b]	659.08±160.70 [a]
Iron (mg)	15.04±3.32 [a]	13.80±3.42 [a]	13.94±3.01 [a]
Magnesium (mg)	328.35±99.98 [b]	351.76±66.27 [b]	334.73±112.70 [a]
Zinc (mg)	10.04±2.07 [a]	9.38.89±2.20 [a]	9.31±2.15 [a]
β-Carotene (µg)	2802.78±99.07 [a]	3019.88±104.92 [b]	2763..90±99.18 [a]
Thiamin(mg)	1.35±0.33 [a]	1.45±0.29 [b]	1.37±0.33 [a]
Riboflavin (mg)	1.06±0.09 [a]	1.08±0.23 [a]	1.03±0.03 [a]
Niacin (mg)	8.67±2.11 [a]	8.65±2.37 [a]	8.00±2.23 [a]
Folic acid (µg)	181.94±26.24 [a]	194.33±29.01 [b]	174.99±33.07 [a]
B_{12}(µg)	0.92±0.03 [a]	0.92±0.02 [a]	0.90±0.03 [a]
Vitamin C(mg)	34.68.±16.25 [a]	39.28±18.71 [b]	33.96±21.17 [a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

The mean daily intake of zinc was highest (10.04 mg) in the respondents living in small sized families than those living in medium and large sized families however the difference was non-significant.

Educational status of respondents

Table 4.31 represented the association of male educational status and mean daily nutrient intake. It was found that those were educated up to matric had significantly ($p<0.01$) higher intake of energy (1795.62kcal) than the respondents those were illiterate (1580.51 kcal) and graduate (1563.67 kcal). The intake of calcium (663.72 mg), phosphorus (717.34 mg) and magnesium (280.16 mg) was significantly ($p<0.01$) higher among the respondents those were educated upto matric level than those respondents who illiterate (540.01 mg, 598.93 mg and 235.63 mg, respectively) can read and write (584.95 mg, 608.59 mg and 246.02 mg, respectively) and educated upto primary level (591.41mg, 633.87 mg and 263.94 mg, respectively).

Table 4.31: Association of education with mean daily nutrient intake of female respondents (n=150)

Nutrients	Mean daily intake							
	Illiterate (n=103)	Can read and write (n=5)	Primary (n=17)	Middle (n=5)	Matric (n=12)	Senior secondary (n=1)	Graduate (n=6)	Post-graduate (n=1)
Energy (Kcal)	1113.70±198.59[a]	1128.95±106.97[a]	1121.18±148.68[a]	1271.35±31.24[a]	1145.30±116.92[a]	1284.67±0.00[a]	1132.93±99.34[a]	1115.02±0.00[a]
Protein (g)	35.64±4.63[a]	35.65±5.18[ab]	36.85±6.18[ab]	37.02±2.34[a]	42.49±5.25[b]	31.50±0.00[a]	36.52±5.92[ab]	39.17±0.00[b]
Fat (g)	13.54±2.71[a]	14.91±3.43[a]	15.43±3.97[a]	14.60±2.70[a]	17.16±3.21[a]	18.28±0.00[a]	14.87±5.77[a]	20.82±0.00[a]
Calcium (mg)	363.23±115.50[a]	361.83±124.75[a]	353.32±116.23[a]	406.42±105.23[ab]	413.88±125.36[b]	359.32±0.00[a]	423.93±63.11[b]	409.53±0.00[b]
Phosphorus (mg)	641.07±139.13 [a]	623.94±103.08[a]	644.11±157.69[a]	614.28±84.79[a]	647.40±115.44[a]	629.55±0.00[a]	651.97±107.29[a]	631.92±0.00[a]
Magnesium (mg)	275.57±58.72[a]	274.02±57.98[a]	273.93±57.333[a]	281.28±51.71[a]	231.24±54.29[a]	280.51±0.00[a]	284.58±59.62[a]	282.92±0.00[a]
Iron (mg)	9.77±2.20 [a]	10.01±2.08[a]	10.75±2.11[a]	9.81±2.10[a]	9.64±2.18[a]	9.39±0.00[a]	9.81±2.17[a]	10.07±0.00[a]
Zinc (mg)	6.30±1.32[a]	6.22±1.69[a]	6.31±1.32[a]	6.61±1.17[a]	6.62±1.54[a]	6.23±0.00[a]	6.33±1.35[a]	6.05±0.00[a]
β-Carotene (µg)	2196.46±187.53[ab]	2024.34±231.21[a]	2129.988±180.23[ab]	1994.48±151.23[a]	2186.27±275.33[ab]	2333.39±0.00[b]	2045.59±147.52[a]	2180.35±0.00[ab]
Thiamin (mg)	0.92±0.11[a]	0.91±0.21[a]	0.91±0.19[a]	0.97±0.11[a]	0.98±0.16[a]	0.95±0.00[a]	0.94±0.18[a]	1.01±0.00[a]
Riboflavin (mg)	0.82±0.14[a]	0.78±0.19[a]	0.76±0.18[a]	0.90±0.16[a]	0.81±0.13[a]	0.88±0.00[a]	0.85±0.06[a]	0.91±0.15[a]
Niacin (mg)	5.21±1.22[a]	5.20±1.28[a]	5.44±1.08[a]	5.39±1.05[a]	5.47±0.17[a]	5.29±0.00[a]	5.89±1.23[a]	5.71±0.00[a]
Folic acid (µg)	137.63±31.54[a]	137.70±35.90[a]	147.25±27.78[a]	150.87±13.39[a]	136.45±24.27[a]	140.50±0.00[a]	142.54±14.54[a]	138.77±0.00[a]
B_{12} (µg)	0.67±0.09[a]	0.66±0.06[a]	0.65±0.18[a]	0.71±0.10[a]	0.65±0.16[a]	0.68±0.00[a]	0.69±1.08[a]	0.65±0.00[a]
Vitamin C (mg)	24.28±9.20[a]	26.69±13.33[a]	28.64±12.36[a]	30.44±8.26[a]	29.14±9.65[a]	26.35±0..00[a]	25.87±6.98[a]	31.54±0.00[a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.32: Association of education with mean daily nutrient intake of geriatric male respondents (n=150)

Nutrients	Mean daily intake							
	Illiterate (n=44)	Can read and write (n=13)	Primary (n=33)	Middle (n=17)	Matric (n=19)	Senior Secondary (n=5)	Graduate (n=14)	Post-graduate (n=5)
Energy (Kcal)	1580.51±231.93^{a}	1724.91±243.05^{ab}	1740.41±619.96^{ab}	1675.95±275.98^{ab}	1795.62±250.42^{b}	1641.69±362.45^{ab}	1563.67±278.28^{a}	1643.93±255.38^{ab}
Protein (g)	39.69±10.50^{a}	37.22±13.49^{a}	39.22±12.20^{a}	45.77±10.51^{a}	40.61±10.38^{a}	38.61±12.47^{a}	43.84±9.14^{a}	45.09±13.25^{a}
Fat (g)	15.41±6.24^{a}	18.03±2.98^{a}	22.74±3.12^{ab}	21.67±6.41^{a}	28.45±6.21^{ab}	27.84±4.56^{ab}	26.54±3.58^{ab}	25.63±4.96^{ab}
Calcium (mg)	546.01±152.36^{a}	584.95±127.28^{a}	591.47±84.52^{a}	619.117.61^{ab}	663.72±115.96^{b}	613.10±108.57^{ab}	653.01±167.32^{b}	611.30±118.52^{ab}
Phosphorus (mg)	598.93±203.85^{a}	608.59±225.67^{a}	633.87±208.19^{a}	682.76±246.63^{ab}	717.34±219.50^{b}	682.11±197.71^{ab}	662.53±249.7^{ab}	658.56±239.50^{ab}
Magnesium (mg)	235.63±109.06^{a}	246.02±112.89^{a}	263.94±132.34^{a}	278.72±91.36^{ab}	280.16±110.31^{b}	264.00±105.93^{ab}	262.28±145.97^{ab}	271.20±139.48^{a}
Iron (mg)	13.12±3.46^{a}	13.57±2.83^{a}	15.46±5.26^{ab}	14.32±2.85^{a}	15.14±3.52^{ab}	15.13±3.20^{ab}	16.03±4.10^{b}	15.75±2.77^{ab}
Zinc (mg)	8.74±2.04^{a}	9.18±2.21^{a}	9.82±2.16^{a}	9.76±1.79^{a}	9.46±2.20^{a}	9.23±1.91^{a}	9.15±2.68^{a}	9.47±2.18^{a}
β-Carotene (µg)	2765.54±230.77^{a}	2885.63±398.41^{a}	2871.40±392.21^{a}	3017.50±303.68^{ab}	3140.81±329.18^{b}	2707.25±182.58^{a}	3067.04±271.23^{b}	3007.36±233.54^{ab}
Thiamin(mg)	1.32±0.35^{a}	1.47±0.31^{a}	1.60±0.67^{a}	1.47±0.30^{a}	1.58±0.26^{a}	1.29±0.37^{a}	1.39±0.33^{a}	1.44±0.47^{a}
Riboflavin (mg)	0.98±0.20^{a}	1.07±0.27^{a}	1.31±0.26^{a}	1.10±0.20^{a}	1.20±0.28^{a}	1.08±0.25^{a}	1.10±0.24^{a}	1.12±0.15^{a}
Niacin (mg)	7.76±2.13^{a}	9.03±2.17^{a}	9.24±2.59^{a}	9.04±1.75^{a}	9.19±2.27^{a}	8.20±2.50^{a}	9.01±2.78^{a}	9.47±02.96^{a}
Folic acid (µg)	166.40±30.23^{a}	183.96±21.98^{a}	180.95±27.23^{a}	188.55±28.25^{b}	187.51±26.49^{ab}	185.28±24.37^{ab}	190.57±39.67^{b}	192.70±36.29
B_{12} (µg)	0.93±0.02^{a}	0.96±0.15^{a}	0.99±1.02^{a}	0.98±0.18^{a}	0.90±0.21^{a}	0.89±0.09^{a}	0.89±0.14^{a}	1.12±0.29^{a}
Vitamin C(mg)	32.39±4.12^{ab}	31.62±17.45^{b}	32.29±9.25^{a}	35.95±13.12^{ab}	38.16±8.69^{b}	38.01±9.56^{b}	35.45±12.36^{ab}	40.12±13.69^{b}

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.33: Association of spouse education with mean daily nutrient intake of female respondents (n=150)

Nutrients	Mean daily intake							
	Illiterate (n=34)	Can read and write (n=22)	Primary (n=25)	Middle (n=21)	Matric (n=19)	Senior secondary (n=5)	Graduate (n=21)	Post-graduate (n=3)
Energy (Kcal)	1072.76±145.46[a]	1145.06±138.20[a]	1131.11±139.93[a]	1160.35±99.32[a]	1132.93±109.34[a]	1164.35±138.56[a]	1032.27±97.56[a]	1124.27±152.63[a]
Protein (g)	35.11±8.41[a]	35.65±5.99[a]	33.45±4.21[a]	36.30±4.12[a]	38.31±6.28[a]	40.50±7.55[a]	36.51±6.92[a]	36.52±4.51[a]
Fat (g)	14.05±2.52[a]	14.17±3.75[a]	14.45±2.99[a]	15.78±3.56[a]	16.26±3.96[a]	15.75±3.85[a]	15.40±2.49[a]	15.59±6.64[a]
Calcium (mg)	413.23±115.50[a]	461.83±124.75[a]	493.32±116.23[a]	506.42±105.23[a]	491.88±125.36[a]	519.32±49.53[a]	513.93±63.11[a]	509.53±0.00[a]
Phosphorus (mg)	641.07±139.13[a]	643.94±103.08[a]	644.11±157.69[a]	654.28±84.79[a]	647.40±115.44[a]	656.55±94.03[a]	651.97±107.29[a]	631.92±0.00[a]
Magnesium (mg)	275.57±58.72[a]	264.02±57.98[a]	263.93±57.33[a]	266.28±51.71[a]	281.24±54.29[a]	281.51±0.00[a]	281.08±59.62[a]	275.92±61.58[a]
Iron (mg)	8.46±1.74[a]	9.27±2.67[a]	9.79±1.38[a]	9.80±2.0[a]	9.81±2.18[a]	9.63±1.99[a]	10.11±2.23[a]	10.24±2.75[a]
Zinc (mg)	5.92±1.74[a]	5.49±0.12[a]	6.33±2.15[a]	6.22±1.12[a]	6.46±1.73[a]	6.25±1.12[a]	6.90±1.75[a]	6.45±2.01[a]
β-Carotene (µg)	2074.46±174.58[a]	2084.35±214.35[a]	2114.45±190.23[ab]	2009.14±151.23[a]	2286.27±275.33[ab]	2301.39±210.56[ab]	2415.59±147.52[b]	2208.35±201.21[ab]
Thiamin(mg)	0.87±0.24[a]	0.95±0.18[a]	0.93±0.12[a]	0.92±0.17[a]	0.94±0.18[a]	0.98±0.18[a]	0.97±0.19[a]	1.02±0.03[a]
Riboflavin (mg)	0.70±0.17[a]	0.76±0.13[a]	0.75±0.13[a]	0.71±0.12[a]	0.77±0.14[a]	0.82±0.16[a]	0.83±0.17[a]	0.83±0.22[a]
Niacin (mg)	5.05±1.67[a]	5.31±1.01[a]	5.42±1.07[a]	5.10±0.99[a]	5.32±1.16[a]	5.74±1.41[a]	5.49±1.28[a]	5.29±1.28[a]
Folic acid (µg)	130.70±35.74[a]	133.34±23.14[a]	140.03±24.56[a]	138.41±31.21[a]	140.03±27.38[ab]	148.34±28.59[b]	150.50±21.27[b]	143.14±32.04[ab]
B_{12}(µg)	0.61±0.14[a]	0.61±0.18[a]	0.67±0.17[a]	0.68±0.12[a]	0.68±0.09[a]	0.72±0.17[a]	0.73±0.13[a]	0.71±0.16[a]
Vitamin C(mg)	23.31±8.21[a]	28.64±12.36[a]	29.14±9.65[ab]	33.44±8.26[b]	28.44±8.22[a]	32.39±8.26[b]	34.16±10.08[b]	29.54±10.71[ab]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.34: Association of spouse education with mean daily nutrient intake male respondents (n=150)

Nutrients	Mean daily intake							
	Illiterate (n=103)	Can read and write (n=12)	Primary (n=13)	Middle (n=7)	Matric (n=9)	Senior secondary (n=1)	Graduate (n=5)	Post-graduate (n=0)
Energy (Kcal)	1612.93±27.35 [a]	1772.92±164.67 [a]	1798.21±281.23 [a]	1599.35±205.04 [a]	16.11±237.53 [a]	1661.72±0.00 [a]	1589.1±77.626 [a]	-
Protein (g)	44.34±9.41 [a]	38.32±13.04 [a]	42.05±11.53 [a]	34.85±3.14 [a]	43.17±10.08 [a]	39.17±0.00 [a]	45.21±13.58 [a]	-
Fat (g)	23.67±10.22 [a]	16.21±9.02 [a]	19.90±8.59 [a]	23.08±10.84 [a]	18.45±7.45 [a]	21.62±0.00 [a]	18.29±5.23 [a]	-
Calcium (mg)	549.33±156.02 [ab]	437.65±178.56 [a]	417.89±123.67 [a]	526.10±132.84 [a]	575.26±117.84 [ab]	601.10±0.00 [b]	591.64±107.23 [ab]	-
Phosphorus (mg)	714.23±209.21 [ab]	689.11±258.97 [a]	689.25±185.31 [a]	681.87±106.65 [a]	694.56±239.51 [ab]	705.88±0.00 [b]	701.27±166.86 [ab]	-
Magnesium (mg)	255.36±86.68 [ab]	241.78±117.29 [a]	224.48±102.39 [a]	246.64±148.39 [a]	273.56±137.32 [ab]	305±0.00 [b]	280.20±105.19 [ab]	-
Iron (mg)	13.15±2.57 [a]	14.57±2.11 [a]	15.67±2.08 [a]	14.58±3.58 [a]	16.68±3.07 [a]	13.04±0.00 [a]	13.75±2.79 [a]	-
Zinc (mg)	8.96±2.72 [a]	8.86±2.18 [a]	8.47±2.17 [a]	8.64±2.72 [a]	9.29±2.19 [a]	9.42±0.00 [a]	10.45±2.98 [a]	-
β-Carotene (µg)	2388.99±246.13[a]	2346.00±245.65[a]	2312.27±230.67 [a]	2807.36±195.36[b]	2901.27±67.01 [b]	2856.23±0.00 [b]	2949.13±152.35[b]	-
Thiamin (mg)	1.44±0.25	1.62±0.27	1.580.38	1.30±0.36	1.38±0.21	1.25±0.00	1.42±0.15	-
Riboflavin (mg)	1.10±0.29 [a]	1.13±0.27 [a]	1.29±0.22 [a]	1.08±0.03 [a]	1.03±0.13 [a]	1.05±0.00 [a]	1.11±0.25 [a]	-
Niacin (mg)	8.47±2.39 [a]	8.18±2.69 [a]	8.47±0.06 [a]	9.14±2.71 [a]	9.32±2.48 [a]	9.41±0.00 [a]	8.47±2.98 [a]	-
Folic acid (µg)	148.60±24.53 [a]	164.79±20.73 [a]	174.74±37.56[a]	179.95±23.99 [ab]	180.56±20.57[ab]	181.94±0.00[ab]	198.17±29.57 [b]	-
B_{12} (µg)	1.05±0.19 [a]	0.93±0.19 [a]	90.±0.22 [a]	89±0.15 [a]	0.88±0.11 [a]	0.86±0.00 [a]	1.04±0.20 [a]	-
Vitamin C (mg)	32.39±8.16 [a]	33.62±7.14 [a]	32.29±8.56 [a]	36.05±11.98 [a]	37.11±7.09 [a]	36.17±0.00 [a]	37.12±10.23 [a]	-

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Mean daily intake of iron was significantly ($p<0.01$) higher among the male respondents those were educated upto primary (15.46 mg), matric (15.14 mg), senior secondary (15.13 mg), graduate (16.03 mg) and post graduate level (15.75 mg) than those respondents who were illiterate (13.12 mg), can read and write (13.57 mg) and middle level (14.32 mg) whereas intake of β-carotene (3140.81 µg), vitamin C (40.13) and folic acid (192.70 µg) significantly ($p<0.01$) higher among those male respondents who were educated upto post graduate level, respectively than the rest of respondents. Mean intake of protein, fats, zinc, thiamin, riboflavin, niacin and vitamin B_{12} was not affected by educational status of geriatric male at a significant level.

Educational status of respondent's spouse

Table 4.33 depicted the association of female respondent's spouse education with food intake. The data revealed that the respondent's spouse who was educated upto graduate level those female respondents had significantly ($p<0.01$) higher intake of β-carotene (2415.59 µg), vitamin C (34.16 mg) and (folic acid 150.50 µg) than rest of the respondents. It was found that intake of energy (1164.35 kcal), protein (40.50g), calcium (519.32 mg), phosphorus (656.55 mg), magnesium (281.51 mg), thiamine (0.98 mg), was highest among the respondents with spouse education upto senior secondary level whereas intake of fat (16.26 g) , iron (10.24 mg), riboflavin (0.83 mg) and niacin (5.79 mg) was highest among those female respondents whose spouse were educated upto matric and post graduate level. However, the differences in intake of these nutrients were non-significant.

Data presented in the Table 4.34 depicted the association of male respondent's spouse education with food intake. The data revealed that the respondent's spouse who was educated upto senior secondary level those male respondents had significantly ($p<0.01$) higher intake calcium (601.10 mg), phosphorus (705.88 mg) and magnesium (305.21 mg) than those respondents whose spouse can read and write (437.65mg, 689.11 mg and 241.78 mg, respectively)), primary (417.89 mg, 689.25 mg and 224.48 mg, respectively) and middle (526.10mg, 601.87 mg and 246.64 mg, respectively) but did not differed significantly to those respondents whose spouse were illiterate (549.33 mg, 714.23 mg and 255.36 mg, respectively), matric (575.26 mg, 694.56 mg and 273.56 mg, respectively) and graduate level (591.64 mg, 701.27 mg and 280.20mg, respectively). Mean daily intake of β-carotene (2949.13 µg), vitamin C (37.12 mg) and folic acid (198.17 µg) was significantly ($p<0.01$) higher among the respondents those spouse were graduate that those respondents whose spouse were illiterate (2388.99 µg, 32.39 mg and 148.60 µg, respectively), can read and write (2346.00 µg, 33.62 mg and 164.79 µg, respectively) primary (2312.27 µg, 32.29 mg and

174.74 µg, respectively) but was not significantly ($p<0.01$) higher than those respondents whose spouse were educated upto middle (2807.36 µg, 36.05mg and 179.95 µg, respectively), matric (2801.27 µg, 37.11 mg and 180.56 µg, respectively) and senior secondary (2856.23 µg, 36.17 mg and 181.94 µg, respectively). A non-significant difference was observed in the mean intake of energy, protein, fat, iron, zinc, thiamin, riboflavin, niacin and vitamin B_{12} by the respondents with spouse those were having different educational qualification (upto illiterate, can read and write, primary, middle, matric, senior secondary and graduation level of education).

Occupation of respondents

Data presented in the Table 4.35 illustrated that occupation of geriatric respondents was classified into six categories i.e. labourer, caste occupation, business, agriculture, ex-service and none. It was reported that intake of protein (39.13 g) was significantly ($p<0.01$) higher among the respondents those were business person than those occupation was labourer (32.46g), ex-service (32.05g) and none (30.51g) but not significantly ($p<0.01$) higher than those occupation was agriculture (33.30g). Mean daily intake of calcium (424.25 mg), phosphorus (646.91 mg), magnesium (269.76 mg), β-carotene (2718.57 µg), vitamin C (35.26 mg), folic acid (155.42 µg) and vitamin $B_{12.}$ (0.84 µg) was significantly ($p<0.01$) higher among the respondents belonging to agriculture than the respondents those were labourer, and none but did not significantly ($p<0.01$) higher than those were doing business and ex-service. It was observed that mean daily intake of fats, thiamine, riboflavin and niacin was not affected by the occupation of female geriatric respondents.

Table 4.36 represented the association of between occupation of male respondents and mean daily nutrient intake. It was found that those were doing business (48.11 g) and ex-service (47.68 g) had significantly ($p<0.01$) higher intake of protein than those were indulged in labour (41.91 g), caste agriculture (41.93 g) and none (35.61 g). The mean daily intake of calcium (597.94 mg), phosphorus (687.04 mg), magnesium (272.38 mg) β-carotene (3001.20 µg) and vitamin C (40.33 mg) was significantly ($p<0.01$) higher in those respondents who were in ex-service group than rest of the respondents.

It was observed that mean intake of fats (g), zinc (mg), thiamine (mg), riboflavin (mg), niacin (mg), folic acid (µg) and vitamin B_{12} (µg) was not affected by the occupation of male geriatric respondents at a significant level.

Table 4.35: Association of occupation on mean daily food intake of geriatric female respondents (n=150)

Nutrients	Laboures (n=8)	Caste occupation (n=0)	Business (n=2)	Agriculture (n=7)	Ex-service (n=19)	None (n=114)
Energy (kcal)	1247.32±83.25[a]	-	1132.38±30.68[a]	1214.77±192.10[a]	1093.88±139.71[a]	1132.93±130.34[a]
Protein (g)	32.46±6.18[a]	-	39.13±2.14[b]	33.30±7.94[ab]	32.05±5.99[a]	30.51±9.68[a]
Fat (g)	15.67±6.72[a]	-	13.56±5.07[a]	15.79±8.17[a]	13.67±8.32[a]	14.87±8.77[a]
Calcium (mg)	372.38 ±43.21[a]	-	410.70±75.38[ab]	424.25±81.45[b]	420.08±109.31[ab]	403.93±125.11[a]
Phosphorus (mg)	628.74±105.16[a]	-	640.25±46.19[ab]	646.91±164.51[b]	641.90±151.87[ab]	607.92±170.29[a]
Magnesium (mg)	230.02±59.30[a]	-	258.88±11.56[ab]	269.76±74.50[b]	256.14±56.70[ab]	250.50±59.62[a]
Iron (mg)	10.97±2.00[a]	-	9.83±0.79[a]	9.13±3.03[a]	10.70±1.98[a]	11.51±2.11[a]
Zinc (mg)	7.26±1.25[a]	-	6.63±0.35[a]	6.67±2.03[a]	7.81±1.37[a]	7.12±1.28[a]
β-Carotene (µg)	2098.66±202.75[ab]	-	1813.36±46.35[a]	2718.57±79.62[b]	2237.08±187.58[ab]	2129.87±204.72[ab]
Thiamin(mg)	1.08±0.18[a]	-	1.00±0.03[a]	1.09±0.26[a]	0.98±0.17[a]	0.93±0.13[a]
Riboflavin (mg)	0.76±0.10[a]	-	0.83±0.03[a]	0.81±0.13[a]	0.84±0.15[a]	0.75±0.15[a]
Niacin (mg)	6.57±1.67[a]	-	5.99±0.35[a]	6.04±1.43[a]	5.89±1.73[a]	5.09±1.28[a]
Folic acid (µg)	134.67±32.66[a]	-	141.00±21.94[a]	155.42±20.12[b]	148.28±31.91[ab]	139.41±35.85[a]
B_{12} (µg)	0.83±0.14[b]	-	0.75±0.03[ab]	0.84±0.26[b]	0.72±0.17[ab]	0.68±0.19[a]
Vitamin C(mg)	23.09±13.26[a]	-	20.26±12.89[a]	35.26±13.24[b]	30.01±5.03[a]	26.11±12.01[a]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.36: Effect of occupation on mean daily food intake of geriatric male respondents (n=150)

Nutrients	Mean daily intake					
	Laboures (n=18)	Caste occupation (n=3)	Business (n=20)	Agriculture (n=42)	Ex-service (n=47)	None (n=20)
Energy (Kcal)	1779.96±353.94[a]	1702.81±327.87[a]	1655.04±231.53[a]	1589.85±251.17[a]	1604.75±231.53[a]	1637.60±200.09[a]
Protein (g)	41.91±11.26[a]	45.10±12.03[ab]	48.11±8.38[b]	41.93±12.54[a]	47.68±10.16[b]	35.61±8.65[a]
Fat (g)	20.52±8.92[a]	21.19±7.70[a]	20.86±4.17[a]	23.560±8.04[a]	22.477±8.64[a]	20.48±4.46[a]
Calcium (mg)	546.22±136.46[a]	539.04±100.83[a]	568.04±158.91[a]	583.95±153.64[ab]	597.94±177.89[b]	585.39±76.24[ab]
Phosphorus (mg)	628.03±265.79[a]	492.59±114.59[a]	679.28±235.85[b]	676.81±205.04[ab]	687.04±222.98[b]	684.86±240.35[ab]
Magnesium (mg)	287.66±112.16[a]	214.22±104.43[a]	270.76±100. 68[ab]	266.02±99.61[ab]	272.38±118.39[b]	270.19±92.77[ab]
Iron (mg)	14.80±2.79[a]	13.44±3.68[a]	13.71±266[a]	15.79±3.52[a]	14.40±5.01[a]	14.36±2.96[a]
Zinc (mg)	9.43±2.23[a]	8.74±2.83[a]	9.53±2.23[a]	9.27±2.30[a]	9.66±2.05[a]	9.78±1.71[a]
B-Carotene (µg)	2351.12±152.15[a]	2051.24±121.01[a]	3001.20±112.33[b]	2851.20±147.83[b]	2974.96±111.25[b]	2981.25±108.11[b]
Thiamin(mg)	1.38±0.66[a]	1.09±0.52[a]	1.40±0.32[a]	1.18±0.61[a]	1.40±0.30[a]	1.40±0.34[a]
Riboflavin (mg)	1.06±0.25[a]	1.07±0.26[a]	1.14±0.26[a]	1.10±0.31[a]	1.21±0.17[a]	1.11±0.24[a]
Niacin (mg)	6.12±2.16[a]	6.04±4.16[a]	6.24±2.18[a]	6.09±2.53[a]	6.45±2.67[a]	6.12±2.57[a]
Folic acid (µg)	163.39±27.98[a]	160.76±26.40[a]	178.46±23.47[a]	171.37±27.01[a]	177.38±20.43[a]	170.56±9.67[a]
B_{12}(µg)	0.88±0.17[a]	0.88±0.16[a]	0.88±0.9[a]	0.97±0.12[a]	0.93±0.14[a]	1.12±0.14[a]
Vitamin C(mg)	28.26±5.54[a]	32.02±13.32[a]	40.33±15.02[b]	35.02±18.32[ab]	38.92±13.32[b]	38.67±20.41[b]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Family income

Table 4.37 depicts the values on association of family income of female respondents with mean daily nutrient intake of female respondents on mean daily food intake. It was observed that intake of energy (1194.44kcal), protein (39.49 g), calcium (492.44 mg), phosphorus (591.72 mg), magnesium (287.47 mg), iron (12.06 mg), zinc (6.70 mg), β-carotene (2216.41 µg), vitamin C (34.06mg), thiamine (0.93mg), folic acid (145.59 µg) and vitamin B_{12} (0.73 µg) was significantly ($p<0.01$) higher among the female respondents whose income was above Rs. 36000 per month than those income was below Rs. 12000, Rs. 12001to 2400 per month but was not significantly ($p<0.01$) higher than those respondents whose income was Rs. 24001 to 36000 per month. Mean daily intake of fats, riboflavin and niacin was not affected by the family income of female respondents.

