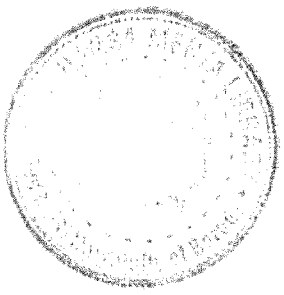


REVIEW OF LITERATURE

REVIEW OF LITERATURE

The present study was designed with a central objective of exploring problems related to diet and health and developing suitable measures for health promotion for the aged. The study was distributed in four phases. The objectives of the study included survey of elderly women with different living arrangements for various problems regarding food related activities, diet, nutrition and disease profile, to identify elderly anemic women for iron folic acid supplementation, formulation and evaluation of some nutritious food item for geriatric feeding and assessment of the effect of soy foods on health and nutritional status of institutionalized elderly. The relevant review of literature has been presented under the following heads.

- **AGEING**
- **LIVING ARRANGEMENTS AMONG ELDERLY**
- **PSYCHO-SOCIAL ASPECTS OF AGEING**
- **HEALTH AND MORBIDITY IN AGED**
- **NUTRITIONAL STATUS OF THE ELDERLY**
- **FOOD RELATED PROBLEMS DURING AGEING**
- **HEALTH FOODS FOR THE ELDERLY**
- **HEALTH ISSUES IN COMMUNITY GERIATRICS**

AGEING:

Ageing is a universal process. It should be regarded as a normal inevitable biological phenomenon. Living longer is both an achievement and a perpetual challenge. Investing in health and promoting it throughout the life span is the only way to ensure that more people reach old age in good health and are capable of contributing to society intellectually, physically and spiritually. Ageing implies deterioration. During ageing process changes in physiological, pathological and

social conditions show a declining trend resulting in a decreased functional capacity.

Globally both the number and the proportion of older persons defined as aged 60 and over are growing in virtually all countries and worldwide trends are likely to continue unabated. In 2002 there was an estimated 605 million older persons in the world, nearly 400 million of them were living in low-income countries. Greece and Italy had the highest proportion of older persons (both 24% in 2000). By 2025, the number of older persons worldwide are expected to reach more than 1.2 billion, with about 840 million of these in low-income countries. Currently, more than half of the world's women aged 60 years and over are living in developing regions, 198 million compared with 135 million in the developed regions. And the percentage of older women living in developing regions will grow dramatically in the future, since two-thirds of the women in the age group 45-59 currently live in developing countries as compared with only one third in the developed countries (WHO, 2005).

The elderly population in the eighth and later decades of life increase in number at a faster rate and as a result, the elderly population in a country gets more advanced in age as the years pass by with considerable economic, social and health implications. A big segment of this population will be physically fragile, economically unproductive and totally dependent on others.

In all ages over 65 years, there are more women than men in our society. Despite their lower mortality rates, older women have greater morbidity, including more limitation in self-care. One of the main social effects of extension of life in later years is the extended period of widowhood for women (Dhar, 2005). Since on an average woman live longer than men, the health problems of older adults, in reality, are often those of older women. Women experience greater life expectancy than men as a result they compromise a lot among majority of older adults. Consequently, older women exhibit higher health service utilization rates than older men.

Until 60 years ago, the ratio of elderly women to men was about equal. During this century, there has been a dramatic lowering of mortality rates and improvement in life expectancy, with the most substantial gains among women. As a result, life expectancy from birth for females has increased a phenomenal 27 years since 1900. Currently, life expectancy at birth for women is 78.8 years, but only 71.5 years for men. Demographic predictions indicate that both the proportion of women in the elderly population and the proportion of elders in the general population will continue to increase for the foreseeable future.

In all countries, people are living longer. The greying of humanity is a revolution, a revolution that is changing family structure; that is hitting developing countries harder than others. Since the last century, human civilization has witnessed a silent revolution, unseen and unheard by many. Although its impact is subtle, it is of utmost significance to everyone. The biggest achievement of the last century was greater longevity that has resulted in an increasing ageing population worldwide. A man ages continuously through an irreversible biological process, socially as perceived by the members of the society, economically by retiring from the workforce and chronologically with the passage of time. The survival of an increasing number of people beyond their traditional adult roles causes population ageing (Bhattacharya, 2005).