Table 4.37: Association of family income with mean daily nutrient intake of geriatric female respondents (n=150)

Nutrients	Mean daily intake			
	<12000 (n=22)	**12001-24000 (n=58)**	**24001-36000 (n=47)**	**>36000 (n=23)**
Energy (kcal)	1058.85±194.65^{a}	1081.98±180.81^{a}	1193.18±194.72^{b}	1194.44±201.30^{b}
Protein (g)	33.02±6.42^{a}	34.25±5.92^{a}	37.13±7.02^{b}	39.49±8.13^{b}
Fat (g)	13.79±6.56	14.19±6.56	14.87±6.77	15.95±4.21
Calcium (mg)	330.85±111.46^{a}	415.52±106.83^{b}	479.36±151.36^{c}	392.44±91.23^{a}
Phosphorus (mg)	505.15±165.38^{a}	519.73±152.39^{a}	591.33±165.76^{b}	591.72±148.36^{b}
Magnesium (mg)	268.01±64.75^{a}	274.04±54.82^{a}	283.06±61.59^{a}	287.47±59.49^{a}
Iron (mg)	7.34±1.82^{a}	8.75±2.10^{a}	11.21±2.11^{b}	12.06±2.68^{b}
Zinc (mg)	6.02±1.30^{a}	6.19±1.35^{a}	6.61±1.29^{b}	6.70±1.45^{b}
β-Carotene (µg)	1786.76±138.63^{a}	1838.65±145.05^{a}	2021.99±217.24^{b}	2216.41±249.91^{b}
Thiamin (mg)	0.87±0.18^{a}	0.88±0.18^{a}	0.97±0.19^{ab}	0.98±0.21^{b}
Riboflavin (mg)	0.73±0.15^{a}	0.73±0.17^{a}	0.76±0.14^{a}	0.77±0.13^{a}
Niacin (mg)	5.33±1.35^{a}	5.11±1.24^{a}	5.41±1.19^{a}	5.45±1.33^{a}
Folic acid (µg)	132.00 ±15.69^{a}	139.38±19.55^{ab}	139.68±14.56^{ab}	145.59±21.03^{b}
B_{12}(µg)	0.62±0.18^{a}	0.63±0.18^{a}	0.72±0.18^{b}	0.73±21^{b}
Vitamin C (mg)	14.08±10.85a	22.85±15.96ab	24.46±15.96b	34.06±9.78c

Values are Mean ± SD Row Means with the same superscript do not differ significantly

Table 4.38 depicts the values on effect of family income of male respondents on mean daily food intake of male respondents on mean daily food intake. It was found that mean daily intake of protein (61.02 g), calcium (594.56 mg), phosphorus (681.59 mg), magnesium (351.76 mg), β-carotene (3179.82 µg), vitamin C (47.74 mg) and folic acid (193.36 µg) was significantly ($p<0.01$) higher among the male respondents whose income

was above Rs. 36000 per month than those income was below Rs. 12000, Rs. 12001to 2400 per month but was not significantly ($p<0.01$) higher than those respondents whose income was Rs. 24001 to 36000 per month. Mean daily intake of energy (1638.05kcal), fats (22.48 g), zinc (9.90 mg) intake was highest among the respondents with income Rs. 24001 to Rs. 36000 while the intake of iron (14.90 mg), riboflavin (1.09 mg), niacin (9.75 mg) and vitamin B_{12} (1.01 µg) was highest among the respondents with income above Rs, 36000 per month. However, the differences in intake of these nutrients were non-significant.

Table 4.38: Association of family income with mean daily nutrient intake of geriatric male respondents (n=150)

Nutrients	Mean daily intake			
	<12000 (n=22)	**12001-24000 (n=70)**	**24001-36000 (n=31)**	**>36000 (n=27)**
Energy (kcal)	1568.47±100.99[a]	1568.96±56.04 [a]	1638.05±348.33[a]	1584.65±278.75[a]
Protein (g)	49.48±15.6 [a]	50.20±15.90 [a]	55.60±13.58[ab]	61.02±12.5[ab]
Fat (g)	18.33±11.65 [a]	19.83±6.51 [a]	22.48±12.67[a]	20.15±11.06[a]
Calcium (mg)	591.24±142.00 [a]	551.08±105.57 [a]	608.47±150.61[ab]	594.56±104.28[b]
Phosphorus (mg)	640.94±299.51[a]	650.11±271.35[ab]	679.84±91.36[a]	681.59±59.90[ab]
Magnesium (mg)	323.23±174.05 [a]	335.69±113.04 [a]	350.10±115.32[b]	351.76±103.72[b]
Iron (mg)	12.19±0.96 [a]	13.94±2.85 [a]	14.24±2.76 [a]	14.95±3.42[a]
Zinc (mg)	9.76±1.86 [a]	9.35±1.99 [a]	9.90±1.70 [a]	9.46±2.17[a]
β-Carotene (µg)	2572.68±260.87 [a]	2790.83±618.54[ab]	3064.69±628.71[ab]	3179.82±476.73[b]
Thiamin(mg)	1.67±0.50 [a]	1.42±0.34 [a]	1.42±0.59[a]	1.67 ±0.80[a]
Riboflavin (mg)	1.04±0.25[a]	1.01±0.28 [a]	1.04±0.23[a]	1.09±0.40[a]
Niacin (mg)	8.24±3.56 [a]	8.49±3.02 [a]	8.60±2.36 [a]	9.75±2.69[a]
Folic acid (µg)	173.53±27.59 [a]	178.81±32.71 [a]	185.40±34.70[b]	193.36±33.12[b]
B_{12}(µg)	0.88±0.16 [a]	0.92±0.19 [a]	0.94±0.17[a]	1.01±0.16[a]
Vitamin C(mg)	30.56±2.17 [a]	35.41±3.77 [a]	42.88±1.89[ab]	47.74±2.76[b]

Values are Mean ± SD Row Means with the same superscript do not differ significantly

4.3 Health problems among geriatric respondents

4.3.1 Personal habits of geriatric respondents regarding health

Personal habits regarding health states that how many respondents spent time in physical activities which were beneficial in maintenance of good health. Respondents were asked about their exercise, walking, yoga and any other kind of physical activity schedules. Data presented in the Table 4.39 revealed that majority of the respondents (92.00%; 48.33% rural and 43.67% urban) were exercising rarely followed by weekly (3.67%; 1.33% rural and 6.00% urban), daily (1.67%; 1.33% rural and 2.00% urban), alternatively (1.00%; 0.67% rural and 1.33% urban), monthly (1.00%; 2.00% urban) and fortnightly basis (0.67%; 1.33%

urban). It was observed that 51.33 per cent, 20.67 per cent, 1.00per cent, 0.67per cent 1.33per cent and 25.00per cent respondents were going for walk daily, alternatively, weekly, fortnightly, monthly and rarely basis, respectively.

Table 4.39: Personal health habits of geriatric respondents (N=300)

Activity	Area	Daily	Alternatively	Weekly	Fortnightly	Monthly	Rarely
Exercise	Rural (n=150)	2(1.33)	1(0.67)	2(1.33)	-	-	145(96.67)
	Urban (n=150)	3(2.00)	2(1.33)	9(6.00)	2(1.33)	3(2.00)	131(86.33)
	Total (n=300)	5(1.67)	3(1.00)	11(3.67)	2(0.67)	3(1.00)	276(92.00)
Walking	Rural (n=150)	60(40.00)	43(28.67)	2(1.33)	-	-	45(30.00)
	Urban (n=150)	94(62.67)	19(12.67)	1(0.67)	2(1.33)	4(2.67)	30(20.00)
	Total (n=300)	154(51.33)	62(20.67)	3(1.00)	2(0.67)	4(1.33)	75(25.00)
Yoga	Rural (n=150)	20(13.33)	10(6.67)	5(3.33)	-	-	115(77.33)
	Urban (n=150)	7(4.67)	5(3.33)	-	1(0.67)	2(1.33)	135(89.33)
	Total (n=300)	27(9.00)	15(5.00)	5(1.67)	1(0.33)	2(0.67)	250(83.33)

Values in parentheses indicate percentage

Yoga was done by 9.00per cent respondents daily, 5.00per cent alternatively, 1.67per cent weekly, 0.33 per cent fortnightly and 0.67per cent monthly while 83.33per cent respondents were not performing any kind of physical activity.

4.3.2 Prevalence of anaemia among the geriatric respondents

Respondents from rural and urban area were motivated for the haemoglobin test to their nearby hospital to assess the prevalence of anaemaia among them. Results revealed that most of female respondents (52.00%; 27.33% rural and 24.67% urban) were suffering from moderate anemia followed by 30.67 per cent respondents (13.33% rural and 17.33% urban), 12.67 per cent respondents (6.67% rural and 6.00% urban) and 4.67 per cent respondents (2.67% rural and 2.00% urban) those were in the category of anaemia as mild, normal and severe, respectively.

Table 4.40: Prevalence of anaemia among the geriatric respondents (N=300)

Anaemia Status	Hb level (g/dl)	Female (n=150)			Hb level (g/dl)	Male (n=150)		
		Rural	Urban	Total		Rural	Urban	Total
Normal	≥12	10(6.67)	9(6.00)	19(12.67)	≥ 13	18(12.00)	15(10.00)	33(22.00)
Mild	10-11.99	20(13.33)	26(17.33)	46(30.67)	11-12.99	33(22.00)	40(26.67)	73(48.67)
Moderate	7-9.99	41(27.33)	37(24.67)	78(52.00)	8-10.99	24(16.00)	13(8.67)	37(24.67)
Severe	<7	4(2.67)	3(2.00)	7(4.67)	<8	-	7(4.67)	7(4.67)

Values in parentheses indicate percentage
Hb-Haemoglobin (g/dl), WHO- International classification, 2004

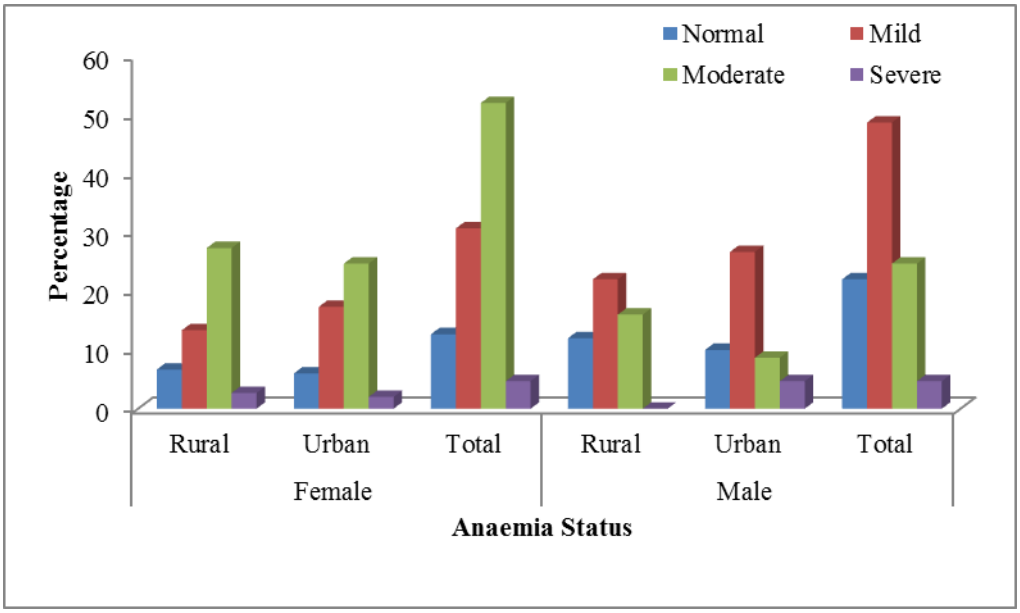

Fig. 4.8: Prevalence of anaemia among the geriatric respondents

Table 4.40 (Fig. 4.8) represented that majority of male respondents (48.67%; 22.00% rural and 26.67% urban) were suffering from mild stage of anemia followed by 24.67 per cent respondents (16.00% rural and 8.67% urban), 22.00 per cent respondents (12.00% rural and 10.00% urban) and 4.67 per cent respondents (2.67% urban) those were lying in the category of anaemia as moderate, normal and severe, respectively. Out of 300 respondents 4.67 per cent were suffering from severe anaemia while 14.00 per respondents were having normal level of haemoglobin in blood serum.

4.3.3 Distribution pattern of health problems among geriatric respondents

The elderly respondents from urban and rural area of Sirsa district were enquired about the common health problems faced by them at different interval of time. The results of commonly prevailing health problems are presented in the Table 4.41 It was observed that out of 300 respondents, 22.33% respondents from urban and 32.33% respondents from rural area were rarely suffered from stomach pain while 2.67% urban and 1.33% rural respondents were suffering from stomach pain regular basis. 20% urban and 15.67% rural respondents occasionally had stomach pain. Majority of the respondents (83.00%; 38.67% urban and 43.3% rural) rarely faced diarrhoea followed by 10.67% occasionally (7.00% urban and 3.67% rural), 4.33% often (3.00% urban and 1.33 rural) and 2.67% respondents on regularly basis (1.33% urban and 1.33% rural), respectively.

Majority of the respondents 37.67% (57.33% rural and 28% urban) occasionally suffering from constipation followed by often (37.00%; 30.67% and 43.33% urban) rarely (12.33%; 12.67% rural and 12.00% urban) and regularly basis (11.00%; 5.33% rural and16.67% urban). Most of the respondents (87.00%) were facing flatulence regularly whereas only 3.00 percent respondents (2.00% rural and 4.00% urban) faced it rarely.

Table 4.41: Distribution pattern of health problems among geriatric respondents **(N=300)**

Health problem	Rural (n=150)				Urban (n=150)			
	Regularly	Often	Occasionally	Rarely	Regularly	Often	Occasionally	Rarely
Stomach pain	4(2.67)	2(1.33)	47(15.67)	97(32.33)	8(2.67)	15(10.00)	60(40.00)	67(44.67)
Diarrhoea	4(2.67)	5(3.33)	11(14.67)	130(86.33	4(2.67)	9(6.00)	21(14.00)	116(77.33)
Constipation	8(5.33)	46(30.67)	77(51.33)	19(12.67)	25(16.67)	65(43.33)	42(28.00)	18(12.00)
Flatulence	141(94.00)	4(2.67)	2(1.33)	3(2.00)	120(80.00)	15(10.00)	9(6.00)	6(4.00)
Lack of appetite	36(24.00)	25(16.67)	33(22.00)	56(48.67)	49(32.67)	25(16.67)	29(19.33)	47(31.33)
Difficulty in breathing	5(3.33)	9(6.00)	28(18.67)	107(39.00)	8(5.33)	24(16.00)	53(35.33)	65(43.33)
Joint pain	126(84.00)	13(8.67)	7(4.67)	4(2.67)	120(80.00)	11(7.33)	11(7.33)	8(5.33)
Back ache	52(34.67)	51(34.00)	34(22.67)	13(8.67)	92(61.33)	32(21.33)	16(10.67)	10(6.67)
Toothache	9(6.00)	11(7.33)	91(60.67)	39(26.00)	30(20.00)	28(18.67)	65(43.33)	27(18.00)
Tremor of hands	5(3.33)	1(0.67)	9(6.00)	135(90.00)	2(1.33)	2(1.33)	15(10.00)	131(94.00)
Irritability	-	1(0.67)	17(11.33)	132(88.00)	1(0.67)	14(9.33)	68(45.33)	67(44.67)
Loneliness	1(0.67)	6(4.00)	107(78.00)	36(24.00)	5(3.33)	47(31.33)	87(58.00)	11(7.33)
Difficulty in sleeping	26(17.33)	37(24.67)	28(18.67)	59(39.33)	40(26.67)	43(28.67)	33(22.00)	34(22.67)
Eye infections	31(20.67)	26(17.33)	30(20.00)	63(42.00)	40(26.67)	25(16.67)	44(29.33)	41(27.33)
Hearing problems	5(3.33)	1(0.67)	9(6.00)	135(90.00)	2(1.33)	3(2.00)	15(10.00)	130(93.33)
Skin allergy	3(2.00)	5(3.33)	6(4.00)	136(90.67)	130(86.67)	7(3.67)	3(2.00)	10(6.67)

Values in parentheses indicate percentage

Flatulence was occasionally faced by 6.33% respondents (2.67% rural and10.00% urban). Most of the urban people (32.67%) feel lack of appetite while rural respondents (99.33%) feel lack of appetite rarely. Majority of the respondents (65.00%) reported lack of appetite rarely followed by regularly (28.33%; 24.00% rural and 32.67% urban) occasionally (20.67%; 22.00% rural and 19.33% urban) and often basis (16.33%; 16.67% rural and 16.67% urban). Maximum respondents (60.67%) faced difficulty in breathing rarely. whereas minimum respondents (4.33%) face it on regular basis. Among 300 respondents 18.67% rural and 35.33% urban respondents faced difficulty in breathing occasionally, while 16.00% urban and 6.00% rural respondents on often basis. It was noticed that maximum number of the respondents (82.00%; 84.00% rural and 80.00% urban) suffering from joint pain regularly, whereas minimum number of respondents (4.00%; 2.67% rural and 5.33% urban) faced it rarely basis. Six percent respondents (4.67% rural and 7.33% urban) faced joint pain occasionally while 8.00 percent respondents (8.67% rural and 7.33% urban) faced joint pain often basis.

Majority of the respondents (47.67%; 34.67% rural and 61.33% urban) suffering from back ache regularly followed by often (27.667%; 34.00% rural and 21.33% urban), occasionally (16.67%; 22.67% rural and 10.67% urban) and rarely basis (7.67% ; 8.67% rural and 6.67% urban). Most of the respondents (57.00%) suffered from toothache while 13.33 percent respondents suffered from it regularly. Thirteen percent (7.33% rural and18.67% urban) respondents faced toothache often basis and 22.00 percent respondents (26.00% rural and 18.00% urban) rarely. Tremor of hands was not a major health issue (87.00% respondents faced it rarely) among the elderly respondents. Eight percent respondents (6.00% rural and10.00% urban) faced tremor of hands occasionally followed by 2.33 percent (3.33% rural and1.33% urban) and 1.00 percent (0.67% rural and 1.33% urban) respondents on regular and often basis, respectively. It was observed that, majority of urban respondents (28.67%) faced difficulty in sleeping regularly while majority of rural respondents (39.33%) it rarely. Difficulty in sleeping was faced by 20.33 percent (18.67% rural 22.00%) urban, 15.67 percent (24.67% rural and 26.67% urban), 23.00 percent (17.33% rural and 28.67% urban) and 31.00 percent respondents occasionally, often regularly and rarely basis, respectively. Irritability was reported occasionally, often, regularly and rarely in 28.33 percent (11.33% rural and 45.33% urban), 5.00 percent (0.67% rural and 9.33% urban), 0.33 percent (0.67% urban) and 66.33 percent (88.00% rural and44.67% urban) respondents, respectively. Majority of the respondents were suffering from loneliness often, rarely and regularly basis, respectively. Table 4.45 revealed that most of the urban respondents (89.33%) suffered from eye infection occasionally whereas most of rural respondents (42.00%) faced it rarely. Majority of the respondents (89.33%) suffered from eye infections rarely followed by 24.67% (20.00% rural and 29.33% urban) and 17.00 percent (17.33% rural and16.67% urban) represents faced eye infections occasionally, regularly and often, respectively. It was observed that most of rural

(90.00%) and urban respondents (93.33%) rarely faced the hearing problem. Majority of the urban respondents (46.67%) reported skin allergy regularly while majority of rural respondents (90.67%) reported them rarely. Three per cent respondents faced skin allergy occasionally, 4.00 per cent respondents (3.33% rural and 4.67% urban) often, 44.33 per cent respondents (2.00% rural and 86.67% urban) regularly and 48.67 per cent respondents (90.67% rural and 6.67% urban) rarely faced skin allergy.

4.3.4 Distribution of disease (s) and risk factors among the geriatric respondents

The geriatric respondents were asked about various chronic diseases among urban and rural respondents. Cataract was more prevalent among rural (58.00%) respondents than that of urban respondents (53.33%). Seventy four percent of urban respondent and 40.67 per cent of rural respondents were suffering from blood pressure problem while 42.67 per cent respondents (59.33% rural and 26.00% urban) were not facing any kind of Blood Pressure issue. Table 4.42 (Fig. 4.9) represents that majority of the respondents (93.67%; 94.00% rural and 93.33% urban) were not having Asthma disease, whereas 6.00 percent rural and 6.67 percent urban respondents suffering from Asthma.

Table 4.42: Prevalence of disease (s) and risk factors among the geriatric respondents

(N=300)

Diseases	Rural (n=150)		Urban (n=150)	
	Yes	No	Yes	No
Cataract	87 (58.00)	63 (42.00)	80 (53.33)	70 (23.33)
Blood Pressure	61 (40.67)	89 (59.33)	111 (74.00)	39 (26.00)
Asthma	9 (6.00)	141(94.00)	11(6.67)	139 (93.33)
Renal Calculi	3 (2.00)	147 (49.00)	33 (22.00)	117(78.00)
Diabetes	26 (17.33)	124 (82.67)	51 (34.00)	99 (66.00)
Heart Disease	29 (19.33)	121 (8.67)	43 (28.67)	107 (71.33)
Osteoarthritis	27 (18.00)	123 (82.00)	61(40.67)	89 (59.33)

Values in parentheses indicate percentage

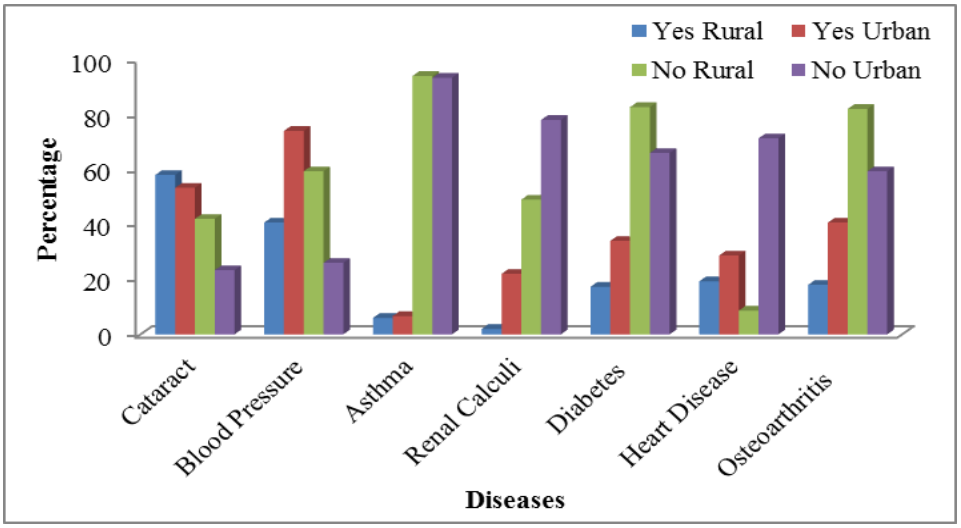

Fig. 4.9: Prevalence of disease (s) and risk factors among the geriatric respondents

Two per cent rural respondents and eleven per cent urban respondents were suffering from renal calculi while 80 per cent (98.00% rural and 78.00 urban) respondents didn't renal calculi. It was observed that 17.33 per cent rural and 34.00 per cent urban respondents were suffering from Diabetes mellitus, whereas 74.33 per cent respondents (82.67% rural and 66.00% urban) were free from Diabetes mellitus. Heart disease was more common among urban respondents (28.67%) than that of rural respondents (19.33%). Seventy six percent respondents didn't reported heart disease. It was reported that 18.00 percent rural and 40.67 percent urban respondents were having other disease while most of the respondents (70.67%; 82.00% rural and 59.33 urban).

4.3.5 Age wise distribution of disease among geriatric respondents

Among the 300 respondents the time of onset of any disease was different among the respondents. Data in the Table 4.43 represented that majority of the respondents (33.33%; 33.33% rural and 33.33% urban) were suffering from cataract in the age group of 61 to 70 years followed by 23.67 per cent respondents (28.26% rural and 28.67% urban) and 2.00 per cent respondents (2.67% rural and 1.33% urban) who were in the age group of 71 to 80 years and 81 to 90 years, respectively. Majority of the respondents (41.33%; 23.33% rural and 59.33% urban) were suffering from blood pressure were in the age group of 61 to 70 years, followed by 12.67 per cent respondents (12.67% rural and 12.67% urban) and 3.33 per cent respondents (4.67% rural and 2.00% urban) those were suffering from blood pressure in the age group of 71 to 80 years and 81 to 90 years, respectively.

Asthma was found in maximum number of respondents (2.33%) at the age of 61 to 70 years while in minimum number of respondents (1.00%) at the age of 81 to 90 years of age. Renal calculi was observed among majority of the respondents (9.76%; 2.00% rural and 18.00% urban) in the age of 61 to 70 years of age followed by 2.00 per cent respondents, (4.00% urban) and 0.67 per cent respondents (0.67% urban) in the age of 71 to 80 years and 81 to 90 years, respectively.Majority of the respondents (19.67%; 13.33% rural and 26.00% urban) suffering from diabetes were from age group of 61 to 70 years while 9.00 per cent respondents were in the age group of 71 to 80 years. Heart disease was occurring at the age of 61 to 70 years of age among the most of respondents (35.67%; 17.33% rural and 18.00% urban) whereas 6.33 per cent respondents (2.00% rural and 10.67% urban) in the age of 71to 80 years, respectively. It was observed that most of respondents suffering from osteoarthritis (18.00%; 11.33% rural and 24.67% urban) were observed in the age group of 61 to 70 years while 9.33 per cent respondents (4.00% rural and 16.00% urban) were found in the age group of 71 to 80 years of age.

Table 4.43: Age wise distribution of diseases among geriatric respondents (N=300)

Diseases	Rural (n=150)		Urban (n=150)	
	Yes	No	Yes	No
Cataract	87 (58.00)	63 (42.00)	80 (53.33)	70 (46.67)
61-70 yrs	50 (33.33)	-	50 (33.33)	-
71-80 yrs	43 (28.26)	-	28 (28.67)	-
81-90 yrs	4 (2.67)	-	2 (1.33)	-
Blood Pressure	61 (40.67)	89 (59.33)	111 (74.00)	39 (26.00)
61-70 yrs	35 (23.33)	-	89 (59.33)	-
71-80 yrs	19 (12.67)	-	19 (12.67)	-
81-90 yrs	7 (4.67)	-	3 (2.00)	-
Asthma	9 (6.00)	141(94.00)	11(6.67)	139 (92.33)
61-70 yrs	5 (3.33)	-	6 (4.00)	-
71-80 yrs	2(1.33)	-	4(2.67)	-
81-90 yrs	2(1.33)	-	1(0.67)	-
Renal Calculi	3 (2.00)	147 (49.00)	33 (22.00)	117(39)
61-70 yrs	3 (2.00)	-	26 (17.33)	-
71-80 yrs	-	-	6 (4.00)	-
81-90 yrs	-	-	1 (0.67)	-
Diabetes	26 (8.67)	124 (82.67)	51 (34.00)	99 (66.00)
61-70 yrs	20 (13.33)	-	39 (26.00)	-
71-80 yrs	6 (4.00)	-	12(8.00)	-
81-90 yrs	-	-	-	-
Heart Disease	29 (9.67)	121 (40.33)	43 (28.67)	107 (35.67)
61-70 yrs	26 (0.67)	-	27 (18.00)	-
71-80 yrs	3	-	16 (10.67)	-
81-90 yrs	-	-	-	-
Osteoarthritis	27 (18.00)	123 (82.00)	61 (40.67)	89(59.33)
61-70 yrs	17 (11.33)	-	37 (24.67)	-
71-80 yrs	5(3.33)	-	24 (16.00)	-
81-90 yrs	1(0.67)	-	-	-

Values in parentheses indicate percentage

4.3.6 Prevalence and medicinal Status of the diseases among geriatric respondents

Data presented in the Table 4.44 represented the number of respondents whose disease were under control with or without medical treatment and whose disease were not in control even with regular medical treatment. Among the cataract patients (n=167) 1.00 per cent respondents (1.15% rural and 2.30% urban respondents) were regulating the diseased conditions with medicine and 1.00 per cent respondents (2.30% rural and 1.25% urban respondents) were under control without any medicine. It was observed that 49.67 per cent respondents (90.80% rural and 80.50% urban respondents) were not under controlled condition of disease but taking medical treatment while 4.00 per cent respondents (5.75%

rural and 8.75% urban respondents) were not under control and not using any medicine. Out of 55.67 per cent respondents 50.67 per cent respondents were taking medicine and 5.00 per cent respondents were not taking medicines to control the severity disease. Among the patents of blood pressure (57.33%) 0.63 per cent rural respondents were controlling the disease with medicine and 4.92 per cent urban respondents were not using any medicine and disease was under control. It was observed that 14.33 per cent respondents (34.42% rural and 19.81% urban respondents) were taking medicine and not under control whereas 41.67 per cent respondents (29.67% urban and 59.01% rural and 80.18% urban respondents) were not in control and not taking any kind of medicines. Among the 57.33 per cent respondents suffering from blood pressure 14.67 per cent respondents were taking medicine and 42.67 per cent respondents were not taking medicines to control the diseased level.

Table 4.44 revealed that among the asthma patients (n=20) 1.00 per cent respondents (11.11% rural and 18.18% urban respondents) were controlling the severity of the disease with medicine while 0.33 per cent respondents were controlling the disease without medicine. It was observed that 3.33 per cent respondents (66.67% rural and 36.36% urban respondents) were not under control even with the intake of medicines while 2.00 per cent respondents (22.22% rural and 36.36% urban respondents) were not taking medicine and they were not under control level of disease. Data presented in the Table 4.48 depicts that 9.33 per cent respondents (5.56% rural and 78.79% urban) were taking medicine to control renal calculi level but not under control level whereas 1.67 per cent respondents (were not taking any kind of medicine to control the severity of disease and were not under the control level of disease. Among the diabetic patients (n=77) only 2.67per cent respondents (7.69% rural and11.76% urban respondents) were controlling the diseased condition with medicine while 1.67 per cent respondents (7.69% rural and 5.88% urban respondents) were under control without any medical treatment. Forty seven respondents (20 rural and 27 urban respondents) were taking medicine but not under control while 17 respondents (2 rural and 15 urban respondents) were not taking medical treatment and were not under control level of diabetes. Out of 25.67per cent diabetic patients 18.33 per cent respondents were taking medicine and 7.33per cent respondents were not taking medicines to control the diseased level. Twenty four per cent respondents (19.33% rural and 28.67% urban respondents) were suffering from heart disease, out of that 10.34 per cent rural respondents and 7.65 per cent urban respondents were taking medical treatment to control the level of severity of disease and 0.67 per cent respondents (3.45% rural and 3.33% urban respondents) were under the control level without any medical treatment. Seventeen per cent respondents (65.52% rural and 74.41% urban respondents) were not under control level of disease with the use of medicine while 7.67 per cent respondents (20.69% rural and 39.53 % urban respondents) were not under control level of disease and not taking any kind of disease to control it. It was observed that 37 respondents (12.33%) were taking medicine to control the heart disease level while 25 (8.33%) respondents (8.33%) were not taking any kind of medicine to control the condition of the heart disease.

Table 4.44: Status and prevalence of the disease (s) and risk factors in geriatric respondents (N=300)

Diseases	N	Rural (n=150)					Urban (n=150)					Status (%)	
		Total	Under control		Not under control		Total	Under control		Not under control			
			UM	NUM	UM	NUM		UM	NUM	UM	NUM	UM	NUM
Cataract	167 (55.67)	87 (58.00)	1 (1.15)	2 (2.30)	79 (90.80)	5 (5.75)	80 (53.33)	2 (2.50)	1 (1.25)	70 (87.50)	7 (8.75)	152 (50.67)	15 (5.00)
Blood pressure	172 (57.33)	61 (40.67)	1 (0.63)	3 (4.92)	21 (34.42)	36 (59.01)	111 (74.00)	-	-	22 (19.81)	89 (80.18)	44 (14.67)	128 (42.67)
Asthma	20 (6.67)	9 (6.00)	1 (11.11)	-	6 (66.67)	2 (22.22)	11 (7.33)	2 (18.18)	1 (9.09)	4 (36.36)	4 (36.336	13 (4.33)	7 (2.33)
Renal calculi	36 (12.00)	3 (2.00)	-	-	2 (5.56)	1 (2.78)	33 (22.00)	-	3 (9.00)	26 (78.79)	4 (12.12)	28 (9.33)	8 (2.67)
Diabetes	77 (25.67)	26 (17.33)	2 (7.69)	2 (7.69)	20 (76.92)	2 (7.69)	51 (34.00)	6 (11.76)	3 (5.88)	27 (52.94)	15 (29.41)	55 (18.33)	22 (7.33)
Heart disease	72 (24.00)	29 (19.33)	3 (10.34)	1 (3.45)	19 (65.52)	6 (20.69)	43 (28.67)	2 (7.65)	1 (3.33)	32 (74.41)	17 (39.53)	37 (12.33)	25 (8.33)
Osteoarthritis	88 (29.33)	27 (9.00)	1 (3.70)	7 (25.93)	12 (44.44)	7 (25.93)	61 (40.67)	5 (8.20)	8 (13.11)	35 (57.38)	18 (29.51)	53 (17.67)	35 (11.67)

Values in parentheses indicate percentage UM: Under Medical treatment, NUM: Not Under Medical treatment

Eighty eight respondent were suffering from osteoarthritis, out of them 2.00 per cent respondents (3.70% rural and 8.20% urban respondents) were controlling the severity level by use of medicines while 5 per cent respondents (25.93% rural and 13.11% urban respondents) were not taking any kind of medicine, were under control level. Twelve rural respondents (44.44%) and 35 urban respondents (57.38%) were taking medicine but not under control level while 7 rural (25.93%) and 18 urban respondents (29.51%) were not taking any kind of medical treatment to control the level of disease. It was observed that out of 88 patients 17.67 per cent respondents were taking medical treatment and 11.67 per cent respondents were not taking any kind of medical treatment to control the severity of disease.

4.3.7 Anthropometric measurements of geriatric respondents

Table 4.45: Anthropometric measurements of geriatric respondents (N=300)

Anthropometric measurements	Standard	Rural (n=150)	Z-value	Urban (n=150)	Z-value	Total (n=300)	Z-value
Male							
Height (cm)	173	171.25±25.48	0.43^{NS}	168.78±7.35	4.97**	170.17±15.57	1.23^{NS}
Weight (kg)	60	64.71±12.79	3.19**	64.27±10.97	3.37**	64.49±11.88	4.63**
Body Mass Index (kg/m^2)	20.3	22.98±4.12	5.63**	22.55±3.40	5.74**	22.77±33.76	8.01**
Female							
Height (cm)	161	157.11±7.67	4.39**	152.88±6.82	10.31**	154.94±7.54	9.76**
Weight (kg)	55	57.09±10.10	1.70^{NS}	55.50±12.25	0.35^{NS}	56.30±11.49	1.38^{NS}
Body Mass Index (kg/m^2)	21.1	23.30±4.71	5.71**	23.45±5.40	3.76**	23.30±4.71	5.71**

Standard-Reference men and reference women, ICMR-2010 Values are Mean ±SD
**Significant at 1% level *Significant at 5% level ^{NS} - Non-significant

Data presented in the Table 4.45 revealed that mean height of total female respondents (154.49cm; 157.11cm rural female and 152.88 cm urban female) was significantly ($p<0.01$) lower than the height of reference women (161 cm). Average weight of total female (56.30 kg), rural female (57.09 kg) and urban female (55.50kg) respondents was not significantly higher than the weight of reference women weight. It was observed that mean Body Mass Index (BMI) of total female (23.30), rural female (23.30) and urban female (23.45) respondents was significantly ($p<0.01$) higher than the BMI of reference women (21.1). Anthropometric measurements of the male and female respondents are presented in the Table 4.45 depicted that mean height of urban male (168.78 cm) respondents was significantly ($p<0.01$) lower than the reference men height whereas it differed non significantly to total male (170.17cm) and urban male respondents (17125 cm). It was found that average weight of urban male (64.27 kg), rural male (64.71kg) and total male (64.49 kg) was significantly ($p<0.01$) higher than the reference men weight (60 kg). Mean BMI of total

male (22.77), rural female (22.98) and urban female (22.55) respondents was significantly ($p<0.01$) higher than the BMI of reference men (20.3).

Table 4.46: Health status of geriatric respondents as per Body Mass Index (N=300)

Body Mass Index (kg/m^2)	Female (n=150)			Male (n=150)		
	Rural	Urban	Total	Rural	Urban	Total
Under weight (<18.5)	11(7.33)	10 (6.67)	21(14.00)	17(11.33)	11(7.33)	28(18.67)
Normal weight (18.5-24.9)	42(28.00)	37(24.67)	79 (52.67)	29(19.33)	37(24.67)	66(44.00)
Over weight (25-29.9)	22(14.67)	25(16.67)	47 (31.33)	22(14.67)	24(16.00)	46(30.67)
Obese (>30)	-	3(2.00)	3(2.00)	7(4.67)	3(2.00)	10(6.67)

Values in parentheses indicate percentage
Body Mass Index, WHO, International classification, 2004

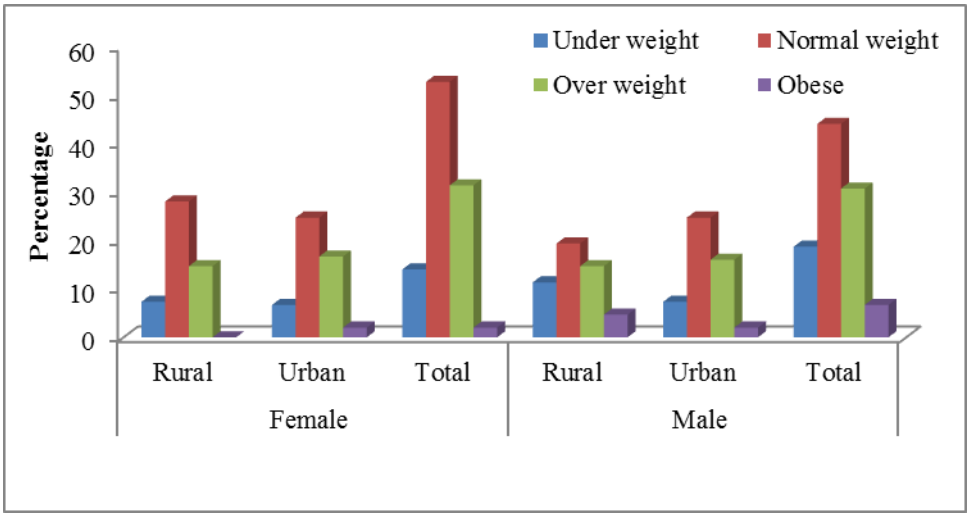

Fig. 4.10: Health status of geriatric respondents as per Body Mass Index

Data presented in the Table 4.46 (4.10) revealed that the health status of geriatric respondents as per Body Mass Index (BMI). It was found that majority of the female respondents were (52.67%; 28.00% rural and 24.67% urban) were under normal weight category followed by 31.33 per cent respondents (14.67% rural and 16.67% urban), 14.00 per cent respondents (7.33% rural and 6.67% urban) and 2.00 per cent respondents those were lying in the category of over-weight, under-weight and obese, respectively. Table 4.46 revealed that 18.67 per cent, 44.00 per cent, 30.67 per cent and 6.67 per cent male respondents were categorized into under-weight, normal weight, over-weight and obese on the basis of BMI, respectively. Maximum male respondents (44.00%) were normal weighted and minimum male respondents (6.67%) were obese.

Prevalence of diseases among geriatric respondents as per Body Mass Index

Data presented in the Table 4.47 revealed that respondents with different diseases and risk factors were lying in different category of BMI.

Table 4.47: Prevalence of diseases among geriatric respondents as per Body Mass Index

(N=300)

Body Mass Index (kg/m^2)	Healthy (n=24)	Diseased (n=276)	Disease type						
			Cataract	Blood pressure	Asthma	Renal calculi	Diabetes	Heart disease	Osteoarthritis
Under weight (<18.5)	4 (1.33)	45 (15.00)	29 (10.50)	29 (10.50)	3 (1.08)	5 (1.81)	14 (5.07)	8 (2.89)	15 (5.43)
Normal weight (18.5-24.9)	14 (4.67)	131 (43.67)	82 (29.71)	70 (25.36)	11 (3.62)	14 (5.07)	34 (12.31)	30 (10.86)	43 (15.58)
Over weight (25-29.9)	6 (2.00)	87 (29.00)	49 (17.75)	62 (22.46)	5 (1.81)	13 (4.33)	25 (9.06)	30 (10.86)	22 (7.97)
Obese (>30)	-	13 (4.33)	7 (2.53)	11 (3.62)	1 (0.36)	4 (1.45)	4 (1.45)	4 (1.45)	8 (2.89)

Values in parentheses indicate percentage

Body Mass Index, WHO, International classification, 2004

It was found that majority of healthy (4.67%) and diseased (43.67%) respondents were lying in the category of normal weight but maximum number of respondents suffering from cataract, blood pressure, asthma, renal calculi, diabetes, heart disease and osteoarthritis (82,70, 11, 14, 34,, 30 and 43 respondents, respectively) were lying in the same category (normal weight).

It was observed that over-weight respondents had more disease (29.00% respondents) and 17.75 per cent, 22.46 per cent, 1.81 per cent, 4.33 per cent, 9.09 per cent, 10.36 per cent and 2.89 per cent respondents suffering from cataract, blood pressure, asthma, renal calculi, diabetes, heart disease and osteoarthritis were lying in the category, respectively. Obese respondents (4.33%) were suffering from cataract (2.53% respondents), blood pressure (3.62% respondents), asthma (0.36% respondents), renal calculi (1.45% respondents), diabetes (1.45% respondents), heart disease (1.45% respondents) and osteoarthritis (2.89% respondents). It was observed that out of 300 respondents 15 per cent respondents were under weight. Among the under-weight respondents 10.50 per cent, 10.50, 1.08 per cent, 1.81 per cent, 5.07 per cent, 2.89 per cent and 5.43 per cent respondents were suffering from cataract, blood pressure, asthma, renal calculi, diabetes, heart disease and osteoarthritis, respectively.

Correlation between the different disease (s) among geriatric respondents

Data presented in the Table 4.48depicts the correlation among different diseases and risk factors prevalent in geriatric respondents. It was observed that cataract is significantly ($p<0.05$) positively correlated to blood pressure ($r=0.6003$). Cataract is positively correlated to renal calculi ($r=0.0842$), diabetes ($r=0.1950$) and heart disease ($r=0.0167$) while negatively correlated to asthma ($r=0.1056$) and osteoarthritis ($r=0.0252$). Blood pressure is significantly ($p<0.05$) positively correlated to heart disease ($r=0.6041$) and cataract ($r=0.6003$). it was found that blood pressure is positively correlated to renal calculi ($r=0.1112$), diabetes($r=0.1983$)and osteoarthritis ($r=0.0377$) whereas negatively correlated to asthma ($r=0.0937$).

Table 4.48: Correlation between the different disease (s) among geriatric respondents

(N=300)

Diseases	Cataract	Blood pressure	Asthma	Renal calculi	Diabetes	Heart disease	Osteoarthritis
Cataract	1.0000	**0.6003***	-0.1056	0.0842	0.1950	0.0167	-0.0252
Blood pressure	**0.6003***	1.0000	-0.0937	0.1112	0.1983	**0.6041***	0.0377
Asthma	-0.1056	-0.0937	1.0000	-0.0165	-0.0347	-0.0472	0.0333
Renal calculi	0.0842	0.1112	-0.0165	1.0000	-0.0526	-0.0109	0.0099
Diabetes	0.1950	0.1983	-0.0347	-0.0526	1.0000	-0.0103	0.1439
Heart diseases	0.0167	**0.6041***	-0.0472	-0.0109	-0.0103	1.0000	0.0511
Osteoarthritis	-0.0252	0.0377	0.0333	0.0099	0.1439	0.0511	1.0000

Pearson Correlation Coefficients

Prob> |r| under H0: Rho=0; Bold figures are significant at $\alpha = 0.05$ (analyzed by using sas 9.3 version)

Table 4.48 illustrated that asthma is positively correlated to osteoarthritis (r=0.033) while negatively correlated to cataract (r=0.1056), blood pressure (r=0.0937), renal calculi (r=0.0165), diabetes (r=0.0347) and heart disease (r=0. .0472). Renal calculi, diabetes and heart disease were positively correlated to cataract (r=0.0842, r=0.1950 and r=0.0167, respectively), blood pressure (r=0.1112, r= 0.1983and r=0.6041, respectively) and osteoarthritis (r=0.0099, r= 0.1439and r=0.0511, respectively) while negatively correlated to asthma (r=0.0165, r=0.0347 and r=0.0472, respectively), renal calculi (r=0.0526 and r=0.0109), diabetes (r=0.0526 and r=0.0103) and heart disease (r= 0.0109 and r=0.0103). It was observed that osteoarthritis is positively correlated to blood pressure (r=0.0377), asthma (r=0.0333), renal calculi (r=0.0099), diabetes (r=0.1439) and heart disease (r=0.0511) and negatively correlated to cataract (r=0.0252). However, statistically the differences were found to be no significant.

4.3.8 Assessment of nutritional knowledge of geriatric respondents

Data presented in the Table 4.49 illustrated about knowledge regarding nutrition among geriatric respondents. It was found that 65.67 per cent respondents believed that eating too heavy meals twice a day is better for health than eating four small meals daily and 62.67 per cent respondents think that eating egg is better than eating pulse. Ninety five per cent and 76.00 per cent respondent replied that one cannot live on milk only and costly foods are more nutritious, respectively is correct. They believed that ‘off season fruits and vegetables are more nutritious’ Majority (70.67%) of respondents believed to add all food stuffs in diet and 65.00 per cent told that soft drinks provide nutrients. The statements ‘dehusked pulses should be included in diet’ and ‘peanuts, till are equally nutritious as almonds and cashewnuts’ were correct according to 81.67 per cent and 21.33 per cent respondents, respectively. Most of the elderly (66.67%) stated that there is no need to add more amount of milk and egg in diet.

Table 4.49: Knowledge of nutrition among geriatric respondents (N=300)

Sr. No.	Statement	Correct	Incorrect
A.	**Balanced diet**		
1	Eating too heavy meals twice a day is better for health than eating four small meals daily.	197(65.67)	103(34.33)
2	Off season fruits and vegetables are more nutritious.	270(90.00)	30(10.00)
3	Eating egg is better than eating pulse.	188(62.67)	112(37.33)
4	One cannot live on milk only.	285(95.00)	15(5.00)
5	Costly foods are more nutritious	228(76.00)	72 (24.00)
6	Add all food groups i.e. cereals, pulses, GLV's, roots and tubers, other vegetables, milk and milk products, fats and oils, sugar and jaggery in daily diet.	212(70.67)	88(39.33)
7	Soft drinks like coca- cola, limca etc. don't provide nutrients.	195(65.00)	105(35.00)
8	More amount of milk and egg should be included in diet of old person.	100(33.33)	200(66.67)
9	Almonds and walnut are good for health.	300 (100.00)	-
10	Dehusked pulses should be included in diet.	245 (81.67)	55(18.33)
11	Peanuts, till are equally nutritious as almonds and cashewnuts.	64 (21.33)	236 (78.67)
12	One should drink sufficient liquids including water.	293(97.66)	7(2.33)
13	Fruits and vegetables provide energy along with vitamins and minerals.	96(32.00)	204(68.00)
14	Shallow frying is better than deep frying.	279(93.00)	21 (7.00)
15	Desi ghee gives more calories than refined oil.	287(95.67)	13(4.33)
16	Sprouted pulses are more nutritious than un-sprouted pulses.	266(88.67)	34(11.33)
17	Eating more raw fruits and vegetables helps to relieve constipation	157(52.33)	143(47.67)
B.	**Importance of GLV's and Fruits in diet**		
1	Consume green leafy vegetables (GLV's) daily.	300(100.00)	-
2	Fruits and vegetables need to be washed before consumption.	300(100.00)	-
3	GLV's and fruits provide vitamins and minerals.	208(69.33)	92(30.67)
4	Eat fruits and vegetables by colour.	10(3.33)	290(96.67)
5	Dark yellow fruits and vegetables are good for eyesight.	109(36.33)	191(63.67)
6	Eat seasonal fruits and vegetables.	259(86.33)	41(13.67)
7	GLV's are good source of iron.	117(39.33)	183(61.00)
8	Amla and citrus fruits are rich sources of Vitamin C.	168(56.00)	132(44.00)
C.	**Conservation of nutrients**		
1	Pulses should be soaked before cooking.	291(97.00)	9(3.00)
2	Vegetables should be washed before cutting.	104(34.67)	196(65.33)

3	Rice should not be washed by rubbing before cooking.	202(67.33)	98(32.67)
4	Thin skin should be removed while peeling vegetables and fruits.	246(82.00)	54(18.00)
5	Vegetables should not be cut in small pieces to conserve nutrients.	169(56.33)	131(43.67)
6	Wheat flour +chickpea flour should be used for making *chapaties*.	198(66.00)	102(34.00)
7	Buffalo's milk is more nutritious than cow's milk.	288(96.00)	12(4.00)
8	For quick cooking of pulses, baking soda should be added while cooking.	258(86.00)	42(14.00)
9	Add vegetables in boiling water while cooking.	232(77.33)	68(22.67)
10	Cooked vegetables should be reheated for a long period and served.	148(49.33)	152(50.67)
11	Boiling milk helps to kill harmful bacteria.	142(47.33)	158(52.67)
12	Leaves of radish should not be thrown away.	116(38.67)	184(61.33)
13	Cereals and pulses, if consumed in combination, are more nutritious.	281(93.67)	19(6.33)
14	Oils are better than ghee for deep frying.	300(100.00)	-
15	Sprouting and fermentation helps to improve nutritive value of foods.	104 (34.67)	196(65.33)
16	Chooker should be removed from wheat flour before making dough	278(92.67)	22(7.33)
17	Excess water during cooking of rice should be thrown away.	265(88.33)	35(11.67)
D.	**Kitchen hygiene and sanitation**		
1.	Before preparing of meal, hand should be washed.	300(100.00)	-
2.	Kitchen should have appropriate exhaust.	295 (98.33)	5(1.67)
3.	Vegetables should be washed in running water before cutting.	272(90.67)	28(9.33)
4.	Drinking water pot should be covered.	300(100.00)	-
5.	Clean utensils with liquid soap.	113(37.67)	187(62.33)

Values in parentheses indicate percentage

Most of the respondents (97.66%, 93.00%, 95.67% and 85.67%) responded that the statements i.e. One should drink sufficient liquids including water, Shallow frying is better than deep frying, desi ghee gives more calories than refined oil, sprouted pulses are more nutritious than un-sprouted pulses were correct. Thirty two percent and 52.33 per cent respondents believed that fruits and vegetables provide energy along with vitamins and minerals and eating more raw fruits and vegetables helps to relieve constipation was correct. Majority of the respondents were of view that one should consume green leafy vegetables (GLV's) daily, fruits and vegetables need to be washed before consumption, GLV's and fruits provide vitamins and minerals, eat seasonal fruits and vegetables, amla and citrus fruits are rich sources of vitamin C. Pulses should be soaked and vegetables should be washed under

running water was correct according to 97.00 per cent and 34.67 percent respondents, respectively and incorrect according to 3.00 per cent and 65.33 per cent, respectively. Eighty two per cent and 67.33 per cent respondents believed that thin skin should be removed while peeling vegetables and fruits and rice should not be washed by rubbing before cooking while 56.33 per cent respondents believed that cutting of vegetables into small pieces is correct. Mixing of flours, adding vegetables in boiling water and buffalo milk is more nutritious than cow milk were correct statements according to 56.33 per cent, 66.00 per cent and 96.00 per cent of respondents, respectively use of some practices i.e. for quick cooking of pulses, baking soda should be added while cooking, cooked vegetables should be reheated for a long period and served, boiling milk helps to kill harmful bacteria, leaves of radish should not be thrown away, choker should be removed from wheat flour before making dough, excess water during cooking of rice should be thrown away was correct according to 86.00 per cent, 49.33 per cent, 47.33 per cent, 38.67 per cent, 92.67 per cent and 88.33 per cent, respectively, whereas statements viz. cereals and pulses in combination are more nutritious, oils are better than ghee for deep frying and sprouting and fermentation helps to improve nutritive value of foods were correct according to 93.67 per cent, 100.00 per cent and 34.67 per cent of respondents, respectively. Use of hygienic practices was followed by respondents. Majority (98.33%. 90.67%, 100.00%) of the respondents hygienic practices in kitchen i.e. before preparing of meal, hand should be washed (100%), kitchen should have appropriate exhaust (98.33%), vegetables should be washed in running water before cutting (90.67%) and drinking water pot should be covered (100%) were correct and should be followed strictly while cleaning utensils with liquid soap was correct according to 37.67 per cent respondent.