Despite the predominance of women among the elderly, there is not much focus on elderly women and gender has not yet been adequately incorporated into theories of ageing. Consequently, there are many gaps in our knowledge about older women, their problems, their concerns, their relationships and their strengths.

Generations of older Indians have found shelter in the extended family system during crisis, be it social, economic or psychological. However due to the traditional urbanization, families become nuclear, smaller and not capable of caring for older relatives. Still, families care for older people in India. Living in old age homes is neither popular nor feasible. According to a national sample survey (cited from Indira Jaiprakash, 1999), 8% of urban and 5.9% of rural elderly live alone mostly due to widowhood, childlessness or migration of children.

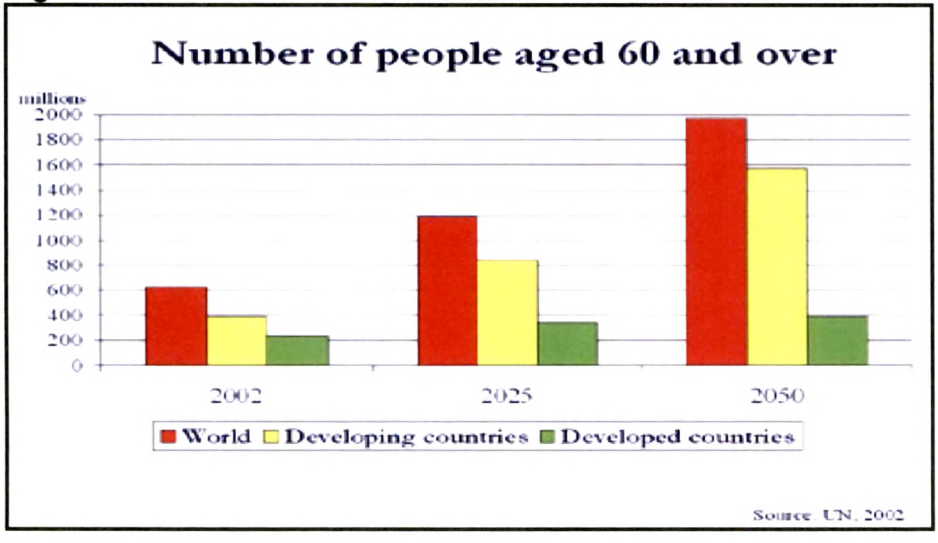
Kalyan Bagchi (1999) has shown his concern for the aged women. According to him women, especially in the developing world, are gender- discriminated and as such are illiterate or under-literate, have no skill oriented training to even get a part time job for earning, have no decision – making power with special reference to property and financial matters. They are therefore economically dependent on others.

Interesting fact in elderly is the clubbing of physical, mental and social status unlike in adults. Elderly's physical illness will affect his social and economic well being (Dhar, 1993).

Lal et. al., (1999) showed the concern that longer life means more people would grow to be very old. The oldest generation needs action now to help meet their special needs for health and social support. By the year 2050, there may be 370 millions over 80's – five times as many as they are today. Care for health including reproductive health, in earlier life, helps to ensure a healthy old age.

A demographic revolution is underway throughout the world. Today, world-wide, there are around 600 million persons aged 60 years and over; this total will double by 2025 and will reach virtually two billion by 2050 - the vast majority of them in the developing world. Figure 2.1 shows the predicted figures of people aged 60 years and above in the coming future.

Figure 2.1



All over the world the population of aged is increasing relative to the level of development. There is no doubt that population ageing will affect every single individual of the society in many ways. India too, faces many demographic problems in the shape of the rising profile of the aged population. The recent data shows the population of the aged, that is, those of the age of 60 years and above is on the increase. In 1971, they were 28 million and in 1981, 42 million, in 1991, 56 million and in 2001, 75 million. It is expected that in 2025 their population will be more than 175 millions. Their proportion in the population has gone up (Joshi A K, 2006).