4.4 Development and organoleptic evaluation of value added food products prepared for geriatric respondents

Various products like *chapatti, cheela, lapsi, kasaar, kheer, khichari, parantha* and porridge were developed utilizing different grains, vegetables and other ingredients. All the developed products were organoleptically evaluated. The sensory evaluation of developed products was done by using nine point Hedonic scale by ten semi-trained panalists from CCS HAU, Hisar and ten respondents from the study area.

Data presented in the Table 4.50 revealed that the scores of sensory evaluation given by ten geriatric respondents under study. Data presented in the Table 4.50 revealed that control *chapati* was ‘liked very much’ in terms of colour (7.65), appearance (7.65), aroma (7.60), texture (7.55), taste (7.90) and overall acceptability (7.68). The *chapati* type I and type II were ‘liked moderately’ in terms of colour (7.50 and 7.50), appearance (7.25 and 7.30), aroma (7.50 and 7.55), texture (7.40 and 7.50), taste (7.40 and7.45) and overall acceptability (7.55 and 7.59) (Table 4.52,). According to the results of sensory evaluation control *cheela* was ‘liked very much’. In terms of all the sensory characteristics, *cheela* type I was ‘liked

very much' except aroma which was 'liked moderately. *Cheela* type II was 'liked moderately' in terms of all the sensory attributes i.e. colour (7.45), appearance (7.45), aroma (7.80), texture (7.20), taste (7.45) and overall acceptability (7.33). The score for sensory attributes of *laapsi* i.e. colour, appearance, aroma, texture, taste and overall acceptability were 7.50, 7.50, 7.40, 7.40, 7.30 and 7.46, respectively. Sensory evaluation results showed that *laapsi* type I and type II were 'liked very much' by the judges in terms of colour (7.60 and 7.60), appearance (7.55 and 7.60), aroma (7.40), texture (7.90), taste (7.65 and 7.65) and overall acceptability (7.62 and 7.55)except the aroma (7.40) and texture (7.50) of *lapsi* type II, respectively. The colour (7.20), appearance (7.50), aroma (7.20), texture (7.40), taste (7.15) and overall acceptability (7.34) of Control *kasaar* were 'liked moderately'. *Kasaar* type I and type II were 'liked moderately' in terms of sensory attributes i.e. colour (7.50 and 7.20), appearance (7.25 and 720), aroma (7.50 and 7.20), texture (7.15 and 7.20), taste (6.90and 7.15)and overall acceptability (7.29 and 7.18) according to the nine point Hedonic scale. The results depicted that control *kheer* was 'liked very much' in respect of colour (7.65), appearance (7.75), aroma (7.65), texture (7.60), taste (7.75) and overall acceptability (7.66) (Table 4.50).

Kheer type I was 'liked very much' in terms of colour (7.65), appearance (7.95), aroma (7.55), texture (7.75), taste (8.05) and overall acceptability (Table 4.52). The mean scores of *kheer* type II were 7.45, 7.45, 7.65, 7.20, 7.45 and 7.32 for colour, appearance, aroma, texture, taste and overall acceptability, respectively and lying in the category 'liked moderately'.

The colour (7.20), appearance (7.40), texture (6.60) and overall acceptability (7.60) of control *khichari* were 'liked moderately' while appearance (8.00) and taste were 'liked very much'. The score for sensory attributes of *khichari* type I i.e. colour, appearance, aroma, texture, taste and overall acceptability were 7.20, 7.60, 8.00, 7.40, 7.40 and 7.62, respectively according to the nine point Hedonic scale. *Khichari* type II was 'liked extremly' in terms of all the sensory attributes i.e. appearance (8.60), texture (9.00), taste (9.00) and overall acceptability (8.80) except colour (8.40) aroma (8.00) which was 'liked very much'. Control and type II *parantha* was 'liked very much' in terms of sensory characteristics as colour (7.60 and 7.80), appearance (7.55 and 7.70), aroma (7.65 and 7.80), texture (7.75 and 7.75), taste (7. 45 and 7.30) and overall acceptability (7.30 and 7.80). The results depicted that *parantha* type II 'liked moderately' in respect of colour (7.25), appearance (7.30), aroma (7.35), texture (7.20), taste (6.85) and overall acceptability (7.25). It was observed that control and type I porridge were 'liked very much' in terms of sensory characteristics as colour (7.55 and 7.80), appearance (7.60 and 7.70), aroma (7.65 and 7.80), texture (7.75 and 7.75), taste (7. 55 and 7.30) and overall acceptability (7.68 and 7.80). The results depicted that porridge type II 'liked moderately' in respect of colour (7.45), appearance (7.40), aroma (7.50), texture (7.40), taste (7.45) and overall acceptability (7.55).

Table 4.50: Sensory evaluation of value added food products developed for geriatric respondents (panel from study area)

Chapati						
Type	**Colour**	**Appearance**	**Aroma**	**Texture**	**Taste**	**Overall Acceptability**
Control (WF)	7.65±0.16	7.65±0.16	7.60±0.21	7.55±0.20	7.90±0.19	7.68±0.12
Type I (WF:BGF)	7.50±0.18	7.25±0.14	7.50±0.17	7.40±0.15	7.40±0.23	7.55±0.17
Type II (W:BG:M:PM:GG)	7.50±0.15	7.30±0.15	7.55±0.20	7.50±0.18	7.45±0.17	7.49±0.11
Cheela						
Control (BGF)	7.65±0.18	7.75±0.18	7.65±0.18	7.60±0.19	7.75±0.19	7.66±0.18
Type I (BGF:WF)	7.65±0.15	7.95±0.17	7.45±0.18	7.75±0.21	8.05±0.15	7.62±0.15
Type II (BGF:WF:MF:PMF)	7.45±0.15	7.45±0.18	7.65±0.15	7.20±0.20	7.45±0.21	7.33±0.41
Laapsi						
Control (WF)	7.50±0.13	7.50±0.13	7.40±0.17	7.40±0.19	7.30±0.12	7.46±0.12
Type I (WF:BGF)	7.60±0.13	7.55±0.15	7.70±0.13	7.90±0.10	7.65±0.21	7.62±0.14
Type II (W:BG:M:PM)	7.60±0.15	7.60±0.17	7.40±0.22	7.50±0.22	7.65±0.15	7.55±0.16
Kasaar						
Control (WF)	7.20±0.11	7.50±0.13	7.20±0.11	7.40±0.17	7.15±0.13	7.34±0.12
Type I (WF:BGF)	7.50±0.20	7.25±0.10	7.50±0.10	7.15±0.15	6.90±0.17	7.29±0.12
Type II (WF:BGF:MF:PMF:SS)	7.20±0.11	7.20±0.12	7.20±0.12	7.20±0.10	7.15±0.13	7.18±0.11
Kheer						
Control (Rice)	7.65±0.18	7.75±0.13	7.65±0.18	7.60±0.19	7.75±0.19	7.66±0.18
Type I (MG:FM)	7.65±0.15	7.95±0.10	7.55±0.18	7.75±0.22	8.05±0.15	7.74±0.15
Type II (Carrot)	7.45±0.15	7.45±0.12	7.65±0.15	7.20±0.20	7.45±0.21	7.32±0.18
Khichari						
Control (R:GG)	7.20±0.17	7.40±0.11	8.00±0.20	6.60±0.11	8.00±0.17	7.60±0.15
Type I (R:M:GG:BG)	7.20±0.17	7.60±0.11	8.00±0.20	7.40±0.11	7.40±0.11	7.62±0.10
Type II (R:M:GG:BG:C:P:FL)	8.40±0.11	8.60±0.11	8.00±0.20	9.00±0.00	9.00±0.00	8.80±0.00
Parantha						
Control (WF)	7.60±0.15	7.55±0.18	7.65±0.15	7.75±0.14	7.45±0.15	7.59±0.18
Type I (WF:BGF:MF:PMF)	7.80±0.13	7.70±0.15	7.80±0.17	7.75±0.14	8.30±0.10	7.85±0.15
Type II (WF:MF:BGF:BG:C)	7.25±0.19	7.30±0.19	7.35±0.24	7.20±0.22	6.85±0.22	7.25±0.10
Porridge						
Control (WG)	7.55±0.15	7.60±0.18	7.65±0.15	7.75±0.14	7.55±0.15	7.68±0.18
Type I (WG:RG)	7.80±0.14	7.70±0.15	7.80±0.17	7.75±0.14	7.30±0.10	7.80±0.14
Type II (WG:RG:MG:BGG:SS)	7.45±0.20	7.40±0.19	7.50±0.24	7.40±0.22	7.45±0.22	7.55±0.10

Values are mean ± SE of ten observations
BGF – Bengal gram flour, C – carrot, FL – fenugreek leaves, GG – green gram,
MF – maize flour, MG – maize grits, P – peas, PMF – pearl millet flour,
RG – rice grits, SS – sesame seeds, WF – wheat flour, WG – wheat grits

Data presented in the Table 4.51 revealed that control *chapati* was 'liked very much' in terms of colour (7.90), appearance (8.00), aroma (7.80), texture (7.90), taste (7.80) and overall acceptability (7.88) Sensory evaluation results showed that *chapati* type I and type II were 'liked very much' by the judges in terms of colour (7.80 and 7.90), appearance (7.60 and 7.80), texture (7.70 and 7.55), taste (7.70 and 7.70) and overall acceptability (7.68 and 7.64) except the aroma (7.40 and 7.40) of *chapati* type I and II, respectively.

According to the results of sensory evaluation control *cheela* was 'liked moderately'. In terms of all the sensory characteristics *cheela* type I was 'liked moderately' *cheela* type II was 'liked moderately' in terms of all the sensory attributes i.e. colour (7.40), appearance (7.10), aroma (6.50), texture (6.80), taste (5.95) and overall acceptability (6.7) .The score for sensory attributes of control *laapsi* i.e. colour, appearance, aroma, texture, taste and overall acceptability were 6.70, 6.80, 6.80, 6.60, 6.40 and 6.66, respectively according to the nine point Hedonic scale. Sensory evaluation results showed that *laapsi* type I and type II were 'liked moderately' by the judges in terms of colour (6.90 and 6.90), appearance (7.00 and 6.90), aroma (7.00 and 6.60), texture (7.20 and 6.70), taste (6.96) and overall acceptability (6.76 and 6.42) except the taste (6.36) of *lapsi* type II. The colour (7.20), appearance (7.40), aroma (7.45), texture (7.40), taste (7.35) and overall acceptability (7.34) of control *kasaar* were 'liked moderately'. In terms of sensory attributes i.e. colour (7.50 and 7.20), appearance (7.25 and 7.10), aroma (7.70 and 7.30), texture (7.25 and 7.20), taste (6.65 and 6.65) and overall acceptability (7.29 and 7.12) *kasaar* type I and type II were 'liked moderately' according to the nine point Hedonic scale. The results depicted that control *kheer* was 'liked very much' in respect of colour (7.55), appearance (7.60), aroma (7.70), texture (7.60), taste (7.60) and overall acceptability (7.72) (Table 4.53). *kheer* type I was 'liked very much' in terms of colour (7.55), appearance (7.80), aroma (7.60), texture (7.70), taste (7.60) and overall acceptability(7.66) (Table 4.53). The mean scores of *kheer* type II were 7.40, 7.40, 7.50, 7.30, 7.25 and 7.32 for colour, appearance, aroma, texture, taste and overall acceptability, respectively and lying in the category 'liked moderately'.

The colour (7.90), appearance (7.80), aroma (7.70), texture (7.60) taste (7.60) and overall acceptability (7.72) of control *khichari* were 'liked very much'. The score for sensory attributes of *khichari* type I i.e. colour, appearance, aroma, texture, taste and overall acceptability were 7.60, 7.20, 7.30, 7.50, 7.40 and 7.40, respectively according to the nine point Hedonic scale. *Khichari* type II was 'liked very much' in terms of all the sensory attributes i.e. colour (7.70), appearance (7.80), aroma (7.80) texture (7.10), taste (7.70) and overall acceptability (7.74). Control, typeI and type II *parantha* was 'liked very much' in terms of sensory characteristics as colour (7.50, 720 and 7.10), appearance (7.4, 7.10 and 7.70), aroma (7.10, 6.90 and 6.80), texture (7.40, 7.00 and 6.80), taste (7. 50, 670 and 6.80) and overall acceptability (7.22, 6.96 and 6.82).

Table 4.51: Sensory evaluation of value added food products developed for geriatric respondents (panel from COHS, CCS HAU, Hisar)

Chapati						
Type	**Colour**	**Appearance**	**Aroma**	**Texture**	**Taste**	**Overall Acceptability**
Control (WF)	7.90±0.23	8.00±0.21	7.80±0.25	7.90±0.23	7.80±0.25	7.88±0.20
Type I (WF:BGF)	7.80±0.20	7.60±0.16	7.40±0.22	7.70±0.15	7.70±0.21	7.64±0.15
Type II (W:BG:M:PM:GG)	7.90±0.18	7.80±0.20	7.40±0.27	7.55±0.22	7.70±0.21	7.64±0.19
Cheela						
Control (BGF)	7.10±0.41	6.90±0.41	6.90±0.38	6.60±0.40	6.20±0.47	6.56±0.37
Type I (BGF:WF)	7.10±0.31	7.30±0.30	7.30±0.21	7.00±0.26	6.50±0.34	6.94±0.24
Type II (BGF:WF:MF:PMF)	7.40±0.16	7.10±0.18	6.50±0.17	6.80±0.20	5.94±0.24	6.72±0.61
Laapsi						
Control (WF)	6.70±0.15	6.80±0.13	6.80±0.20	6.60±0.16	6.40±0.16	6.66±0.13
Type I (WF:BGF)	6.90±0.38	7.00±0.39	7.00±0.36	7.20±0.42	6.96±0.38	6.76±0.42
Type II (W:BG:M:PM)	6.90±0.18	6.90±0.28	6.60±0.27	6.70±0.33	6.36±0.35	6.42±0.28
Kasaar						
Control (WF)	7.20±0.11	7.40±0.13	7.45±0.11	7.40±0.17	7.35±0.13	7.73±0.12
Type I (WF:BGF)	7.50±0.20	7.25±0.10	7.70±0.10	7.25±0.15	6.90±0.17	7.29±0.12
Type II (WF:BGF:MF:PMF:SS)	7.20±0.11	7.10±0.12	7.30±0.12	7.20±0.10	6.65±0.13	7.12±0.11
Kheer						
Control (Rice)	7.55±0.18	7.60±0.13	7.70±0.18	7.60±0.19	7.60±0.19	7.72±0.18
Type I (MG:FM)	7.60±0.15	7.80±0.10	7.60±0.18	7.70±0.22	7.67±0.15	7.66±0.15
Type II (Carrot)	7.40±0.15	7.40±0.12	7.50±0.15	7.30±0.20	7.25±0.21	7.32±0.18
Khichari						
Control (R:GG)	7.90±0.23	7.80±0.20	7.70±0.30	7.60±0.31	7.40±0.34	7.68±0.23
Type I (R:M:GG:BG)	7.60±0.22	7.20±0.29	7.30±0.21	7.50±0.17	7.40±0.22	7.40±0.15
Type II (R:M:GG:BG:C:P:FL)	7.70±0.30	7.80±0.29	7.80±0.25	7.70±0.30	7.70±0.30	7.74±0.27
Parantha						
Control (WF)	7.50±0.13	7.45±0.16	7.40±0.16	7.40±0.22	7.50±0.16	7.22±0.38
Type I (WF:BGF:MF:PMF)	7.20±0.20	7.10±0.18	6.90±0.31	7.00±0.39	6.70±0.40	6.96±0.32
Type II (WF:MF:BGF:BG:C)	7.10±0.28	7.10±0.23	6.80±0.25	6.80±0.25	6.80±0.25	6.82±0.24
Porridge						
Control (WG)	7.50±0.22	7.20±0.29	7.30±0.21	7.50±0.17	7.40±0.22	7.40±0.15
Type I (WG:RG)	7.70±0.30	7.80±0.29	7.80±0.25	7.70±0.30	7.70±0.30	7.74±0.27
Type II (WG:RG:MG:BGG:SS)	7.30±0.26	7.30±0.26	7.20±0.25	7.30±0.33	7.40±0.31	7.30±0.26

Values are mean ± SE of ten observations.

BGF – Bengal gram flour, C – carrot, FL – fenugreek leaves, GG – green gram,
MF – maize flour, MG – maize grits, P – peas, PMF – pearl millet flour,
RG – rice grits, SS – sesame seeds, WF – wheat flour, WG – wheat grits

It was observed that control and type II porridge were 'liked moderately' in terms of sensory characteristics as colour (7.50 and 7.30), appearance (7.20 and 7.30), aroma (7.30 and 7.20), texture (7.50 and 7.30), taste (7. 40 and 7.40) and overall acceptability (7.40 and 7.30). The results depicted that porridge type I 'liked very much in respect of colour (7.70), appearance (7.80), aroma (7.80), texture (7.70), taste (7.70) and overall acceptability (7.74).

4.5 Proximate composition of organoleptically acceptable food products

The results of proximate composition of value added food products prepared for geriatric respondents are presented in Table 4.52.

Moisture

Moisture content of *chapati* ranged from 27.19 to 29.31 per cent. Moisture content of *cheela, laapsi, kasaar, kheer, khichari, parantha* and porridge ranged from 30.63 to 31.89 per cent, 81.37 to 82.70 per cent, 11.68 to 12.65 per cent, 82.70 to 84.03 per cent, 77.98 to 78.68 per cent, 31.03 to 31.88 per cent and 77.69 to 78.63 per cent, respectively. A narrow range of variation was observed for moisture content in all the food products.

Protein

Table 4.52 illustrated that protein content of control *chapati* (8.52%) increased significantly ($p<0.05$) by the addition of Bengal gram flour (10.98%) and Bengal gram flour, maize flour, pearl millet flour and green gram flour (11.65%). Addition of wheat flour in place of Bengal gram flour in *cheela* did not improved its protein content. *Cheela* type II contained (5.59%) contained significantly ($p<0.05$) higher amount of protein than that of control (4.87%) and *cheela* type I (4.80%). Control *laapsi* contained 6.25 per cent of protein and *laapsi* type I and type II contained significantly ($p<0.05$) higher amount of protein (6.65% and 6.73%) than control *laapsi* but difference were not significant. It was observed that *kasaar* type II (7.96%) had significantly ($p<0.05$) higher amount of protein than control *kasaar* (7.00%) but had not significantly ($p<0.05$) higher amount than type I *kasaar* (7.41%). Addition of carrot in place of rice decreased protein content (6.15%) significantly ($p<0.05$) to control *kheer* (6.89%) and *kheer* prepared using foxtail millets (popped) and maize grits (6.79%). It was observed that *khichari* type I and type II (12.94% and 12.17%) and *parantha* type I and type II (12.07% and 11.67%) had significantly ($p<0.05$) higher amount of protein than control *khichari* (10.87%) and *parantha* (10.39%) and *khichari* type I and *parantha* type I but type I khichari and type I *parantha* had significantly ($p<0.05$) higher amount of protein than type II *khichari* and type II *parantha*. Protein content of control porridge was 6.12 per cent. Protein content of type I and type II was 7.58 per cent and 8.57 per cent which was significantly ($p<0.05$) higher than control porridge while protein content of type II porridge was significantly ($p<0.05$) higher than the protein content of type I porridge.

Table 4.52: Proximate composition of value added food products prepared for geriatric

Chapati					
Type	**Moisture**	**Protein**	**Crude Fat**	**Crude fiber**	**Ash**
Control (WF)	27.19 ± 0.24	8.52 ± 0.02	2.70 ± 0.03	0.61± 0.02	0.67 ± 0.02
Type I (WF:BGF)	28.33 ± 0.53	10.98 ± 0.04	3.02 ± 0.05	1.19 ± 0.01	1.32± 0.01
Type II (W:BG:M:PM:GG)	29.31 ± 0.57	11.65 ± 0.03	2.99 ± 0.07	1.32 ± 0.02	1.45 ± 0.02
CD (P<0.05)	NS	0.11	NS	0.06	0.07
Cheela					
Control (BGF)	31.86 ± 0.59	4.87 ± 0.05	9.08 ±0.02	0.93± 0.02	1.30 ± 0.01
Type I(BGF:WF)	30.63 ± 0.75	5.80 ± 0.02	10.08 ±0.02	1.19 ± 0.02	1.53 ± 0.03
Type II (BGF:WF:MF:PMF)	30.74 ± 0.55	5.59 ± 0.09	10.21 ±0.01	1.90 ± 0.04	2.21 ± 0.01
CD (P<0.05)	NS	0.21	0.07	0.09	0.07
Laapsi					
Control (WF)	81.37 ± 0.73	6.25 ± 0.03	2.73 ± 0.03	0.28 ± 0.03	0.41 ± 0.02
Type I (WF:BGF)	82.70 ± 0.32	6.65 ± 0.04	3.06 ± 0.07	0.47 ± 0.04	0.60 ± 0.08
Type II (W:BG:M:PM)	82.61 ± 0.34	6.73 ± 0.05	3.43 ± 0.27	0.59 ± 0.05	0.73 ± 0.03
CD (P<0.05)	NS	0.18	0.56	0.14	0.18
Kasaar					
Control (WF)	11.68 ± 0.39	7.00 ± 0.20	2.65 ± 0.03	0.92 ± 0.04	0.41 ± 0.02
Type I (WF:BGF)	12.62 ± 0.28	7.41 ± 0.26	2.91 ± 0.04	1.23 ± 0.02	0.60 ± 0.08
Type II (WF:BGF:MF:PMF:SS)	12.50 ± 0.32	7.96 ± 0.04	2.52 ± 0.17	1.76 ± 0.03	0.73 ± 0.03
CD (P<0.05)	NS	0.67	NS	0.12	0.16
Kheer					
Control (Rice)	82.70±0.31	6.89±0.02	7.03±0.12	0.55±0.03	1.08 ± 0.04
Type I (MG:FM)	83.59±0.28	6.79±0.08	7.16±0.03	0.58±0.03	1.28 ± 0.04
Type II (Carrot)	84.03± 0.53	6.15±0.02	7.01± 0.07	0.63±0.03	1.15 ± 0.04
CD (P<0.05)	NS	0.46	NS	NS	0.15
Khichari					
Control (R:GG)	77.98±0.12	10.87±0.21	6.75±0.17	1.72±0.07	1.50±0.03
Type I (R:M:GG:BG)	78.41±0.28	12.94±0.06	7.00±0.04	2.14±0.07	2.02±0.03
Type II (R:M:GG:BG:C:P:FL)	78.63±0.63	12.17±0.14	6.74±0.40	2.34±0.16	2.84±0.03
CD (P<0.05)	NS	0.53	NS	0.38	0.11
Parantha					
Control (WF)	31.08 ± 0.24	10.39 ± 0.01	4.70 ± 0.01	1.52 ± 0.02	1.52 ± 0.02
Type I (WF:BGF:MF:PMF)	31.43 ± 0.27	12.07 ± 0.04	5.28 ± 0.05	2.04 ± 0.04	1.82 ± 0.02
Type II (WF:MF:BGF:BG:C)	31.88 ± 0.06	11.67 ± 0.27	5.05 ± 0.10	2.80 ± 0.02	2.33 ± 0.02
CD (P<0.05)	NS	0.55	NS	0.09	0.08
Porridge					
Control (WG)	77.69 ± 0.72	6.12 ± 0.00	3.51 ± 0.06	1.34 ± 0.03	1.05 ± 0.04
Type I (WG:RG)	78.11 ± 0.56	7.58 ± 0.12	3.29 ± 0.03	1.82 ± 0.02	1.32 ± 0.03
Type II (WG:RG:MG:BGG:SS)	78.63 ± 0.28	8.57 ± 0.01	4.06 ± 0.06	1.97 ±0.04	1.49 ± 0.02
CD (P<0.05)	NS	0.24	0.18	0.12	0.07

Values are mean ± SE of three independent determinations

BGF – Bengal gram flour, C – carrot, FL – fenugreek leaves, GG – green gram,
MF – maize flour, MG – maize grits, P – peas, PMF – pearl millet flour,
RG – rice grits, SS – sesame seeds, WF – wheat flour, WG – wheat grits

Crude fat

Table 4.52 revealed that *chapati, kasaar, kheer, khichari* and *parantha* contained 2.70 to 3.02 per cent, 2.52 to 2.65 per cent, 7.01 to 7.03 per cent, 6.74 to 7.00 per cent and 4.70 to 5.28 per cent of crude fat content, respectively. The crude fat content of *cheela* type I and type II was significantly ($p<0.05$) higher than control *cheela* while fat content of *cheela* type II was significantly ($p<0.05$) higher than *cheela* type I. Crude fat content of *laapsi* type II (3.43%) was significantly ($p<0.05$) higher than control *laapsi* (2.73%) while crude fat content of *laapsi* type I (3.06%) did not differed significantly ($p<0.05$) than that of *laapsi* type II. Crude fat content of porridge type II (4.06%) was significantly ($p<0.05$) higher than control porridge (3.51%) and porridge type I (3.39)while crude fat content of control porridge and porridge type I did not differed significantly among themselves.

Crude fiber

Data presented in the Table 4.52 depicts that *chapatti, cheela, kasaar, parantha* and porridge type I (1.19%, 1.19%, 1.23%, 2.04% and 1.82%) and type II (1.32%, 1.90%, 1.76%, 2.80 and 1.97%) contained significantly ($p<0.05$) higher amount of crude fiber than their respective control products (0.91%, 0.93, 0.92%, 1.52% and 1.34%) but *chapatti, cheela, kasaar, parantha* and porridge type II had significantly ($p<0.05$) higher amount of crude fiber than that of *chapatti, cheela, kasaar, parantha* and porridge type I, respectively. It was observed that crude fiber content of type I and type II *laapsi* (0.47% and 2.14%) and *khichari* (0.59% and 2.34%) improved significantly ($p<0.05$) than that of control *laapsi* (0.28%) and *khichari* (1.72%) but did not differed significantly among themselves. A narrow range of variation was observed in the crude fiber content of *kheer* (0.55% to 0.63%).

Ash

Data presented in the Table 4.52 revealed that *chapati* type II (1.45%) contained double the amount of ash than that of control *chapati* (0.67%). *Chapati* type I contained significantly ($p<0.05$) higher amount of ash content (1.32%) than control chapatti while significantly ($p<0.05$) lower amount than type II chapatti. *Cheela* type I type II (1.53% and 2.21%) contained significantly ($p<0.05$) higher amount of ash than control *cheela* (1.30%) and differed significantly ($p<0.05$) among themselves. Ash content of type I and type II *laapsi* improved (0.60% and 0.73%) significantly ($p<0.05$) than that of control *laapsi* (0.41%) but did not differed significantly ($p<0.05$) among themselves. Addition of Bengal gram flour did not improved significantly ($p<0.05$) ash content of *kasaar* type I (0.60%) than that of control *kasaar* (0.47%). *Kasaar* type II (078%) had significantly ($p<0.05$) higher amount of ash content than that of control *kasaar* and *kasaar* type I. data in Table 4.52 revealed that type I (2.02%, 1.8% and 1.32%) and type II (2.84%, 2.33% and 1.49%) of *khichari, parantha* and porridge contained significantly ($p<0.05$) higher amount of ash than that of their respective control products (1.50%, 1.52% and 1.05%) while type II *khichari, parantha* and porridge contained significantly ($p<0.05$) higher amount of ash content than that of type I *khichari, parantha* and porridge, respectively.

CHAPTER -V

DISCUSSION

The present study was conducted in Sirsa districts of Haryana state to study the nutritional status of geriatric respondents and development of value added food products. This chapter presents the discussions regarding the findings of the study. The relevant discussions have been presented under the following subheadings:

5.1 Socio-economic profile of geriatric respondents

5.2 Nutritional status of geriatric respondents

5.2.1 Frequency of food consumption

5.2.2 Food consumption pattern

5.2.3 Nutrient intake pattern

5.3 Health problems among geriatric respondents

5.4 Development and organoleptic evaluation of value added food products

5.5 Proximate composition of organoleptically acceptable food products

5.1 Socio-economic profile of geriatric respondents

In rural block out of 150 respondents majority of the respondents were from Darbi village (23.70%) followed by Moriwala (14.67%), Sikanderpur (6.00%) and Rasulpur (5.67%) village. Among urban respondents 14.7 per cent were from Farm colony, 10.67 per cent were from Hari Vishnu Colony, 6.33 per cent were from Khairpur, 13.67 per cent were from MC Colony and 4.67 per cent were from Shah Satnam Colony. Out of 300 respondents surveyed, 50 per cent were from rural area and 50 per cent from urban area; 50 per cent were male and 50 per cent were female. One hundred eighty five (61.67%) respondents were in age group of 61 to 70 years; 84 respondents in the age group of 71 to 80 and 31 respondents in age group of 81 to 90 years. In our country population above 60 years of age constituted 8.6 per cent of the total population and majority of them are in the age group of 65 to 79 years. This may be the reason for the majority of the respondents in present study constituted this age group (Joshi *et al*., 2017). In different studies in India majority of the respondents were in the age group of 61 to 70 years of age as reported (Mohapatra *et al.*, 2009, Tiwari *et al.,* 2010, Katta *et al.,* 2011, Shrivastwa *et al.,*2013, Kritika *et al.,* 2014, Prakash *et al*., 2015 and Bartwal *et al.*, 2016). Fifty four per cent rural, 59.33 per cent urban respondents consulted to private hospital, 28.00 per cent rural respondents, 27.33 per cent urban respondents consulted to PHC 12 per cent rural and 17.33 per cent urban respondents consulted to charitable source of health facility.

Eighty four per cent urban and 89.33 per cent rural respondents lived in joint family. Similar observations were made by Mishra *et al*. (2012), Shanker *et al*. (2014) and Bartwal *et al*. (2016). Sixteen per cent respondents used to live in nuclear family set ups. Kumar *et al*. (2012) and Khushboo *et al*. (2015) found mostly elderly living in nuclear families.

Out of 300 respondents, 94 of rural and 87 of urban people belonged to medium sized family followed by 34 rural, 43 urban respondents in small family and 22 rural and 20 urban respondents belonged to large family. Similarly Kimaya and Sharma (2013) reported that out of 400 respondents, 117, 234 and 49 respondents were living in small, medium and large sized families, respectively. Majority of the respondents (63.67%) live in pucca house followed by partial pucca and kachcha house. The results of present study are in close agreement with those of Agarwal (2012) who reported that 33.20 per cent respondents from the study were living in pucca house and 67.70 per cent respondents were living in semi-pucca house.

Out of 300 respondents 50 (17 rural and 33 urban respondents) respondents had primary education, 22 (5 rural and17 urban respondents) had middle education, 31 respondents (12 rural and 19 urban) had matric, 6 respondents (1 rural and 5 urban) had senior secondary education, 20 respondents (6 rural and 14 urban) had graduation and 6 respondents (1 rural and 5 urban) had post-graduation. Majority of the respondents were illiterate (65.33%). Similar observations were reported in earlier studies conducted by Agarwal and Varma (2015), Khushaboo *et al*. (2015), Bartwal *et al*. (2016) and Ghirmire *et al*. (2017) while Lahiri *et al* .(2015) found only 7.70 per cent of the elderly as illiterate in the study conducted in rural area of West Bengal. In regards of Spouse's education, majority of respondent's spouse (54.67%) were in category of illiterate followed by educated up to primary (12.67%), can read and write (11.33%), middle (9.33%), matric (9.33%), senior secondary school (2.00 %), graduate (8.26 %) and post graduate (1.00%). These results are in close agreement to those reported by Agrawal and Varma (2015) for spouse education of urban respondents of Rajsthan, India. It was observed that 145 (96.67%) rural and 143 (95.33%) urban respondents living with family while 5 rural and 6 urban respondents were living alone. Agarwal (2012), Madhu *et al*. (2013) and Bartwal *et al*. (2016) reported that majority of elderly respondents were living with families and only.

Out of 300 respondents 26 were labourer; 3 respondents were indulged in caste occupation; 49 respondents were indulged in agriculture; 22 respondents were business person; 66 respondents were ex-service person and 134 respondents were not indulged in any occupation (None). Findings of present study are similar to earlier workers, Mishra *et al*. (2012), Madhu *et al*. (2013), Kritika *et al*. (2014), Anjana and Asha (2015). Majority of respondents (79 rural and 89 urban) have no lands. Thirty respondents (16 rural and 14 urban) were having land holdings<2.5 acres; 33 respondents (20 rural and 13 urban) were farmers having 2.5 to 5 acres; 24 respondents (14 rural and 10 urban) were farmers having 5 to 10 acres and 45 respondents (24 and 21 urban) were farmers having more than 10 acres of lands. One ninety six respondents (39.33 % rural and 91.33% urban) have no milch animal while 84 respondents (48.67% rural and 7.33 % urban) have 1 to 2 milch animals. It was found that

5.00 per cent respondents (8.67% rural and 1.33% urban) have 2 to 4 milch animals while only 1.67 per cent respondents (3.33% rural) have more than 4 animals.

Majority of the respondents (85.00%) were vegetarian whereas 15 per cent respondents were non- vegetarian. Narapureddy *et al*. (2012) reported that the same findings in his study where 90.90 per cent were vegetarian while 9.10 per cent elderly were non-vegetarian. Goel *et al*. (2006) and Tirkey *et al*. (2015) reported that more number of elderly were vegetarian. Bartwal *et al*. (2016) reported 48.67 per cent of elderly were vegetarian and 51.36 per cent of elderly were non-vegetarian under the study. Majority (161) of the elderly respondents used to spend 1 to 2 hours in household activities. Only 3.33 per cent respondents worked for 4 to 6 hours and 11.33 per cent respondents were working for 2 to 4 hours. Majority of the respondents (87.33% and 77.33%) spend less than 1 hour in agriculture and animal husbandry followed by 12.33per cent and 10.67 per cent, 6.00 per cent and 1.67 per cent and 4.00 per cent and 0.33 per cent respondents who were spending 1 to 2 hours, 2 to 4 hours and 6 to 8 hours in animal husbandry activities, respectively. Most of respondents (95.67% and 85.67%) spent less than 1 hour in recreational and religious activities while 4.33 per cent and 14.33 per cent respondents spent 1 to 2 hours in recreational activities daily. Sethi (2003) found that 52.00 per cent of elderly go for morning walk and spent less than 1 hours and only 7.69 per cent of elderly subjects were performing yoga for 20 minutes.

5.2 Nutritional status of geriatric respondents

5.2.1 Frequency of food consumption

It was found that majority of respondents consumed wheat daily, rice and maize weekly, pearl millet fortnightly and barley and oats rarely basis. Among the pulses most of respondents consumed green gram dal on alternate days, Bengal gram weekly, black dal, moth bean dal and lentil was consumed rarely. Data regarding food consumption pattern of green leafy vegetables revealed that coriander leaves consumed daily, *bathu* leaves, fenugreek leaves, Bengal gram leaves and mustard leaves consumed weekly while amaranths and spinach was consumed on fortnightly basis.

The consumption pattern of roots and tubers revealed that majority of the respondents (90.67%) consumed onion, ginger and garlic at daily basis, potato on alternate days, carrot and sweet potato, radish on fortnightly basis and colocasia and turnip on rarely basis. Tomato and green chillies were consumed daily, peas, bottle gourd and ridge gourd were consumed alternatively, brinjal and lady finger were consumed weekly, cauliflower was consumed fortnightly and cabbage was consumed rarely by majority of elderly respondents. *Kinow* (60.67%) consumed on alternate days, guava (69.00%), apple (62.33%), papaya (68.33%) and watermelon (38.00%) were consumed weekly my majority of the respondents whereas banana (44.67%), lemon (54.67%), orange (77.67%) mango (54.67%) and muskmelon (56.67%) was consumed fortnightly. Ber (61.67%), peach (76.33%), plum (84.33%) and *lichi* (62.33%)

were consumed rarely by most of the people. It was found that most of respondents consumed buffalo's milk and curd daily, buttermilk alternatively, *paneer* and sweets weekly basis. It was revealed from the Table 4.4 that most of the respondents consumed *desi* ghee (88.67%), vegetable oil (29.00%) and mustard oil (55.00%) daily whereas hydrogenated fat was not consumed by most of the respondents (85.33%).

It was found that above 90 per cent geriatric respondents prefer to consume *chapatti*, milk, porridge, *khichari*, dal (split), *laapsi*, *desi* ghee and dehusked dal. Seventy to ninety per cent respondents prefer to consume *kasaar*, *parantha* jaggery, butter and buttermilk. Fifty to seventy per cent respondents preferred *pulao* and *khoya ladoo*. It was observed that majority of geriatric respondents avoided consuming, black gram dal, *rajmah,* whole Bengal gram dal and sprouted pulses, brinjal, cauliflower, lady finger, potato, spinach, pickles, cold drinks, coffee and noodles. Sethi (2003) reported that 20.00 per cent elderly avoided fried foods, 54.00 per cent elderly consume less spicy foods and 76.00 per cent elderly used to avoid processed foods. Decreased digestive efficiency, gastrointestinal disturbance and doctor's advice are the major factors in avoidance of some food products.

5.2.2 Food consumption pattern

It was observed that mean intake of cereals (166.29g), pulses (16.74g), fats and oil (14.07g), sugars (9.60 g), milk and milk products (223.87 g), green leafy vegetables (39.49 g), roots and tubers (45.45g), other vegetables (55.70 g) and fruits (32.96 g) was significantly ($p<0.05$) lower than their respective RDI given for female geriatric respondents. Aggarwal and Varma (2015) reported that elderly women of Rajsthan (60-70 years) were taking 189.54 g of cereals, 25.62 g of pulses, 41.14g of fats and oils, 28.87g of sugars and jaggery, 346.14 g of milk and milk products, 12.81 g of green leafy vegetables, 48.79 g of roots and tubers, 43.40 g of other vegetables and 42.24 g of fruits daily which was in agreement to our study. Sumathi *et al.* (2004) reported the mean daily intake of cereals (309.66 g), pulses (14.63 g) fats and edible oil (14.67g), sugar & jaggery (32.20 g), milk and milk products (162.10 g), green leafy vegetables (4.10 g) , roots & tubers (54.95g), other vegetables (101.90 g) and fruits (61.80 g) among male (65 to 70 years) respondents of Mysure city (Karnataka) and found to be significantly lower than RDI and similar to our results. Desai *et al.* (2013) reported that there was profound effect of age on diet profile in both the elderly male and female in rural area of Vadodhara, Gujrat. A general disinterest in food intake was observed with old age group (>75 years). Monotony of diet and other associated psychological problems reduces appetite and compromise food intake. Mean consumption of cereals and millets, which forms the bulk of the Indian diet, was below the Recommended Dietary Intake and the consumption of other vegetables (such as brinjals, ladies fingers, french beans, cluster beans and bottle gourd) were greater than the recommended levels in females (Arlappa *et al.*, 2013). In her study Kimaya and Sharma (2013) reported slightly higher mean intake of food

stuffs than our study as pulses (62.4 gm), other vegetables (112.32 gm), milk and milk products (319.5 gm) and fats (30.8 gm) and found to be higher than the recommended dietary intake. In elderly females, the intake of other vegetables (108.9 gm) and fat (31.0 gm) was more than the RDI.

According to per cent intake of RDI, the respondents were divided into four adequacy groups as ≤50%, 50-74.9%, 75-99.9% and ≥100%.of RDI. Data related to adequacy of revealed that mean daily intake of cereals, pulses, fats and edible oil, sugar & jaggery, milk and milk products, green leafy vegetables, roots & tubers, other vegetables and fruits was significantly ($p<0.05$) less than 50 per cent of RDI among the majority of female and male respondents except the intake of energy which was lying in the category 75 to 99.9 per cent of RDI. This study showed a mean deficit intake of cereals, green leafy vegetables, root vegetables, fruits, and sugar in both sexes as compared to RDI. The survey carried out by National Nutrition Monitoring Bureau (NNMB) in nine states of India in 2001, revealed that the average daily intakes of various foods except for roots and tubers were below the recommended levels. The intake of green leafy vegetables and fruits was inadequate. It is to be noted that the nutrient intakes were compared with Indian Adults requirements as there are no specific recommendation for Indian elderly. Sethi (2003) stated that physiological conditions, doctor's advice, decreased physical activity, lack of appetite, contributed to lower intake of various food stuffs (cereal, pulses, fats and oils, sugars and jaggery, milk and milk products, green leafy vegetables, roots and tubers, other vegetables and fruits) among the elderly respondents of Hisar district, Haryana. The comparison mainly serves to highlights the various deficiencies in the diet consumed by elderly. Mean daily intake of female respondents was low for cereals, pulses, fruits, vegetables and milk and milk products in comparison to recommended daily intake (RDI). Low consumption may be attributed to the limits of physiological and morbidity status. Fruits are an expensive item which may not be readily eaten by a low-middle socio-economic status. Sometimes elderly give less preference to themselves when it comes to the distribution of such expensive item. Inequality in intra-household food allocation was found to be more prevalent in low income groups (Agrawal and Varma, 2015). A community based cross-sectional study; was carried out by the National Nutrition Monitoring Bureau (NNMB), during 2005-06 among the rural population (n=2138) of nine major states of India (Arlappa *et al*., 2016). The consumption of all the foods was below recommended daily intakes (RDI), and the in-adequacy (<70% of RDI) of intake was high with respect to leafy vegetables, milk & milk products, fats & oils and sugar & jaggery.

5.2.3 Nutrient intake pattern

It was observed that mean intake of energy, protein, fat, calcium, magnesium, iron, zinc, β- carotene, vitamin C, thiamine riboflavin niacin and vitamin B_{12} among rural, urban and total geriatric female and male was significantly ($p\leq0.01$) lower than RDA/EAR

recommended for them except in the male respondents with 45 kg and 50 kg body weight (differed non significantly) and protein intake of male respondents with 45 kg body weight which was significant ($p \leq 0.01$) higher (50.97g) than the EAR of male respondents for the respective group (45.27g). Khoshaboo *et al.* (2015) reported that the average nutrient intake of sedentary female and male geriatric respondents with reference to energy (1442 kcal and 1432 kcal), fat (45g and 40 g) protein (33g and 33g), calcium (213 mg and 161mg), iron (17 mg and 13 mg) and vitamin C (31mg and30.93 mg). It was observed that the average intake of almost all the nutrient was found to be lesser than RDA. The mean daily intake of energy and protein in 60-80 y old females was 1474. kcal/d and 47.1 gm/d, respectively whereas that of fat was 31.37 gm/d, respectively. Yadav *et al.* (2012) in her study observed that decrease in nutrient intake with corresponding decline in nutritional status at significant level. In urban male mean energy intake was found to be negative while in rural males mean energy intake was found to be less than RDA. The intake of protein, fat, iron and ascorbic acid was more than the RDA in all urban and rural population (malnourished and at risk group). Mean energy intake was found to be less than RDA in rural whereas higher than RDA among urban female identified with obesity. Mean intake of protein was found to be less than RDA in rural and urban females. Mean intake of iron was found to be negative in all four groups of rural and urban female. Ascorbic acid intake was of urban female was found to be positive while it was negative in rural females in comparison to RDA. Mean daily intake of calorie and protein in 60-80 y old males was 1647.1 kcal and 53.4 gm/day, respectively, whereas mean intake fat was found to be 50.3 gm/d (Kimaya and Sharma, 2013). Agarwalla *et al.* (2015) cited most common reasons for calorie intake were difficulty in chewing and swallowing (59.50 %) and loss of appetite (54.20%). The inability of elderly to take decisions about food intake (47.80%), lack of funds (48.40 %) and lack of awareness (38.40%) were other reasons cited. Physical and financial dependency definitely influences nutritional status. Prashad (2015) stated that calorie required is usually low than adult population hence the calorie intake is reduced. Average calorie deficit is more in male (754.10kcal) in age group of 70 to 80 years. Variation of average deficit is more in age group of 60 to 70 years between male and female (401.8 kcal and 503.7 kcal).

Adequacy of nutrients revealed that majority of female and male geriatric respondents were taking less than 50 per cent of RDA of energy, protein (EAR), fat, calcium, magnesium, iron, zinc, β- carotene, vitamin C, thiamine riboflavin niacin and vitamin B_{12} except the intake of energy, fat, calcium and phosphorus which was taken 50 to 74.9 per cent of RDA by majority of male geriatric respondents. Similaly, Kimaya and Sharma (2013) reported that percent adequacy for fat was highest in females (116.1%) followed by protein (94.1%), energy (78.6%), total fiber (78.2%) and lowest for carbohydrate (63.6%). Intake of all the nutrients excluding fat was less in elderly females of 60-70 than RDA. The percent adequacy

for fat was found to be highest (93.4%) followed by total fiber (88.9%), protein (88.9%), energy (67.9%) and carbohydrate (56.6%). The study showed that there was a deficient intake of all the macronutrients in both elderly males and females than RDI except fat intake in elderly females. It was also observed that the macronutrient intake in both elderly males and females is influenced by increasing age. Tripathi *et al.* (2017) in their study observed that except for consumption of fat which was 37.00 per cent surplus in female and 50 per cent surplus in male all the other nutrients like carbohydrate, protein, calcium, vitamin C and iron including calorie intake was found to be deficit by 13.58 per cent, 31.11 per cent, 61.25 per cent, 26.67 per cent, 32.35 per cent and 12.56 per cent, respectively in female respondents and 11.32 per cent, 23.91 per cent, 64.75 per cent, 26.82 per cent, 35.30 per cent and 15.15 per cent, respectively in male respondents against their recommended level.

It was observed that consumption of cereal, pulses, fats and edibles oils, milk & milk products, green leafy vegetable, roots and tubers, other vegetables and fruits was significantly ($p<0.005$) higher among the female and male respondents living in joint family than those living alone and living in nuclear family respondents. It was observed that intake of milk and milk products, green leafy vegetables and fruits was significantly ($p<0.01$) higher in medium sized family respondents than respondents belonging to small sized families and large sized families. Roots and tubers and pulses were consumed in significantly ($p<0.01$) higher amount by the female and male respondents of small sized families while intake of cereals was significantly ($p<0.01$) higher in male respondents from large families than small sized. The geriatric female and male those were educated up to matric level had significantly ($p<0.01$) higher intake of pulses and milk and milk products and cereals, respectively whereas intake of fruits was significantly ($p<0.01$) higher among the respondents those were post graduate than the rest of respondents. Roots and tubers and other vegetables were consumed in significantly ($p<0.01$) higher amount by the male respondents those were graduate. The data revealed that the respondent's spouse who was educated upto post graduate level those female respondents (274.g) had significantly ($p<0.01$) higher intake of milk and milk products. Green leafy vegetables were consumed in significantly ($p<0.01$) higher amount (43.38g) by the female respondents those with graduate spouse. The data revealed that the respondent's spouse who was educated upto senior secondary level those male respondents (300.00g) had significantly ($p<0.01$) higher intake of milk and milk products than fruits were consumed in significantly ($p<0.01$) higher amount by the male respondents those with graduate spouse. It was reported that consumption of pulses, milk and milk products, fruits and other vegetables maximum among the female respondents those occupation was categorized as business, agriculture and ex-service, respectively. Mean daily intake of pulses, fruits, milk and milk products and other vegetables was highest (significantly, $p<0.01$) among the male elders those occupation was categorized into business and ex-service, respectively. Consumption of pulses, milk & milk

products, green leafy vegetables, roots & tubers, other vegetables and fruits was significantly ($p<0.01$) higher among the female and male respondents whose income was above Rs. 36000 per month than those income was below Rs. 12000, Rs. 12001to 2400 and Rs. 24001 to 36000 per month.

The female and male respondents those were living in joint families had significantly ($p<0.01$) higher intake of energy, protein, fat, calcium, phosphorus, iron and β-carotene, thiamine, vitamin C and folic acid than those respondents were living alone and living in nuclear families. There was a significant ($p<0.01$) difference in the intake of energy, protein, fat, calcium, phosphorus, iron and β-carotene, thiamine, riboflavin, vitamin C and folic acid between the respondents (female and male) living in joint families to the respondents living in nuclear families. Mean daily intake of energy, protein, fat, calcium, phosphorus, iron and β-carotene, vitamin C and folic acid was significantly ($p<0.01$) among the female and male respondents from medium families than the respondents from small and large sized families except protein intake of male respondents (significantly ($p<0.01$) higher in small sized family respondents). Mean daily intake of thiamin was found to be in similar amount (0.92 mg) among the female respondents belonging to different family size i.e. small, medium and large. It was found that female respondents those were educated up to matric had significantly ($p<0.01$) higher intake of energy, calcium, phosphorus and magnesium whereas intake of β-carotene, vitamin C and folic acid was significantly ($p<0.01$) higher among the female respondents those were educated upto post graduate. Male respondents those were educated upto matric had significantly ($p<0.01$) higher of energy, calcium, phosphorus and magnesium, upto graduate had significantly ($p<0.01$) higher intake of iron and upto post graduate had significantly ($p<0.01$) higher intake of β-carotene, vitamin C and folic acid. The data revealed that the female respondent's spouse those were educated upto graduate level those female respondents had significantly ($p<0.01$) higher intake of β-carotene, vitamin C and folic acid than rest of the respondents. Male respondent's spouse those was educated upto senior secondary level had significantly ($p<0.01$) higher intake calcium, phosphorus and magnesium than rest of the respondents. It was reported that intake of protein was significantly ($p<0.01$) higher among the female and male respondents those occupation was business. Mean daily intake of calcium, phosphorus, magnesium, β-carotene, vitamin C, folic acid and vitamin B_{12} was significantly ($p<0.01$) higher among the female respondents belonging to agriculture whereas intake of calcium, phosphorus, magnesium, β-carotene, vitamin C was significantly ($p<0.01$) higher among those male respondents who were ex-service. Intake of energy, protein, fat, calcium, phosphorus, iron and β-carotene, vitamin C, folic acid and vitamin B_{12} was significantly ($p<0.01$) higher among the female and male respondents whose income was above Rs. 36000 per month than those income was below Rs. 12000, Rs. 12001to 2400 per

month but was not significantly ($p<0.01$) higher than those respondents whose income was Rs. 24001 to 36000 per month.

Agrawal (2012) reported that elderly living alone had significantly lower intake of food stuffs and nutrients and more prone to malnutrition than that of respondents living with their children or with their spouse. Agarwalla *et al.* (2015) reported that intake of food is determined by the purchasing power and a person can be more decisive about food intake if he or she is financially independent. It was found that not having an income and not receiving regular financial support were associated with poor nutritional status. Kimaya and Sharma (2013) and Goswami *et al.* (2016) found that lower intake of food was not associated to with any of the socieo-demographic factors whereas other studies found a significant association with education, occupation and financial dependence (Vedantam *et al.*, 2010; Jamir *et al.*, 2013 and Majumder *et al.* 2014). Yadav *et al.* (2012) reported in her study relationship of per capita income, education and social participation with food intake and nutrient intake was found to be significant and positive in elderly men from urban area of Allahbad, Uttar Pradesh. It was found that per capita income, education and other social factors were strongly associated variables of nutritional status. There was a positive and significant correlation of social factors with selected nutrients- energy, protein, carotene and ascorbic acid in elderly men respondents. Ghirmire *et al.* (2017) in his study revealed that respondents with formal schooling had the best nutritional status. Education used as a proxy for socieo-economic status, is highly associated with intake of many food items. Contrary to this Kimaya and Sharma (2013) revealed that the micronutrient intake of both elderly male and female was not found to be significantly associated with educational qualification, family size, monthly income and social involvement.

5.3 Health problems among geriatric respondents

Majority of the respondents (92.00%) were exercising rarely followed by weekly (3.67%), daily (1.67%), alternatively (1.00%), monthly (1.00%) and fortnightly basis (0.67%). It was observed that 51.33 per cent, 20.67 per cent, 1.00per cent, 0.67per cent 1.33per cent and 25.00per cent respondents were going for walk daily, alternatively, weekly, fortnightly, monthly and rarely basis, respectively. Yoga was done by 9.00 per cent respondents daily, 5.00 per cent alternatively, 1.67per cent weekly, 0.33 per cent fortnightly and 0.67per cent monthly. Sethi (2003) reported that 7.69 per cent respondents were doing yoga and 73.07 per cent respondents were exercising.

Results revealed that most of female respondents (52.00%) were suffering from moderate anemia followed by 30.67 per cent respondents, 12.67 per cent respondents and 4.67 per cent respondents those were in the category of anaemia as mild, normal and severe, respectively. Majority of male respondents (48.67%) were suffering from mild stage of anemia followed by 24.67 per cent respondents, 22.00 per cent respondents and 4.67 per cent

respondents those were in the category of anaemia as moderate, normal and severe, respectively. Joshi *et al.* (2017) in their study showed that majority of the elderly have moderate anaemia (58.50%) while 27.90 per cent were suffering from severe anaemia. Anaemia of chronic disease was the most common type of anaemia seen in elderly population. Other causes include acute infections, tuberculosis and chronic inflammatory states such as rheumatoid arthritis. Iron deficiency is the second most common cause of anaemia and less intake of iron rich food both in quantity and quality were the reason for that.

Majority of rural and urban respondents suffered from flatulence, back ache and joint pain regularly, constipation, back, toothache and loneliness occasionally and stomach pain, diarrhea, lack of appetite, difficulty in breathing, tremor of hands, irritability, difficulty in sleeping, eye infections, hearing problems and skin allergy rarely except constipation in urban respondents (often). Sethi (2003) reported joint pain as the major problem in majority of elderly (94%) followed by irritability, backache and flatulence. Fifty per cent of elderly has constipation, 44 per cent had toothache, 40 per cent had difficulty in sleeping, 34 per cent had diarrhea, 12 per cent had depression, 41 per cent had lack of appetite and 8 per cent had tremor of hands. Tripathi *et al*. (2017) reported that 38.67 per cent had loss of subcutaneous at, 44 per cent had extra fat, 40 per cent had toothache, 16.67 per cent had tremor of hands. Every three in four female (74.67 %) and 69.33 per cent of males were suffering from joint pain.

Majority of rural and urban respondents were suffering from blood pressure (57.33%) followed by 55.67per cent (cataract), 29.33 per cent (osteoarthritis), 25.67 per cent (diabetes), 24.00 per cent (heart disease), 12.00 per cent (renal calculi) and 6.67 per cent (asthma). Parry *et al.,* (2008) reported hypertension (56.20%), Osteoporosis (32.6%), cataract (70.6 %), heart diseases (75.20%) and diabetes (21.6%) among the geriatric population of Kashmir, India. The presence of hypertension among the elderly in urban area was about twice that in rural areas. It could be because of sedentary and modern life style and stress in urban areas. A high prevalence of osteoarthritis among female elderly was observed which reflects hard life faces by women who never retire from household work unless totally disabled. In the process of caring and nourishing of other family members of the family women in India tend to ignore or neglect their wellbeing. Cataract was more common in rural population which may be due to increased exposure to ultraviolet radiation during long hours of work in open fields. Presence of diabetes in elderly further reflects the increasing changes in life style. Singh *et al.* (2013) found that elderly of Varanasi (U.P.) were suffering from Hypertension, diabetes, heart disease, joint pain and renal diseases. Blood vessel diseases are because of replacement of lipid material to calcium and narrowing of arteries. Problem of bone fragile are more common due to certain amount of decalcification. Diabetes is a long term illness caused by faulty carbohydrate metabolism. Diseases of loco motor system cause more discomfort and

disability than any other chronic diseases of the elderly i.e. fibrolites, myositis, rheumatoid arthritis and osteoarthritis, spondylitis etc. Physical and emotional disturbances i.e. irritability, jealousy, loneliness may occur from social maladjustment. Unadoption of the aged people by the family members, relatives and community results in bitterness, inner withdrawal, depression and weariness of life.

Katta *et al.* (2013), Chaudhary *et al.* (2013), Bhardwaj and Bhardwaj (2016), khushaboo *et al.* (2015), Kalaiselvi *et al.* (2016), Karanth and Thalanjeri (2016) reported the similar results which indicated that majority of the respondents were suffering from non-communicable disease such as hypertension, cataract, heart disease, diabetes and osteoarthritis. The consequence of poor dietary regime was reflected in terms of increase in degenerative disease. Degenerative disease are the most common diseases affecting older persons are all diet affected and micronutrient deficiencies are often common in elderly people due to a number of factors such as their reduced food intake and lack of variety in food they eat and later restrictions by doctors. Neglect in nutrition, lack of personal hygiene and care, more preference towards young members act as contributing factors for precipitation of these diseases. Environment and genetics play a major role in its development. Tyagi (2007) stated that higher values of blood pressure in elderly witness a relatively high level of anxiety and stress among the elderly. The redistribution of fat in favour of central obesity is found to be responsible for increase cardiovascular diseases (CVD), diabetes, osteoarthritis and other disorders. The female were found to belong to high risk as compared to males. In post-menopausal women the prevalence of centralized fat distribution increases in CVD risk.

Maximum number of respondents suffering from diseases (cataract, blood pressure, asthma, renal calculi, diabetes, heart disease and osteoarthritis) was in the age group of 61 to 70 years while minimum number of respondents suffering from disease was in the age group of 81 to 90 years.

Majority of the respondent were taking medical treatment to control severity of disease (cataract, asthma, renal calculi, diabetes, heart disease and osteoarthritis) except the respondents suffering from blood pressure. Chaudhary *et al.* (2013) observed that treatment seeking behavior was more prevalent for heart diseases (90%) and diabetes (92%) as compared to others viz. visual problems (20%), joint complains (54%) and memory loss (13%). Majority of the respondents (71%) went for the health check-up as and when required while only 29 per cent of them visit the health facility for the regular check-up and most of the people don’t go for regular health check-ups.

Mean height of total female respondents (rural female and urban female) was significantly ($p<0.01$) lower than the height of reference women while average weight of total male respondents (rural male and urban male) was significantly ($p<0.01$) higher than the reference men. Average weight of total female respondents (rural female and urban female)

and mean height was not significantly higher than the weight of reference women and height of reference men (except height of rural male). It was observed that mean BMI of total female and male (rural and urban) significantly ($p<0.01$) higher than the BMI of reference women and men. Similarly Mohapatra *et al.* (2009) reported that men were heavier and taller (54.20 kg and 170.02 cm) than women (48.30 kg and 150.88cm). BMI was found to be higher in women (21.3±1.94) than men (19.3±1.55). Ghirmire *et al.* (2017) reported that mean height, weight and BMI of the elderly participants under his study were 1.5±0.1m, 48.1±9.1 kg and 21.4±3.9 kg/m², respectively. It was found that majority of the female and male respondents were (52.67% female and 44.00% male) were under normal weight category, followed by 31.00 per cent respondents (31.33% female and 30.67% male), 16.33 per cent respondents (14.00% female and 18.67% male) and 4.33 per cent (2.00% female and 6.67% male) respondents those were lying in the category of over-weight, under-weight and obese, respectively. Bartwal *et al*. (2016) reported that majority (51.82%)of the elderly were found to have their BMI in normal rang however number of elderly female was under weight and obese (25.68% and 4.32%) more than that of male. Most of the elderly were in normal range of BMI but if we consider age of elderly and cut off consider for Asian people more might have been in overweight and obese category. Many chronic diseases like hypertension, diabetes, certain cancers etc. are related to weight of an individual. It was observed that older adults were less active and often reported reduced appetite and decreased food intake. Tripathi (2018) reported that 57.33 per cent respondents with BMI of normal range whereas 26 per cent were overweight and very few were found moderately underweight i.e. 4 per cent and 7.33 per cent elderly were mildly underweight. Goel *et al.* (2006), Chauhan and Chandrashekhar (2013), Kalia and Virk (2014), Kritika *et al*. (2014), Prashad *et al.* (2015) and Kumar *et al*. (2014) in normal range of BMI, contrary to this Mohapatra *et al.* (2009), Mishra *et al.* (2012), Shanker *et al.*, (2014) and Tirkey *et al.* (2015) reported majority of elderly being underweight, ranging from 42.9 per cent to 88.67 per cent. It was found that majority of healthy (4.67%) and diseased (43.67%) respondents were lying in the category of normal weight but maximum number of respondents suffering from cataract, blood pressure, asthma, renal calculi, diabetes, heart disease and osteoarthritis (82,70, 11, 14, 34,, 30 and 43 respondents, respectively) were lying in the same category (normal weight). Contrary to this Agrawal (2005) reported morbidities (hypertension, diabetes, arthritis, back pain, asthma, thyroid and liver diseases) were found to be more among obese respondents as compared to overweight and normal BMI respondents. Lopez *et al.* (2012) stated that anthropomatric measurements can be affected by dehydration or oedema, whereas Maharana (2014) stated that among elderly calculating BMI using standard height/weight method may not be reliable due to factors such as vertebral collapse, skeletal deformities and other degenerative disease. It was observed that blood pressure is significantly ($p<0.05$) positively correlated to heart

disease (r=0.6041) and cataract (r=0.6003). Singh *et al.,* (2014) stated that after the age of 40 years the depletion of lipid material takes place at the inner walls of arteries breakdown and it is replaced by calcium and leads to narrowing of blood vessels. Diet, hereditary, overweight nervous and emotional stress is main causes of the diseases of blood vessels and correlated to the blood pressure.

5.4 Development and organoleptic evaluation of value added food products

Scores of organoleptic evaluation by CCS HAU, Hisar represented that type I and type II *chapatti, cheela, laapsi, kasaar, kheer, khichari, parantha* and porridge were 'liked moderately' in terms of colour, appearance, aroma, texture, taste and overall acceptability except parantha type I and II which was 'liked '. Organoleptic assessment by ten respondents under study revealed that type I and type II *chapatti, cheela, laapsi, kasaar, kheer, khichari, parantha* and porridge were 'liked moderately' in terms of colour, appearance, aroma, texture, taste and overall acceptability except *khichari* type II which was 'liked very much'. Sethi (2003) reported that sweet porridge was 'liked very much' in terms of all the sensory attributed viz. colour, appearance, aroma, texture, taste and overall acceptability. Shukla (2004) prepared *kheer* incorporating papaya powder and reported it organoleptically acceptable. Chaudhary (2010) also reported that mean scores of color, appearance, aroma, texture, taste and overall acceptability in *khichri* prepared from pearl millet and bengal gram were in the line of 'liked moderately'. Yadav *et al.* (2010) developed pearl millet based organoleptically acceptable gluten free *halwa.* Bajaj (2013) reported that *kheer* prepared incorporating different ratios (4%, 8%, 12% and 16 %) of *ber* powder were 'liked moderately' in terms of colour, appearance, aroma, texture, taste and overall acceptability. Johari (2013) reported that *chapatti, cheela, dalia, halwa, khicahri* and *parantha* prepared from pearl millet and rice along with supplementation of amaranthus grains were found to be organoleptically acceptable. Mean scores for organoleptic acceptability of Type I and Type II of all the products were in the category of 'Liked Moderately'. Overall acceptability scores of Type III of all the products were in the category of 'liked moderately'.

5.5 Proximate composition of organoleptically acceptable food products

A narrow range of variation was observed for moisture content in all the developed products as *chapatti* (27.19 to 29.31%), *cheela* (30.63 to 31.86%), *laapsi* (81.37 to 82.70%), *kasaar* (11.68 to 12.62%), *kheer* (82.59 to 84.70%), *khichari* (77.98 to 78.63%) *parantha* (31.08 to 31.88%) and porridge (77.69 to 78.63%) . Table 4.52 illustrated that protein content of control *chapati* (8.52%) increased significantly ($p<0.05$) by the addition of Bengal gram flour (10.98%) and Bengal gram flour, maize flour, pearl millet flour and green gram flour (11.65%). *Cheela* type II contained (5.59%) contained significantly ($p<0.05$) higher amount of protein than that of control (4.87%) and *cheela* type I (4.80%). Control *laapsi* contained 6.25 per cent of protein and *laapsi* type I and type II contained significantly ($p<0.05$) higher

amount of protein (6.65% and 6.73%) than control *laapsi* but didn't differed significantly among themselves. It was observed that *kasaar* type II (7.96%) had significantly ($p<0.05$) higher amount of protein than control *kasaar* (7.00%) but had not significantly ($p<0.05$) higher amount than type I *kasaar* (7.41%). Addition of sesame seeds increased the protein content of type I and type II *kasaar*. Addition of carrot in place of rice decreased protein content (6.15%) significantly ($p<0.05$) to control *kheer* (6.89%) and *kheer* prepared using foxtail millets (popped) and maize grits (6.79%). This might be due to the fact that rice contained high amoint of protein than carrot. It was observed that *khichari* type I and type II (12.94% and 12.17%) and *parantha* type I and type II (12.07% and 11.67%) had significantly ($p<0.05$) higher amount of protein than control *khichari* (10.87%) and *parantha* (10.39%) and *khichari* type I and *parantha* type I but type I *khichari* and type I *parantha* had significantly ($p<0.05$) higher amount of protein than type II *khichari* and type II *parantha*. Protein content of control porridge was 6.12 per cent. Protein content of type I and type II was (7.58% and 8.57%) significantly ($p<0.05$) higher than control porridge while protein content of type II porridge was significantly ($p<0.05$) higher than the protein content of type I porridge. Table 4.52 revealed that *chapati*, *kasaar*, *kheer*, *khichari* and *parantha* contained 2.70 to 3.02 per cent, 2.52 to 2.65 per cent, 7.01 to 7.03 per cent, 6.74 to 7.00 per cent and 4.70 to 5.28 per cent of crude fat, respectively. Crude fat content of *laapsi* type II (3.43%) was significantly ($p<0.05$) higher than control *laapsi* (2.73%) while crude fat content of *laapsi* type I (3.06%) did not differed significantly ($p<0.05$) that of *laapsi* type II. Crude fat content of porridge type II (4.06%) was significantly ($p<0.05$) higher than control porridge (3.51%) and porridge type I (3.39)while crude fat content of control porridge and porridge type I did not differed significantly among themselves. A slight increase in fat content was observed after addition of sesame seeds could be because attributed to the fact that the fat content of sesame seeds was more as compared to rice.

Data presented in the Table 4.52 depicts that *chapatti*, *cheela*, *kasaar*, *parantha* and porridge type I (1.19%, 1.19%, 1.23%, 2.04% and 1.82%) and type II (1.32%, 1.90%, 1.76%, 2.80 and 1.97%) contained significantly ($p<0.05$) higher amount of crude fiber than their respective control products (0.91%, 0.93, 0.92%, 1.52% and 1.34%) but *chapatti*, *cheela*, *kasaar*, *parantha* and porridge type II had significantly ($p<0.05$) higher amount of crude fiber than that of *chapatti*, *cheela*, *kasaar*, *parantha* and porridge type I, respectively. It was observed that crude fiber content of type I and type II *laapsi* (0.47% and 2.14%) and *khichari* (0.59% and 2.34%) improved significantly ($p<0.05$) than that of control *laapsi* (0.28%) and *khichari* (1.72%) but did not differed significantly among themselves.

Chapati type I contained significantly ($p<0.05$) higher amount of ash content (1.32%) than control chapatti while significantly ($p<0.05$) lower amount than type II chapatti. *Cheela* type I type II (1.53% and 2.21%) contained significantly ($p<0.05$) higher amount of

ash than control *cheela* (1.30%) and differed significantly ($p<0.05$) among themselves. Ash content of type I and type II *laapsi* improved (0.60% and 0.73%) significantly ($p<0.05$) than that of control *laapsi* (0.41%) but did not differed significantly ($p<0.05$) among themselves. Addition of Bengal gram flour did not improved significantly ($p<0.05$) ash content of *kasaar* type I (0.60%) than that of control *kasaar* (0.47%). *Kasaar* type II (078%) had significantly ($p<0.05$) higher amount of ash content than that of control *kasaar* and *kasaar* type I. Type I (2.02%, 1.8% and 1.32%) and type II (2.84%, 2.33% and 1.49%) of *khichari*, *parantha* and porridge contained significantly ($p<0.05$) higher amount of ash than that of their respective control products (1.50%, 1.52% and 1.05%) while type II *khichari*, *parantha* and porridge contained significantly ($p<0.05$) higher amount of ash content than that of type I *khichari*, *parantha* and porridge, respectively. Addition of Bengal gram flour had increased the protein and ash content of the food products. Sesame seeds are good source of protein and minerals. Addition of vegetables (bottle gourd, carrot, fenugreek leaves and peas) had improved the ash content of the value added food products than their respective controls (without vegetables). Similar observations were reported by Nicole *et al*. (2010) and Kadam *et al*. (2012) in their studies. Bajaj (2013) reported moisture content of *kheer* ranged from 70.49 per cent to 71.51 per cent prepared incorporating *ber* powder. Crude fiber and ash content of the *kheer* prepared using *ber* were 0.21 to 0.77 per cent and 3.72 to 4.43 per cent. Increase in ash content might be due to the fact that the mineral content of *kheer* increases after incorporating carrot and foxtail millet leading to increase in ash content. Johari (2013) reported that crude protein found to be 7.3 g, *in chapati* developed using pearl millet and rice with addition of amaranth leaves powder and Bengal gram flour. Proximate estimation revealed that total moisture, crude protein content was found to be 69.8 g/100g and 19.1 g/100g, respectively. Crude fat, ash and crude fiber content was 9.5 g, 1.1 g and 1.3 g/100g, respectively on dry matter basis in *dalia.* Crude protein content in pearl millet and rice *khichri* was very high i.e 24.3 g/100g. Crude fat and crude fiber content of 13.1 g and 2.4 g/100, respectively were analysed. Crude protein content of *halwa* was estimated to be 5.0 g/100g. Crude fat, ash, and crude fiber were 27.6g, 0.5g and 0.4 g/100g respectively present in *halwa*.

CHAPTER -VI

SUMMARY AND CONCLUSION

The present study was conducted to assess the nutritional status of geriatric population and to develop value added food products. A questionnaire-cum-interview schedule was developed and used to collect information on personal and socio-economic profile of respondents and their dietary habits. Dietary survey was conducted to collect information on food and nutrient intake, anthropomatric measurements and nutritional knowledge. Value added food products were developed and analyzed for organoleptic acceptability by semi trained panelists of CCS Haryana Agricultural University, Hisar and by ten respondents from Sirsa district. Organoleptically acceptable products were further analyzed for proximate composition. Data were statistically analyzed using t- test, z- test and ANOVA.

Out of these 300 hundred respondents, 150 respondents from rural and 150 from urban area were selected randomly. In rural block, majority of the respondents were from Dharbhi village (23.70%) followed by Moriwala (14.67%), Sikanderpur (6.00%) and Rasulpur (5.67%) village. Among urban respondents 14.67 per cent from Farm colony, 10.67 per cent from Hari Vishnu Colony, 6.33 per cent from Khairpur Colony, 13.67 per cent from MC Colony and 4.67 per cent from Shah Satnam Colony. Out of 300 respondents surveyed, 50 per cent were male and 50 per cent were female. Forty nine per cent, 6 per cent, 16.67 per cent, 7.33 per cent, 10.33 per cent, 2.00 per cent 6.67 per cent and 2.00 per cent respondents were illiterate, can read and write, primary, middle, matric, senior secondary, graduate and post graduate, respectively. In regards of Spouse's education, majority of respondent's spouse (54.67%) were in category of illiterate followed by educated up to primary (12.67%), can read and write (11.33%), middle (9.33%), high school (9.33%), senior secondary school (2.00 %), graduate (8.26 %) and post graduate (1.00%). Ninety six per cent respondents were living with family 4.00 per cent respondents were living alone. Forty respondents used to live in nuclear families and 260 respondents in joint families. Seventy seven, 181 and 42 respondents were living in small, medium and large families, respectively. Majority of the respondents (63.67%) lived in pucca house followed by partial pucca and kachcha house. One per cent respondents consulted to CHC, 27.67 per cent went to PHC, 56.67 per cent consulted to private hospitals and 14.67 per cent urban respondents consulted to charitable to avail health facility.

Out of 300 respondents, 26 (8.67%) were labourer; 3 (1.00%) respondents were indulged in caste occupation; 22 (7.33%) respondents were business person; 66 (22.00%) respondents were ex-service person and 134 (44.67%) respondents were not indulged in any work (none). Fifty six per cent of respondents (79 rural and 89 urban) had no lands. Thirty

respondents were having <2.5 acres, 33 respondents were having 2.5 to 5 acres, 24 respondents were having 5 to 10 acres and 45 respondents were having more than 10 acres of lands. One ninety six respondents had no milch animal while 84 respondents had 1 to 2 milch animals. Majority of the respondents (85.00%) were vegetarian whereas 15 per cents respondents were non- vegetarian. Majority of the elderly 161 respondents used to spend 1 to 2 hours in household activities. Majority of the respondents (87.33%) spent less than 1 hour in animal husbandry followed by 10.67 per cent, 1.67 per cent and 0.33 per cent respondents who were spending 1 to 2 hours, 2 to 4 hours and 6 to 8 hours in animal husbandry activities, respectively. Most of the respondents (77.33%) were spending less than1 hour in agricultural activities, 12.33 per cent respondents spending 1 to 2 hours in, 4.00 per cent respondents spending 2 to 4 hours 6.00 per cent respondents spending 4 to 6 hours in agricultural activities. Most of respondents (95.67% and 85.67 %) spent less than 1 hour in recreational activities and religious activities.

It was found that majority of respondents that consumed wheat daily, rice and maize weekly, pearl millet fortnightly and barley and oats rarely. Among the pulses most of respondents consumed green gram dal on alternate days, Bengal gram weekly, black dal, moth bean dal and lentil were consumed rarely. Coriander leaves consumed daily, *bathu* leaves, fenugreek leaves, Bengal gram leaves and mustard leaves consumed weekly while amaranths and spinach were consumed fortnightly. Majority of the respondents (90.67%) consumed onion, ginger and garlic at daily basis, potato on alternate days, carrot and sweet potato, radish fortnightly basis and colocasia and turnip on rarely basis, respectively. Tomato and green chillies were consumed daily, peas, bottle gourd and ridge gourd were consumed alternatively, brinjal and lady finger were consumed weekly, cauliflower was consumed fortnightly and cabbage was consumed on rarely by majority of elderly respondents. *Kinow* (60.67%) consumed on alternate days, guava (69.00%), apple (62.33%), papaya (68.33%) and watermelon (38.00%) were consumed weekly my majority of the respondents whereas banana (44.67%), lemon (54.67%), orange (77.67%) mango (54.67%) and muskmelon (56.67%) were consumed fortnightly. Ber (61.67%), peach (76.33%), plum (84.33%) and *lichi* (62.33%) were consumed rarely by most of the people. Most of the respondents consumed buffalo's milk and curd daily, buttermilk alternatively, *paneer* and sweets on weekly basis. Most of the respondents consumed *desi* ghee (88.67%), vegetable oil (29.00%) and mustard oil (55.00%) daily whereas hydrogenated fat was not consumed by most of the respondents (85.33%). Above 90 per cent geriatric respondents preferred to consume *chapatti*, milk, porridge, *khichari*, dal (split), *laapsi*, *desi* ghee and dehusked dal. Seventy to 90 per cent respondent preferred to consume *kasaar, parantha* jaggery, butter and buttermilk. Most of geriatric respondents avoided consuming, black gram dal, *rajmah*, whole Bengal gram dal and sprouted pulses, brinjal, cauliflower, lady finger, potato, spinach, pickles, cold drinks, coffee and noodles.

It was observed that mean intake of cereals, pulses, fats and edible oil, sugars, milk and milk products, green leafy vegetables, roots & tubers, other vegetables and fruits was significantly ($p<0.05$) lower than RDI given for female respondents. Mean intake of cereals, pulses, fats and edible oil, sugars, milk and milk products, green leafy vegetables, roots & tubers, other vegetables and fruits was significantly ($p<0.05$) lower than RDI among male respondents. Mean daily intake of cereals, pulses, fats and edible oil, sugars, milk and milk products, green leafy vegetables, roots & tubers, other vegetables and fruits was significantly ($p<0.05$) less than 50 per cent of RDI among the majority of female and male respondents except the intake of energy which was in the category 75 to 99.9 per cent of RDI. It was observed that mean intake of energy, protein, fat, calcium, magnesium, iron, zinc, β- carotene, vitamin C, thiamine, riboflavin, niacin and vitamin B_{12} among rural, urban and total geriatric female and male was significantly ($p\leq0.01$) lower than RDA/EAR recommended for them except in the male respondents with 45 kg and 50 kg body weight (differed non significantly) and protein intake of male respondents with 45 kg body weight which was significant ($p\leq0.01$) higher (50.97g) than the EAR of male respondents for the respective group (45.27g). Adequacy of nutrients revealed that majority of female and male geriatric respondents were taking less than 50 per cent of RDA/EAR of energy, protein, fat, calcium, magnesium, iron, zinc, β- carotene, vitamin C, thiamine, riboflavin, niacin and vitamin B_{12} except the intake of energy, fat, calcium and phosphorus which was taken 50 to 74.9 per cent of RDA by majority of male geriatric respondents. Consumption of cereal, pulses, fats and edibles oils, milk & milk products, green leafy vegetable, roots and tubers, other vegetables and fruits was significantly ($p<0.005$) higher among the female and male respondents living in joint families than those living alone and in nuclear families except the consumption of pulses (male respondents) sugars (female and male respondents), fats and edibles oils (male respondents). Intake of milk and milk products, green leafy vegetables and fruits was highest in medium sized family respondents, roots and tubers and pulses in small sized families and cereals in large families. The geriatric female and male those were educated up to matric level had highest intake of pulses and milk and milk products and cereals, fruits in post graduate and roots and tubers and other vegetables in graduate respondents. The respondent's spouse educated upto post graduate level those female respondents (274.g) had highest of milk and milk products, green leafy vegetables. The respondent's spouse who were educated upto senior secondary level those male respondents (300.00g) had highest intake of milk and milk products, fruits by respondents those with graduate spouse. It was reported that consumption of pulses, milk and milk products, fruits and other vegetables maximum among the female respondents those occupation was categorized as business, agriculture and ex-service, respectively. Mean daily intake of pulses, fruits, milk and milk products and other vegetables was highest among the male elders those were categorized into business and ex-service,

respectively. Consumption of pulses, milk & milk products, green leafy vegetables, roots & tubers, other vegetables and fruits were significantly ($p<0.01$) higher among the female and male respondents whose income was above Rs. 36000 per month than those income was below Rs. 12000, Rs. 12001to 2400 and Rs. 24001 to 36000 per month.

It was found that female respondents who were educated up to matric had significantly ($p<0.01$) higher intake of energy, calcium, phosphorus and magnesium whereas intake of β-carotene, vitamin C and folic acid was significantly ($p<0.01$) higher among the female respondents those were educated upto post graduation. Male respondents who were educated upto matric had significantly ($p<0.01$) higher intake of energy, calcium, phosphorus and magnesium, upto graduate had significantly ($p<0.01$) higher intake of iron and upto post graduate had significantly ($p<0.01$) higher intake of β-carotene, vitamin C and folic acid. The female and male respondents who were living in joint families had significantly ($p<0.01$) higher intake of energy, protein, fat, calcium, phosphorus, iron and β-carotene, thiamine, vitamin C and folic acid than those respondents were living alone and living in nuclear families. Intake of energy, protein, fat, calcium, phosphorus, iron and β-carotene, vitamin C and folic acid was significantly ($p<0.01$) among the female and male respondents from medium families than the respondents from small and large sized families except protein intake of male respondents of small families. Mean daily intake of protein, calcium, phosphorus, magnesium, β-carotene, vitamin C, folic acid and vitamin $B_{12}$was significantly ($p<0.01$) higher among the female respondents belonging to agriculture whereas intake of calcium, phosphorus, magnesium, β-carotene, vitamin C was significantly ($p<0.01$) higher among those male respondents who were ex-service. Intake of energy, protein, fat, calcium, phosphorus, iron and β-carotene, vitamin C, folic acid and vitamin $B_{12}$was significantly ($p<0.01$) higher among the female and male respondents whose income was above Rs. 36000 per month than those income was below Rs. 12000, Rs. 12001to 2400 per month but was not significantly ($p<0.01$) higher than those respondents whose income was Rs. 24001 to 36000 per month.

Majority of the respondents (92.00%) were exercising rarely followed by weekly (3.67%), daily (1.67%), alternatively (1.00%), monthly (1.00%) and fortnightly basis (0.67%). Yoga was done by 9.00per cent respondents and 51.33 per cent respondents were going for walk daily. Most of female respondents (52.00%) were suffering from moderate anemia followed by 30.67 per cent respondents, 12.67 per cent respondents and 4.67 per cent respondents those were lying in the category of anaemia as mild, normal and severe, respectively. Majority of male respondents (48.67%) were suffering from mild stage of anemia followed by 24.67 per cent respondents, 22.00 per cent respondents and 4.67 per cent respondents those were in the category of anaemia as moderate, normal and severe, respectively. Majority of rural and urban respondents suffered from flatulence, back ache and

joint pain regularly, constipation, back, toothache and loneliness occasionally and stomach pain, diarrhea, lack of appetite, difficulty in breathing, tremor of hands, irritability, difficulty in sleeping, eye infections, hearing problems and skin allergy rarely except constipation in urban respondents (often). Majority of rural and urban respondents were suffering from blood pressure (57.33%) followed by 55.67per cent (cataract), 29.33 per cent (osteoarthritis), 25.67 per cent (diabetes), 24.00 per cent (heart disease), 12.00 per cent (renal calculi) and 6.67 per cent (asthma). Maximum number of respondents suffering from diseases was in the age group of 61 to 70 years. Majority of the respondent were taking medical treatment to control severity of disease (cataract, asthma, renal calculi, diabetes, heart disease and osteoarthritis). Mean height of total female respondents was significantly ($p<0.01$) lower than the height of reference women while average weight of total male respondents was significantly ($p<0.01$) higher than the reference men. Average weight of total female respondents and mean height was not significantly higher than the weight of reference women and height of reference men (except height of rural male). It was observed that mean Body Mass Index (BMI) of total female and male significantly ($p<0.01$) higher than the BMI of reference women and men. It was found that majority (47.33%) of the female and male respondents were under normal weight category, followed by 31.00 per cent respondents, 16.33 per cent respondents and 4.33 per cent respondents those were in the category of over-weight, under-weight and obese, respectively. Most of healthy (4.67%) and diseased (43.67%) respondents were in the category of normal weight and maximum number of respondents suffering from cataract, blood pressure, asthma, renal calculi, diabetes, heart disease and osteoarthritis (82,70, 11, 14, 34,, 30 and 43 respondents, respectively) were in this category. It was observed that blood pressure is significantly ($p<0.05$) positively correlated to heart disease ($r=0.6041$) and cataract ($r=0.6003$). Scores of sensory evaluation by panelists of CCS HAU, Hisar represented that type I and type II *chapatti, cheela, laapsi, kasaar, kheer, khichari, parantha* and porridge were 'liked moderately' in terms of colour, appearance, aroma, texture, taste and overall acceptability except parantha type I and II which was 'liked '. Organoleptic assessment by ten respondents under study revealed that type I and type II *chapatti, cheela, laapsi, kasaar, kheer, khichari, parantha* and porridge were 'liked moderately' in terms of colour, appearance, aroma, texture, taste and overall acceptability except *khichari* type II which was 'liked very much'. Protein content increased significantly in all the developed products in comparison to their respective controls except in *kheer* (type I and type II) and *kasaar* type I. Crude fiber and ash content improved significantly in all the developed products except the crude fiber content of *kheer* (non significant). Crude fiber content did not differed significantly in all the food products except crude fiber content of *cheela* and *laapsi*.

The study conclude that majority of respondents were illiterate , living in medium sized joint families, preferred private hospital's consultation, no land , occupation was none

and middle income group .With the withering of joint families elderly are abandoned. Mean intake of food stuffs and nutrients was below 50 per cent of RDI and RDA, respectively among the geriatric respondents. Elderly are likely to suffer from compromised nutritional status. With increasing age, regulatory functions of vital organs of the body continue to decrease. Due to lower intake of macro and micro nutrients along with prevalence of degenerative diseases highlighted the dual burden of malnutrition. Most of the respondents were under normal weight category as per BMI. Majority of the respondents were suffering from diseases viz. blood pressure, cataract, diabetes, heart diseases, osteoarthritis and renal problems. All the value added food products were organoleptically acceptable and crude protein, crude fiber and ash content improved in most of value added food products as per proximate composition. Hence, there is urgent need to emphasis geriatric nutrition and health care services and social support.

BIBLIOGRAPHY

Adenike A. O., Ogunshe, Adeniyi A., Jayeola, Taiwo C. & Ogundimu, P. 2008. Microbial study on laboratory fermentation of *Iregi*- a potential fermented food condiment from *Delonixregia. J. Food Sci*. *Technol*. **13** (2): 61-64.

Agrawal, A. & Varma, K. 2015. Diet and nutrient intake in Urban women of Rajasthan state, northern India. *Ecology of Food and Nutrition*, **15**(13), 1-15.

Agrawal, P. 2005. Role of lifestyle and diet in emerging obesity among Indian women and its impact upon their health status. Paper for oral presentation in the IUSSP XXV International Population Conference Tours, France, 18-23July.

Agarwalla, R., Saikia, A. M. & Baruah, R. 2015.Assessment of the nutritional status of the elderly and its correlates. *Journal of Family & Community Medicine*, **22**(1), 39.

Agrawal, S. 2012. Effect of living arrangement on the health status of elderly in India: Findings from a national cross sectional survey. *Asian Population Studies*, **8**(1), 87-101.

Akbar, S., Tiwari, S. C., Tripathi, R. K., Kumar, A. & Pandey, N. M. 2014. Reasons for Living of Elderly to In Old Age Homes: An Exploratory Study. *The International Journal of Indian Psychology*, **2**(1), 56-61.

Anjana, A. & Asha, T. C. 2015. Prevalence and correlates of functional limitation among elderly in Kerala. *IJPSS*, **5** (18), 138-150.

Antonelli, E., Rubini V. & Fassona, C. 2002. The self-concept in institutionalized and non-institutionalised elderly people. *Journal of Environmental Psychology*, **20**, 151-164.

Anu, Sehgal, S. & Kawatra, A. 2003.Sensory evaluation of pearl millet based biscuits. *Recent Trends in Millet Processing*, 117-120.

AOAC, 2000. Official Methods of Analysis of Association of Official Agriculture Chemist. Association of Analytical Chemist, Washington. D.C.

Arlappa, N., Balakrishna, N., Kokku, S. B., Harikumar, R., Rao, K. M., Ravindranath, M. & Brahmam, G. N. V. 2016. Diet and nutritional status of the older adults in rural India. *Journal of Aging Research and Healthcare*, **7(**1), 44.

Arlappa, N., Balakrishna, N., Kokku, S. B., Ravindranath, M. & Brahmam, G. N. V. 2013. Effect of nutritional Status on mental health of the Older Adults in Rural India. *Journal of Aging Research and Healthcare*, **1(**3), 55-59.

Arlappa, N., Rao, K. M., Venkaiah, K., Brahmam, G. N. V. & Vijayaraghavan, K. 2009. Nutritional parameters and chronic energy deficiency in older adults of desert areas of western Rajasthan, India. *Journal of Nutrition for the Elderly*, **28**(1), 61-71.

Bajaj, M. 2013. Nutritional evaluation and utilization of Ber (z*iziphusMausitiana* L.) powder for the development of Value added food products. Ph. D thesis, CCSHAU, Hisar.

Banakar, S., Yadav, D.N., Kaur, J. & Anand, T. 2005. Development and shelf life evaluation of Pearl millet based *Upma*dry mix. *Association of Food Scientists and Technologists*, pp 63-65.

Banker, K., Prajapati, B. & Kedia, G. 2011. Study of health profile of residents of geriatric home in Ahmedabad district. *National Journal of Community Medicine*, **2**(3), 378-382.

Bartwal, J., Rawat, C.M.S. & Awasthi, S. 2016. Nutritional status of elderly in rural areas of Haldwani, Nainital district of Uttarakhand. *Int. Journal of Community Med. Public Health*, **3**: 687-691.

Bhardwaj, T. &, Bhardwaj, S. 2016. Health needs of the elderly in rural area of Lalitpur district of Uttar pradesh. *Indian Journal of Gerontology*, **30**(3), 321-355.

Bhawalker, J.S., Dhone, A.B., Jethani, S., ,Singru, S. ,Jadhav, S.L. & Adanthaya, S. 2013. A study of morbidity profile, among geriatric population in an urban area. *Journal of Evolution of Medical and Dental Sciences*, **2**(36), 6963-6967

Bhushnam, G.V., Serrdevi, K. & Kmeshwaran, J. 2013. Assessment of nutritional status of elderly in selected paid and destitute homes in Chennai, India. *American International Journal of*

Research in Humanities, Arts and Social Sciences, **3**(1), 46-49. Available on-http://www.iasir.net

Boulos, C., Salameh, P. & Barberger, G.P. 2014. Factors associated with poor nutritional status among cpmmunity dwelling Lebanese elderly subjects living in rural area: results of the AMEL study. *J. Nutr. Health Aging,***18** (5): 487-494.

Caleindo, M. A. 1979. Nutrition and The World Food Crisis. Mac Millan Publishing Co. Ltd. New York.

Capuron, L, Moranis, A., Combe, N., Gelei, F.C., Funchs, D, Peyrusse, V.D.S., Gateau, P.B. & Laye, S. 2009. Vitamin E status and quality of life in the elderly: influence of inflammatory process. *Bri. J. Nutr.*, **102**, 1390-1394.

Castaneda-Gameros, D., Redwood, S.& Thompson, J. L. 2018.Nutrient Intake and Factors Influencing Eating Behaviors in Older Migrant Women Living in the United Kingdom. *Ecology of Food and Nutrition*, **57**(1), 50-68.

Chandramouli, C. & General, R. 2011. Census of India 2011.*Provisional Population Totals. New Delhi: Government of India*.

Chaudhary, H. 2010. Nutritional and sensory evaluation of bakery products developed from composite flour. M.Sc. Thesis, CCS Haryana Agricultural University, Hisar, India.

Chaudhary, M., Khandhedia, S., Dhaduk, K., Unadkat, S., Makwana, N. & Dipesh, P.2013.Morbidity pattern and treatment seeking behavior of geriatric population in Jamnagar city India.*Journal of Research in Medical and Dental Science*,**1** (1), 12-16.

Chauhan, P. & Chandrashekhar, V. 2013.A study on morbidity pattern among the geriatric people of Venkatachalem village, Nellore District, AP, MRIMS. *Journal of Health Sciences*, **1**(2), 48-53.

Chauhan, K., Singh, N.& Mehta,P.2008.Assessment of nutrition, diet and disease, profile of elderly males residing in rural Vadodra, India.*Asian Journal of Home Science,***3**(2), 234-238. www.researchjournal.co.in/online/subdetail.html.

Das, S.K., Faruque, A.S.G., Aheman, S., Mamun, A.A, Raqib, R., Roy, A.K., Chisti, M.J., Ahemad, T. & Salam, M.A. 2012. Nutritional and micronutrient ststus of elderly people living in a rural community of Bangladesh. J. *Gerontology and Geriatric Research*, **1** (3), doi:10.4172/2167-7182.1000107.

Desai, A.N., Patel, H.V.& Bhattacharya, A.K. 2013.Nutritional status and health of elderly in rural Vadodara.*http//www.japi.org/march_2009/geriatrics_poster_session. html accessed 10 may 2009.*

Dubey, A., Bhasin, S., Gupta, N. & Sharma, N. 2011.A study of elderly living in old age home and within family set-up in Jammu. *Stud Home Comp Sci*., **5**, 93–98.

Eneche, O.A.T. & Oyewole, A. C. 2007.Effect of cooking and soaking on the physical characteristics, nutrient composition and sensory evaluation of indigenous and foreign rice varieties in Nigeria. *African J. Biotech.***6** (8): 1016-1020.

Garrow, J. S. 1981. Treat obesity seriously. A Clinical Manual. Edinburgh Churchill, Livingstone.

Ghani, A., Husain, S. & Zubair, M. 2013. Assessment of nutritional status of geriatric population in Sargodha city.*Int. J. Med. Appl. Health,* **1**(1)

Ghimire, S., Baral, B.K. & Callahan, K. 2017. Nutritional assessment of community-dwelling older adults in rural Nepal.*PLoSONE,***12**(2): e0172052.doi:10.1371/journal.pone.0172052

Ghisla, M.K., Cossi,S., Timpini, A., Baroni, F., Facchi, E. & Marengoni, A. 2007. Predictors of successful rehabilitation in geriatric patients: subgroup analysis of patients with cognitive impairment. *Ageing Clin. Exp. Res.* **19**:417-423.

Global Health and Ageing. 2011. National Institute on Ageing, National Institute on Health, United States: NIH Publication.

Goel, P.K.., Garg, S.K., Singh, J.V., Bhatnagar, M., Chopra, H. & Bajpai, S.K. 2006. Dietary habits and nutritional status of elderly in rural area. *Help Age India-Res. Devel. J.*, **12**.

Goplan, H.S. 2012. Nutritional status of elderly in urban slums of Delhi. Available on http:// nurtiionfoundationofindia.resin/pdfs

Goswami, A. K., Nongkynrih, B., Kalaivani, M., Gupta, S. K. & Pandav, C. S. 2016. Double burden of malnutrition among elderly population of Delhi. *Indian Journal of Community Health*, **28**(4), 324-330.

Grewal, A. 2003. Effect of processing on nutritional quality form products from newly released varieties of green gram. M.Sc. Thesis, CCS Haryana Agricultural University, Hisar, India.

Gupta, S., Gupta, P. K. & Shekhawat, S. S. 2014. The influence of co-morbities and gender differences in causation of physical disability among elderly individuals of north-west Rajasthan. *The Journal of Community Health and Management*, **1**(1), 6-11.

Gupta, S., Rathore, M.S. & Shekhawat, S. S. 2009. A cross sectional study of health profile among rural elderly of north-west Rajasthan. *Indian Journal of Gerontology*, **23**(1), 26-31.

Gupta, S., Yadav, R. & Malhotra, A. K. 2016. Assessment of physical disability using Barthel index among elderly of rural areas of district Jhansi (UP), India. *Journal of Family Medicine and Primary Care*, **5**(4), 853.

Gupta, M. 2003. Nutritional quality of value added food products from amylase rich flour of chickpea and field pea. Ph. D. Thesis, CCS Haryana, Agricultural University, Hisar.

Hooda, S. & Jood, S. (2005). Organoleptic and nutritional evaluation of wheat biscuits supplemented with untreated and treated fenugreek flour. *Food Chemistry*, **90**, 427-435.

ICMR. 2010. Nutrient requirements and recommended dietary allowance for Indian. A report of the expert group of the Indian council of medical research, New Delhi, India.

Jadhav, V.S., Mundada, V.D., Gaikwad, A.V., Doibale, M.K. & Kulkani, A.P. 2012. A study of morbidity profile of geriatric population in the field practice area of rural health training centre, Paithan of govt. Medical college, Aurangabad. *ISOR Journal of Pharmacy*, **2**(2), 184-188. Available on *www.isorphr.org*

Jain, A., Jain, A., Mangal, S., Agarwal, L.& Rai, P. 2010. Assessment of nutritional status of elderly by mini nutritional assessment scale in old age home of Jaipur. *Indian Journal of Gerontology*, **24**(3), 290-298.

Jamir, L., Kalaivani, M., Nankyeih, B., Mishra, P. & Gupta, S.K. 2013. Anthropomatric characteristics and undernutrition among older persons in a rural area of Northern India. *https//doi.org/ 10.1177/101053951349019.*

Jelliffi, D.B. 1966. The assessment of the nutritional status of the community, WHO monograph series no. 53. WGO Geneva.

Johari, A. 2013. Development of pearl millet and rice based gluten free food products. M. Sc. Thesis, CCS Haryana Agricultural University, Hisar.

Joshi, I., Thakur, S., Bhawani, R., Kaushal, V. & Mahajan, A. 2017. Clinic profile and etiology of anaemia in elderly: A hospitali based survey at a tertiary care in the sub-Himalayan region. *Journal of the Indian Academy of Geriatrics*, **13**, 18-22.

Joshi, K., Kumar, R., & Awasthi, A. 2003.Morbidity profile and its relationship with disability and psychological distress among elderly people in north India. *International Journal of Epidemiol*, 3**2**, 978-987.

Kadam, M.L., Salve, R.V., Mehrajfatema, Z.M. & More, S.G. 2012. Development and evaluation of composite flour for *Messi roti/ chapatti*. *Journal of Food Process. Technol.*, **3**: 134.

Kalaiselvi, S., Arjumand, Y., Jyalakshmy, R., Gomathi, R., Pruthu, T. & Palanivel, C. 2016. Prevalence of under-nutrition, associated factors and perceived nutritional status among elderly in a rural area of Puducherry South India. *Archives of gerontology and Geriatrics*, **65**, 156-160.

Kalia, M., Gupta, B.P.,Virk, A. & Singh, J. 2014. Assessment of malnutrition in elderly of rural Punjab. *Healthline*, **5**(2), 24-28.

Kamble, S.V., Ghodke, Y.D., Dhumale, G.B., Avchat, S.S. & Goyal, R.C. 2012. Health status of elderly persons in rural area of India. *Indian Med. Gazette, August*, 295-299.

Kamble, S.V., Ghodke, Y.D., Dhumale, G.B., Goyal, R.C. & Avchat, S.S. 2012. Mental health status of elderly person s in rural area of India. *Indian J. Basic and Applied Med. Res.*, **1** (4)309-312.

Kansal, D., Baliga, S.S., Kruthika, K. & Mallapur, M.D. 2015. Nutritional assessment amomg elderly population of rural Balagan: A cross sectional study. *Int. J. Med. Sci. Pub. Health*, **5**(4), 1496-1499.

Karanth. H. & Thalanjeri, P. 2016. A retrospective study of morbidity pattern in geriatric women of coastal Karnatka. *International Journal of Medical Sciences and Public Health*, **5**(10), 2146-2149s.

Kashyap, S.N. & Sharma, P. 2008. Extent of satisfaction derived by elderly from old age home Uttarakhand, India. *Asian J. Home Sci.*, **3**(2)176-179.

Kataria, R. 2014. Development of maize and rice based gluten free food products. M. Sc. Thesis, CCS Haryana Agricultural University, Hisar.

Katta, A., Gopalkrishanan, S, Ganeshkumar, P., Christopher, A.V., Jha, R.K. & Munuswamy, S. 2013. Morbidity pattern and nutritional status of elderly population in rural Tamilnadu. *Global Journal of Gerontology and Geriatrics*, **1** (1), 07-10.

Kaur, G., Bains, K. & Kaur, H. 2012. Body composition, dietary intake and physical activity level of sedentary adult Indian women. *Journal of Food and Nutrition Sciences*, **3**, 1577-1585.

Kaur, G., Kaur, D. & Verma, P. 2016. Elderly women's quality of life in a conflict border area of India. *Int. Journal of Advanced research in Management and Social Sciences*, **5**(1): 111-117.

Keller, H.H.& Ostbye, T. 2005. Body Mass Index (BMI), BMI change and mortality in community-dwelling seniors without dementia. *The Journal of Nutrition, Health and Aging***, 9**(5), 316-320.

Khalesi,M., Srivastava, P. & Kumar, S. 2015. A study on quality of life between elderly people living in old age home and within family setup. *Dysphrenia*, **6**(2).

Kharat, S. M., Sagare, S. M. & Pandve, H. T. 2017. A Comparative study of nutritional status among elderly population residing in community dwellings and old age homes. *Scholars Journal of Applied Medical Sciences*,**5**(9D), 3780-3784.

Khushaboo, T., Neeru, B., Verma, A. & Sheikh, S.2017. Nutritional status and dietary pattern in elderly people of Trans Yamuna area of Allahbaad. *Worlds Journal of Pharmacy and Pharmaceutical Sciences*,**4**(10), 1142-1155.

Kimaya, R. & Sharma, R. 2013.Macronutrient status of the elderly (60-80 years) From Central India. *African Journal of Food, Agriculture, Nutrition and Development*.**13** (2).

Kirkwood, T.B.L. 2008. Understanding ageing from an evolutionary perspective. Wiley Online Library, *https://doi.org/10.1111/j.1365-2796.2007.01901.x*

Kritika, Deepshikha, Semwal, J., Vyas, S., Juyal, R. & Sati, H.C. 2014. Nutritional status and associated comorbidities among the elderly in Doiwala block, Dehadun. *Ind. Journal of Community Health*, **26** (82):197-203.

Kulkarni, S.R., Ramala, D. & Gupta, R.D. 1994.Effect of adition of colocasia powder in rice flour for product development. *Indian J. Rheol.*, **38** (7), 95-109.

Kumar, P., Das, A. & Rautela, U. 2012. Mental and physical morbidity in old age homes of Lucknow, India. *Delhi Psychiatry Journal*, **15**(1): 111-117.

Kumar, R. & Shafee, M. 2014.Assement of morbidity pattern and its vorrelates among elderly population in rural area of Perambalur, Tamilnadu, India. *Int. Journal of Biomedical Res.*, **5**: 247-250.

Lahiri, S., Biswas, A., Santra, S. & Lahiri, S.K. 2015. Assessment of nutritional status among elderly population in a rural area of West Bengal, India. *International Journal of Medical Science and Public Health*, **4**(4), 569-572.

Lena, A., Ashok, K., Padma,M., Kamath, V. & Kamath, A. 2017. Health and social problems of the elderly: a cross sectional study in Udupitaluka, Karnataka. *Indian Journal of Community Med.*, **2**(1), 133-139.

Leyanna, S.G., Deshpande, S., Kumar, M.K.K., Kumar & Patil, R. S. 2017.Morbidity pattern and its sociodemographic determinants among elderly population of Raichur district, Karnataka, India. *J. Family Med. Prim. Care*, **6**, 340-344.

Lopez, M.J.C., Torralba, S., Zamora, S. & Perez-Llamas, F. 2012. Nutritional and prevalence of under-nutrition assessed by different diagnostic criteria in nursing homes for elderly people. *J. Human Nutrition and Dietetics*. **25**, 239-246.

Madhu, T., Kranthi, V.V.& Shreedevi, A. 2013.A study of socio-demographic profile of geriatric population in the field practice area of Kurnool medical college. *International Journal of Res. Dev. Health*, **1** (12): 69-76.

Maharana, B. & Ladusingh, L. 2014. Gender disparity in health and food expenditure in India among elderly. *International Journal of Population Research*, **8**. http://dx.doi.org/10.1155/2014/ 150105

Mahesh, C., Suraj, K., Kishor, D., Sumit., Makwana, N & Parmar, D. 2013. Morbidity pattern and treatment seeking behavior of geriatric population in Jamnagar city. *J. Res. Med Dent. Sci.*, **1** (1), 12-16.

Mahesh, S. J. 2014. A study on the health issues of the elderly living inn institutions with special reference to Vimala terminal care center, Mysore. *Asian J. Development matters*,**1** (1), 78-83.

Majumder, M., Saha, I. & Chaudhuri, D. 2014. Assessment of nutritional risk in Community dwelling older adults (65 to 75 years). **33** (2), *https//doi.org/10.1080/21551197.2014.908596.*

Mamatha, M., Kamal, G.N., Chandru, R. & Vijayalakshmi, K.G. 2012. Processing and utilization of legume seed coat fiber for functional food formulation. *International Journal of Food Sci. Technol.*, **6**(1), 78-98.

Mamhidir, A.G., Ljunggren, G., M., Ljunggren, M., Kihgren, A. & Kihlgren, A. 2006. Underweight, weight loss and related risk factors among older adults in sheltered housing. *A Swedish Follow up Study*, 10(4), 255-262.

Mathers, J.C. 2015.Impact of nutrition on the ageing process. *Bri. J. Nutri*. **113**: S18-S22.

Mathews, N., Marry, N. & Jackob, S. 2017. Nutritional aspects of physical health related quality of life in elderly. *Indian. J. Gerontol*. **27** (2): 382-388.

Mayor, R. 2006. Significance of grandparents: Perceptions of young adult grandchildren. *Gerontologist*, **16**(1), 137-140.

Meena, S., Singh, V.B., Meena, B.L., Singh, K., Meena, N., Sharma, D. & Beniwal, S. 2014. Study of nutritional status in elderly in Indian population. *Int. J. Current Research*, **6**(11), 10253-10257.

Mishra, C.P. , Shrivastva, P.S. & Gupta, P. K. 2012. Correlates of nutritional status in geriatric population of a rural area of Varanasi. *Indian J. Prev. Soc. Med.*, **43**(1), 6-10.

Mitri, R., Boulos, C.&Adib, S. M. 2017.Determinants of the nutritional status of older adults in urban Lebanon. *Geriatrics & Gerontology International*, **17**(3), 424-432.

Mohapatra, S.C., Shah, A.K., Gambhir, I.S., Singh, I.J. & Mishra, N. K. 2009. Nutritional status in elderly people of Varanasi district. *Indian J. Pre. Soc. Med.*, **4**, 151-156.

Mundey, A., Ambekar, S. ,Goyal, R. C., Agarekar, S. & Wagh, V. V. 2011. Assessment of quality of life among rural and urban elderly population of Wardha district, Maharashtra, India. *Ethno Med*, **5**(2), 89-93.

Mundra, A., Nirmala, B.Y. & Kasturiba, B. 2010. Designing of low glycemic chapatti of dicoccum wheat for the effective management of diabetes. *Karnataka Journal of Agric. Sci.*, 23(3), 577-580.

Narapureddy, B., Naveen, K.H., Madighati P., Singh, R.K. & Pirabu, R.A. 2012. Socio-demographic profile and healthcare seeking behaviour of rural geriatric population of Allahbad district of UP: a cross sectional study. *Int. Journal of Med. Sci. Pub. Health*, **1**: 87-92.

National Institute on Aging, National Institutes of Health. United States: NIH Publication .2011. Global Health and Ageing.

NFHS. 2000. National Family Health Survey Mumbai. India: International Institute of Population Sciences and ORC Macro.

Ngandu, T., Lehtisalo, J., Solomon, A., Levälahti, E., Ahtiluoto, S., Antikainen, R. & Lindström, J. 2015. A 2 year multi domain intervention of diet, exercise, cognitive training, and vascular risk monitoring versus control to prevent cognitive decline in at-risk elderly people (FINGER): A randomised controlled trial. *The Lancet*, **385**(9984), 2255-2263.

Nicole, M., Fei, H.Y. & Claver, I.P.2010. Characterization of easy to eat porridge flours made by soy-maize-sorghum-wheat extrusion cooking process. *Pakistan Journal of Nutrition*, **9**(2), 171-178.

NIN. 2010. Dietary Guidelines for Indians IInd Edition – A manual, National Institute of Nutrition, Hyderabad, India.

Orange, E.E., Mohammed, A.E.S., Aziz, A.A.E., Sadek, I., Hangrass, S.A. & Farag, G.A.S. 2018. Coronary artery diseases among elderly pateients: socio-demographic, lifestyle, psychological, medical and biochemical risk factors. *American J. Geromntol. Geriatrics*, **1** (2), 1-10.

Pai, M. K. 2011. Comparative study of elderly population living in the home for aged vs those living in the community. *Biomedical Research.* **22**(1), 120-126.

Parry, S.H., Kadri, SM. & Gash, B.A. 2008.A study of life style and morbidity profile among geriatrics population in Kashmir, India. *The New Iraqi Journal of Medicine*, **4**(1), 16-21.

Part, K. 2013. Park's textbook of preventive and social medicines.22nd edition Jablpur. Banarsidas Bhanot Publishers, p362.

Payahooo, L., Bishak, Y.K., Gargari, B.P., Alavi, M.B.K. & Jafarabadi, M.A. 2013. Assessment of nutritional and depression status in free living elderly in Tabriz, northwest Iran. *Health Promotion Perspectives.***3** (2): 288-293.

Peter, D., Drik, A., Dolf-De, R., Marcel, H. & Peter, C. 2011.Health aspects, nutrition and physical characteristics in matched samples of institutionalized vegetarian and non-vegetarian elderly (> 65yrs). *Journal of Nutrition & Metabolism,***28**: 37.

Phillips, D.R. 2011. Overview of health and ageing issues in the Asia-Pacific region. In: Chan W, editor. Singapore's ageing population: managing healthcare and end of life decisions. *Abingdon, Oxford: Routledge*, 13–39

Potty, V. J. 1996. How healthy is our geriatric population? a community-based cross-sectional study. *Journal of Family Medicine and Primary Care*, **4**(2), 221.

Prakash, R.S., Voss, M.W., Erickson, K.I. & Kramer, A.F. 2015. Physical activity and cognitive vitality. *Annual Review of Psychology*, **66**, 769-797.

Prasad, K.N., Kamali, M., Kanimojhi, S.,Kanmani, G., Kannan, M & Karthikeyan, A. 2015. A cross sectional study on nutritional status among elderly people in the rural community of Pondicherry. *Int. Archieves of Integrated Medicine, 2*(6), 14-19.

Qadri, S., Ahluwalia, S.K., Ganai, A., Bali, S., Wani, f. & Bashir. H. 2013. An epidemiological study on quality of life among rural elderly population of northern India. *Int. J. Med. Sci. Pub. Health*, 2 (3), 514-522.

Rahman, M.M. 2009. Health status and health need among thr aged population in Chapai Nawabganj district of Bangladesh. *Indian J. Gerontol.*, **23**, 32-41.

Raj, D., Swain, P.K. & Pedgaonkar, S.P. 2014. A study on quality of life satisfaction and physical health of elderly people in Varanasi: An urban area of Uttar Pradesh, India. *Int. Journal of Med. Sci. PublicHealth*, **3**(5), 616-620.

Rajbala, 2010. Improvement in nutritional status of school children through micronutrient rich dietary supplements. Ph. D. Thesis, CCS Haryana Agricultural University, Hisar.

Rao, C. R., Jacob, G. P., Kuppusamy, S., Kamath, V. G.& Kamath, A. 2016. Geriatric concerns-Activities of daily living, nutrition, social security measures in a coastal South Indian Population. *Community Med*, **7**(7), 598-602.

Rao, S.S., Chennamsetty, S.K. & Rao, S.K. 2014. A comparative study of psychiatric morbidity, quality of life (QOL), coping skills among elderly people living in old age homes (OLH) and in the community. *International Journal of Health Sciences and Research*, **4**(8), 212-225.

Ravindran, R. D., Vashist, P., Gupta, S. K., Young, I. S., Maraini, G., Camparini, M. & Ravilla, T. D. 2011. Prevalence and risk factors for vitamin C deficiency in north and south India: a two centre population based study in people aged 60 years and over. *PLoS One*, **6**(12), e28588.

Sai, A.C.T., Ku, P.Y. & Sai, J.D. 2008. Population–specific anthropomatric cut-off standards improve the functionality of the mini nutritional assessment without BMI institutionalized elderly in Taiwan. *The Journal of Nutrition, Health and Aging*, **12**(10), 696-700.

Sample Registration System Statistical Report. 2013. Government of India. New Delhi: Office of Registrar General and Census Commissioner India, Ministry of Home Affairs. 2013.

Sangwan, V. 1997. Food composition pattern and nutritional status of alcoholics before and after addiction: a comparative study. M. Sc. Thesis, CCS Haryana Agricultural University, Hisar.

Saxena,V., Kandpal, S.D., Goel, D. & Bansal, S. 2012. Health status of elderly a community based study. *Indian Journal of Community Health,* **24**(4), 269-274.

Sethi, S. 2003. Development and nutritional evaluation of geriatric convenience foods. Ph. D. Thesis (unpublished), CCS Haryana Agricultural University, Hisar.

Shankar, G. & Sidenur, B. 2016. A morbidity study of elderly residing in urban field practice area of S.N. Medical collage, Bagalkot. *National Journal of Research in Community Medicine*, **5**(4), 229-234.

Shankar, R., Mohapatra, A. & Mahapatra, S.C. 2014.Geriatric nutritional status in rural areas of Varanasi.*The Journal of Community Health Management*, **1**(1), 17-22.

Sheoran, O.P. and Pannu, R. S.1999. Statistical package for agricultural work."O.P. Stat" College of Agriculture, Kaul, CCS HAU, Hisar.

Shradhha, K., Prasantha, B. & Prakash, B. 2012. Study on morbidity pattern among elderly in urban population of Mysure, Karnatka, India. *The Journal of Community Health Management*, **1**(1), 17-22.

Shrivastva, S.R.B.L., Shrivastava, P.S. & Ramaswamy, J. 2013.Assessment of nutritional status in the community and clinical settings. *J. Med. Sci.,* **34** (5), 211-213.

Shukla, P. 2004. Development of dehydrated fruit powder. In: Technologies for women in Agriculture. AICRP, ICAR, Odhisha, 2013.

Singh, B. P. & Singh, T.B. 2014.Gender wise distribution in health complications among elderly of rural Varanasi, Uttar Pradesh. *The Journal of Community HealthManagement*,**1**(1), 50-55.

Singh, D. R. & Shrestha, S. 2016. Nutritional status of senior citizen living in old age homes of Kathmandu metropolitan municipality. *International Journal of Community Medicine and Public Health*, **3**(7), 1707-1715.

Singh, G. 2003. Development and nutritional evaluation of value added food products from pearl millet. Ph. D, Thesis, CCS Haryana Agricultural University, Hisar.

Singh, J.P., Singh, S., Kasturwar, N.B. & Hassan, A. 2013. Geriatric morbidity profile in an urban slum, central India. *Indian Journal of Community Health*,**25**(2), 164-170.

Singh, P., Gupta, R.K., Jan, R. & Shora, T.N. 2014 . Morbidity profile of rural geriatric population in north India: A community based cross-sectional study. *J.K. Sciences*, **18**(2), 98-102.

Sumathi, A., Malleshi, N.G. & Rao, S.V. 2004.Nutritional status of institutionalized elderly in an old age home in Mysurecity: dietary habits and food and nutrition intakes. *Nutrition Research*, **19** (10), 1459-1469.

Tirkey, K., Bala, N., Verma, S. & Sheikh, S. 2015. Nutritional status and dietary pattern in elderly people of transYamuna area of Allahbad. *WJPPS*, ***4***(10): 1027-1042.

Tiwari, S., Sinha, A.K., Patwardhan, K., Gehlot, S., Gambhir, I.S. & Mohapatra, S. C. 2010. Prevelance of health problems among elderly: a study in a rural population of Varanasi. *Indian J. Pre. Soc. Med.*, **41,** 226-230.

Tripathi, K.M., Sharma, J.P., Dubey, S.K., Selvan, T. & Kumar, M. 2017. Nutritional status and dietary pattern in geriatric population of rural Bulandshahr of western Uttar Pradesh. *Journal of Community Mobilization and Sustainable Development*, **12** (1), 31-36.

Trivedi, G. 1963. Measurements and analysis of socio-economic status of rural families. Ph.D. Thesis. IARI, New Delhi.

Tucker, K. 2001. Pattern of food and nutrient intake among the elderly. *J. Family and Community Med*. **5** (4): 129-132.

Tyagi, R. 2007. Body composition and nutritional status of institutionalized and non institutionalized senior citizens.*Intensive course in Biological Anthropology.*1st summer school of the European anthropological association,16-30 June, Prague, Czech Republic, EAA Summer School eBook**, 1,** 225-231.

UN. 2015. United Nations, Department of Economic and Social Affairs, Population Division. World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241.

Velayutham, B., Kangusamy, B., Joshua, V. & Mehendale, S. 2016. The prevalence of disability in elderly in India–Analysis of 2011 census data. *Disability and Health Journal*, **9**(4), 584-592.

Vellas, B., Villars, H. & Abellan, G. 2006. Overview of MNA- its history and challenges. *J Nutr Health Aging*, **10**, 456-465.

Vedantam, A., Subramanian, V., Rao, N.V. & John, R.K. 2009. Malnutrition in free living elderly in rural South India: prevalence and risk factors. *Public Health Nutrition*, **13(**9), 1328-1332.

Venkateshkrishna, N. & Suresh, S. 2018. A Cross-Sectional Study on the Prevalence of Diseases among the Geriatric Population in the Rural Field Practice Areas of a Tertiary Care Hospital in Mangaluru, India. *Journal of Pharmacy Practice and Community Medicine*, **4**(1), 30-32.

Vinitha, D. (2014). Institutional care of the elderly: A study of old age home in Hassan city, Karnataka, India. *International Journal of Interdisciplinary and Multidisciplinary Studies*, **1**(5), 100-107.

Waern, R. V., Cumming, R.G., Blyth, F., Naganathan, V., Allman-Farinelli, M., Le Couteur, D, & Hirani, V. (2015). Adequacy of nutritional intake among older men living in Sydney, Australia: findings from the Concord Health and Ageing in Men Project (CHAMP). *British Journal of Nutrition*, **114**(5), 812-821.

WHO. 2000. Global data on Body Mass Index. Retrieved from http.//apps.who.int/bmi/index.jsp? intropage=intro-3.html.

WHO, E.C. 2004. Appropriate body mass –index for Asian populations and its implications for policy and intervention strategies. *Lancet (London, England)*, **363**(9403), 157.

WHO. 2006. WHO growth standards : Training course on growth assessments, interpreting growth indicators. World Health Organization, Geneva.

WHO. 2010. Hidden cities: unmasking and overcoming health inequities in urban settings. Kobe: World Health Organization, WHO Centre for Health Development, United Nations Human Settlements Programme; 2010 (http://www.who.int/kobe_centre/ publications/ hiddencities_media/who_un_ habitat_hidden_cities_web.pdf).

WHO. 2015. World report on ageing and health.

Yadav, D.N., Sharma, G.K. & Bawa, A.S. 2010. Optimization of soy-fortified instant *sooji halwa* mix using response surface methodology. *Journal of Food Science and Technol*ogy, **44**, 297-300.

Yadav, N., Ravindra, R., Sharma, S., Singh, A., Mishra, M., Dubey, J. & Kumari, A. 2012. Dietary habits and nutritional status of elderly living. *Indian Journal of Prev. Soc. Med.*, **43**(1), 80-86.

ANNEXURE-I

ASSESSMENT OF NUTRITIONAL STATUS OF GERIATRIC POPULATION OF SIRSA DISTRICT, HARYANA

Sr. No. -

Name -

I. General Information

1. Name of respondent
2. Age
3. Village
4. District
5. Health and Public Health Facilities in the village

   i) C.H.C. ii) P.H.C. iii) Private Hospital iv) Dispensary v) Any other (specify)
6. Type of Family

   a) Nuclear

   b) Joint
7. Size of Family

   a) Small (4 members)

   b) Medium (5-8 members)

   c) Large (9 and above)
8. Type of house

   a) Kachcha

   b) Partial Pucca

   c) Pucca
9. Education of the respondent

a)	Illiterate	
b)	Can read and write	
c)	Primary	
d)	Middle	
e)	High School	
f)	10+2	
g)	Graduate	
h)	Post graduate	

10. Education of the respondent's spouse

a)	Illiterate	
b)	Can read and write	
c)	Primary	
d)	Middle	
e)	High School	
f)	10+2	
g)	Graduate	
h)	Post graduate	

11. Type of living arrangement

    a) Living alone

    b) Living with family
12. Occupation of the respondent

    a) Labourer

    b) Caste Occupation

    c) Business

    d) Agriculture

    e) Service

f) Any other

13. Time devoted to different kind of activities daily by the respondent

Activity	**Time**			
	1-2 hrs	**3-4 hrs**	**5-6 hrs**	**7-8 hrs**
Household work				
Animal husbandry				
Agriculture work				
Occupation				

14. Number of milch animals

Animals	**1-2**	**2-4**	**4+**
Cow			
Buffalo			

15. Land holding

Landless	Nil	
Marginal	1-3 acre	
Small	4-6 acre	
Medium	7-9 acre	
Big	Above 9 acre	

16. Total income **(₹)** of family from all sources.

Sources	**Per annum (₹)**
Agriculture	
Animal husbandry	
Any other	
Total	

17. Time devoted to recreational activities daily by the respondent

Activity	**Duration**
Social service	
Gurudwara/Temple	
MahilaMandal	
Any other	

II. Dietary Information

1. Eating habit Vegetarian / Non-vegetarian
2. Common dietary pattern

Time	**Food item**	**Food ingredients**	**Amount**
a) Early morning			
b) Breakfast			
c) Mid-day			
d) Lunch			
e) Evening			
f) Dinner			
g) Late Night			

Frequency of Food Consumed/ Food Consumption Pattern

Food Stuffs	Daily	Alternatively	Weekly	Fortnightly	Rarely	Not consumed
a) Cereals						
1.Wheat						
2.Rice						
3.Bajra						
4.Maize						
5. Any other						
b) Pulses						
1.Bengal Gram						
2.Black Gram						
3.Green Gram						
4.Moth Bean						
5.Lentil						
6.Soyabean						
7. Any other						
c) Leafy vegetables						
1.Amaranth						
2.Bathua						
3.Coriander						
4.Fenugreek leaves						
5.Bengal gram leaves						
6.Mustard						
7.Mint						
8.Spinach						
9. Any other						
d) Roots and Tubers						
1.Radish						
2.Carrot						
3.Potato						
4.Onion						
5.Colocassia						
6.Ginger						
7.Garlic						
8.Turnip						
9.Sweet potato						
7. Any other						
a) Other Vegetables						
1.Brinjal						
2.Tomato						
3.Cauliflower						
4.Cabbage						

5.Green chillies						
6.Lady finger						
7.Peas (Green)						
8.Bottle gourd						
9.Ridge gourd						
10.Drum stick						
b) Fruits						
1.Guava						
2.Apple						
3.Banana						
4.Ber						
5.Lemon						
6.Orange						
7.Plum						
8.Peach						
9.Kinoo						
10.Papaya						
11.Dates						
12.Amla						
13.Bael						
14.Pears						
15.Mango						
16.Watermelon						
17.Muskmelon						
18.Lichi						
c) Milk and Milk Products						
1.Cow's milk						
2.Buffalo's milk						
3.Goat's milk						
4.Curd						
5.Buttermilk						
6.Paneer						
7.Khoya						
8. Sweets						
d) Fats and Edible oils						
1.Desi ghee						
2.Hydrogenated fat						
3.Refined oil (Brand)						
4.Mustard oil						
5.Butter						

Dietary Record (24 Hours Dietary Recall Method), For 3 Consecutive Days

Meal Pattern	Menu	Ingredients	Amount Consumed	Raw Ingredients	Quantity

III. Personal health

1. Habits

Activity	Daily	Alternatively	Fortnightly	Monthly	Rarely	Never
Exercise						
Walking						
Yoga						
Any other						

2. How often suffered from the following health problems

Health problem	Occasionally	Often	Regularly	Never
Stomach pain				
Diarrhoea				
Constipation				
Flatulence				
Lack of appetite				
Difficulty in breathing				
Joint pain				
Back ache				
Toothache				
Tremor of hands				
Irritability				
Depression				
Difficulty in sleeping				
Eye infection				
Any other				

3. Are you suffering from the any of the following disease
   Yes/No

If yes

Disease	Age at which appeared	If at present under control		Medication
		Yes	No	
Hearing problem				
Visual impairment				
Blood pressure				
Asthama				
Renal calculi(kidney stone)				
Diabetes mellitus				
Heart disease				
Any other				

IV. Nutritional status

Anthropomatric measurements

1. Weight (in kgs)
2. Height(in cm)
3. Body mass index (kg/m^2)
4. Haemoglobin level (g/100 ml)

Assessment of Nutrition Knowledge of Geriatric person

A. Balanced diet

Sr. No.	Statement	True\False
1	Eating too heavy meals twice a day is better for health than eating four small meals daily.	
2	Off season fruits and vegetables are more nutritious.	
3	Eating egg is better than eating pulse.	
4	One cannot live on milk only.	
5	Costly foods are more nutritious	
6	Add all food groups i.e. cereals, pulses, GLV's, roots and tubers, other vegetables, milk and milk products, fats and oils, sugar and jaggery in daily diet.	
7	Soft drinks like coca- cola, limca etc. don't provide nutrients.	

8	More amount of milk and milk and egg should be included in diet of old person.	
9	Almonds and walnut are good for health.	
10	Dehusked pulses should be included in diet.	
11	Peanuts, till are equally nutritious as almonds and cashewnuts.	
12	One should drink sufficient liquids including water.	
13	Fruits and vegetables provide energy along with vitamins and minerals.	
14	Shallow frying is better than deep frying.	
15	Desi ghee gives more calories than refined oil.	
16	Sprouted pulses are more nutritious than un-sprouted pulses.	
17	Eating more raw fruits and vegetables helps to relieve constipation	

B. Importance of GLV's and Fruits in diet.

Sr. No.	Statement	True\False
1	Consume green leafy vegetables (GLV's) daily.	
2	Fruits and vegetables need to be washed before consumption.	
3	GLV's and fruits provide vitamins and minerals.	
4	Eat fruits and vegetables by colour.	
5	Dark yellow fruits and vegetables are good for eyesight.	
6	Eat seasonal fruits and vegetables.	
7	GLV's are good source of iron.	
8	Amla and citrus fruits are rich sources of Vitamin C.	

C. Conservation of nutrients.

Sr. No.	Statement	True\False
1	Pulses should be soaked before cooking.	
2	Vegetables should be washed before cutting.	
3	Rice should not be washed by rubbing before cooking.	
4	Thin skin should be removed while peeling vegetables and fruits.	
5	Vegetables should not be cut in small pieces to conserve nutrients.	
6	Wheat flour +chickpea flour should be used for making chapaties.	
7	Buffalo's milk is more nutritious than cow's milk.	
8	For quick cooking of pulses, baking soda should be added while cooking.	
9	Add vegetables in boiling water while cooking.	
10	Cooked vegetables should be reheated for a long period and served.	
11	Boiling milk helps to kill harmful bacteria.	
12	Leaves of radish should not be thrown away.	
13	Cereals and pulses, if consumed in combination, are more nutritious.	
14	Oils are better than ghee for deep frying.	
15	Sprouting and fermentation helps to improve nutritive value of foods.	
16	Chooker should be removed from wheat flour before making dough	
17	Excess water during cooking of rice should be thrown away.	

D. Kitchen hygiene and sanitation.

Sr. No.	Statement	True\False
1	Before preparing of meal, hand should not be washed.	
2	Kitchen should have appropriate exhaust.	
3	Vegetables should be washed in running water before cutting.	
4	Vegetables should be washed in running water before cutting.	
5	Drinking water pot should be covered.	
6	Clean utensils with liquid soap.	

ANNEXURE-II

Nine Point Hedonic Rating Scale

Name…….

Dated……..

Products……..

Test these samples and check how much you like or dislike each one. Use appropriate Scale to show your attitude by assigning points that best describe your feeling about the sample .An Honest expression of your feeling will help us.

Sr.No.	Colour	Appearance	Aroma	Texture	Taste	Overall acceptability	Remarks

Rate	**Organoleptic Score**
Like extremely	9
Like very much	8
Like moderately	7
Like slightly	6
Neither like nor dislike	5
Dislike slightly	4
Dislike moderately	3
Dislike very much	2
Dislike extremely	1

ABSTRACT

Tile of thesis	:	Assessment of Nutritional Status of Geriatric population of Sirsa district, Haryana and development of value added food products
Full name of the degree holder	:	**Mamta Rani**
Admission No.	:	2014HS05D
Title of degree	:	Doctor of Philosophy in Foods and Nutrition
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Degree awarding university	:	CCS Haryana Agriculture University, Hisar
Year of award of degree	:	2019
Major subject	:	Foods and Nutrition
Total number of pages in thesis	:	137+ix+VIII
Number of words in abstract	:	Approx. 475

Key words: Geriatric, nutritional assessment, dietary assessment, anthropomatric measurement, health problems, diseases, organoleptic and proximate composition.

One hundred fifty respondents were selected from 4 villages (Darbhi, Moriwala, Sikanderpur, Rasulpur) of rural block and 150 were selected from 5 colonies (Farm Colony, Khairpur, Hari vishnu Colony, MC Colony, Shah Satnam Colony) of urban block of Sirsa district, Haryana. Out of 300, 150 were female and 150 were male respondents. Intake of cereals, pulses, fats and edible oils, green leafy vegetables, roots and tubers, other vegetables and fruits by male and female respondents were ($p \leq 0.01$) lower than RDI. Mean intake of energy, protein, calcium, phosphorus, magnesium, iron, zinc, β-carotene, thiamine, niacin, folic acid, vitamin B_{12} and vitamin C was ($p \leq 0.01$) lower than RDA/EAR among female and male respondents. Adequacy of food stuffs and nutrients revealed that majority of male and female were taking below 50 per cent of RDI and RDA/EAR. Intake of cereals, pulses, fats and edible oils, green leafy vegetables, roots and tubers, other vegetables and fruits by respondents belonging to joint families than nuclear families and living alone . The intake of cereals, milk and milk products was found to be increased with increased income of the family. Education of respondent influences the intake of food groups. Intake of energy, protein, fats, calcium, phosphorus and iron was higher by respondents of joint families. Intake of energy, fat, calcium, iron, β-carotene, thiamine, niacin, folic acid and vitamin B_{12} was found to be higher in the respondents whose average family income was above Rs. 36000/month. Majority of rural and urban respondents suffered from flatulence, back ache and joint pain regularly, constipation, back, toothache and loneliness occasionally. Majority of rural and urban respondents were suffering from blood pressure, cataract, osteoarthritis, diabetes, heart disease and renal calculi. Most of respondents suffering from diseases were in the age group of 61 to 70 years. Majority of the respondent were taking medical treatment to control severity of disease. Mean BMI of total female and male significantly ($p<0.01$) higher than the BMI of reference women and men. Majority of the female and male respondents were under normal weight category. Most of healthy and diseased respondents were in the category of normal weight. Scores of sensory evaluation by represented that type I and type II *chapatti, cheela, laapsi, kasaar, kheer, khichari, parantha* and porridge and their respective control were organoleptically acceptable. Protein content increased significantly in all the developed products in comparison to their respective controls except in *kheer* (type I and type II) and *kasaar* type I. Crude fiber and ash content improved significantly in all the developed products except the crude fiber content of *kheer*. Due to lower intake of food stuffs, macro and micro nutrients along with prevalence of degenerative diseases highlighted the dual burden of malnutrition. The planning, implementations and promotion of low cost, preventive measures such as health, nutrition and physical education could enhance the possibility to improve health status of elderly.

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2) Mamta Rani and Boora. P. 2018. Common health problems among geriatric population of Sirsa district of Haryana. XXXII Biennial conference of the Home science association of India on Family and Community sciences: a catalyst for sustainable development (1-3 Feb, 2018). MPUAT, Udaipur, Rajasthan . pp239-240.

3) Mamta Rani and Boora. P. 2018. A study on socio-ecomomic profile and daily activity pattern among geriatric population of Sirsa district of Haryana. Global Research Initiatives for Sustainable Agriculture and Allied Sciences (28-30 October, 2018). I. C College of Home Science, CCSHAU, Hisar. pp-187-188

4) Mamta Rani and Boora. P. 2018. Organoleptic acceptability of food products prepared for geriatric population of Sirsa district, Haryana. Third convention of Veterinary Biochemists and Biotechnologists of India and National Symposium on Bridging Biochemical and Interventions and Environmental Remediations for One Health Improvement (2-3 Nov,2018). LLUVAS, Hisar, Haryana . pp 191-192.

5) Mamta Rani and Boora, P. 2019. Distribution of Agricultural activities among elderly Population of Sirsa district, Haryana. International Symposium on Innopreneurship: A need of sustainable development (2-3 Feberuary, 2019). Directorate of Research, CCS HAU, Hisar, Haryana. pp

6) Mamta Rani and Boora, P. 2019. Age Wise Distribution of Diseases among the Geriatric Population of Sirsa district, Haryana. International Conference on Climate Change towards Health and Agricultural sustainability (18-20 Feberuary, 2019).Guru Jambheshwar University of Science and Technology, Hisar. pp 159.

7) Mamta Rani and Boora, P. 2019. Age Wise Distribution of Diseases among the Geriatric Population of Sirsa district, Haryana. *International Journal of Current Microbiology and Applied Sciences*, **8** (4), 1445-1452.

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I also undertake that patent, if any, arising out of the research work conducted during the programme shall be filed by me only with due permission of the competent authority of Chaudhary Charan Singh Haryana Agricultural University, Hisar.

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