As can be seen from table (2.1), the population figures given by Census of India (2001), the proportion of the people who are 60 years and above has been increasing consistently over the last century, particularly after 1951. In 1901, the proportion of the population aged 60 years and above in India was about 5%, which marginally increased to 5.4% in 1951 and by 1991, it has been found to rise to about 6.7%. Again by the year 2001, it has further increased to 6.97%. It is expected to rise to about 8.94% by 2016. In a similar way if we look into the proportion of elderly male and elderly female, the population of elderly female is increasing at a faster rate compared to elderly male. The statistics shows that since 1901 till independence there was not drastic rise in the total population of the older people but after 50 years of independence very much increase (approx. 1.54 %) in the population of the elderly was seen. Again there is more rise in the proportion of elderly women compared to elderly men. This shows the area of concern for the better health of the elderly women towards the oldest years of their life. This is true for the coming years also where same rise is predicted in just 15 years of span.

In much of the developing world population ageing is less pronounced because the transition to low levels of fertility and mortality is still underway. In a number of developing countries, particularly in East and Southeast Asia, fertility declines began relatively early and proceeded rapidly. As a result, increases in the older segment of these populations are now occurring at rates that exceed those experienced in most of the developed world. If future fertility and mortality declines

proceed as now projected by the United Nations (2002), population ageing will become a universal phenomenon in all developing countries and all world regions in the next few decades.

Table – 2.1: Proportion of older people in India (1901 – 2016)

Year	Population age 60 or over		
	Proportion to total population (percent)		
	Men	Women	Total
Census Date			
1901	4.55	5.59	5.06
1911	4.81	5.65	5.22
1921	5.04	5.70	5.37
1931	4.86	5.35	5.09
1941	5.43	5.91	5.66
1951	5.21	5.66	5.43
1961	5.46	5.80	5.63
1971	5.94	5.99	5.97
1981	6.35	6.50	6.42
1991	6.67	6.67	6.67
1996	6.67	6.67	6.67
2001	6.91	7.03	6.97
Prediction Date			
2006	7.41	7.55	7.48
2011	8.05	8.23	8.14
2016	8.84	9.05	8.94

Source: - Census of India 2001. Population Projections for India and States, 1996-2016: Report of the Technical Group on Population Projections constituted by the Planning Commission, Registrar General, India, New Delhi.

According to Gavrilov and Heuveline (2003), population ageing has the following notable features: (1) The most rapid growth occurs in the oldest age groups – the oldest-old (80+ or 85+ years) and centenarians (100+ years) in particular. In other words, population ageing is becoming "deeper" with preferential accumulation of particularly old and frail people. (2) Population ageing is particularly rapid among women, resulting in "feminization" of population ageing (because of lower mortality rates among women). For example, in the United States, there were 20.6 million older women and 14.4 million older men in 2000, or a sex ratio of 143 women for every 100 men. The female to male ratio increases with age reaching 245 for persons 85 and over. (3) Another consequence of lower female mortality is the fact that almost half of older women (45%) in 2000 were widows, thus living without spousal support. (4) Population ageing also causes changes in living arrangements resulting in increasing number of older people living alone (about 30% of all non-institutionalized older persons in 2000 lived alone in the United States). (5) Since older persons have usually lower income and a higher proportion of them are living below the poverty line, population ageing is associated with poverty, particularly in developing countries.

Leete R, (2003) shared his theories of increasing population of elderly. According to the author the demographic facts of global ageing are becoming increasingly well understood. Population ageing is an inevitable consequence of the demographic transition, that is, the shift from higher to lower levels of mortality and, especially, to lower levels of fertility. And because this transition is taking place at a much faster pace in developing countries, so, too, population ageing is occurring at a more rapid rate in these countries. The number and proportion of older persons is increasing at a faster rate than any other age group in the population. Today, one out of every ten persons in the world is aged 60 or over. By 2020, the corresponding figure will be about one out of every eight. Two thirds of all older persons live in developing countries - numbering some 400 million persons. Women comprise by far the greater number and proportion of older populations in almost all societies: the disparity increasing with advancing age.

LIVING ARRANGEMENTS AMONG ELDERLY

Issues concerning household structure and support for older adults in developing countries are becoming increasingly important as population ageing begins to influence many of these societies. The mortality and fertility declines that move populations through their demographic transitions inevitably result in increase, over time in the proportion of a population who are old (Grigsby, 1991).

As per NFHS-2 (National Family Health Survey) data (Radkar and Kaulagekar, 2006) in most of the cases, typically elderly is between 60 and 70 years with no education and low standard of living. Most of the elderly from urban as well as rural areas own the house. Urban elderly enjoy the comforts of day-to-day life whereas their rural counterparts are deprived of basic needs like water, toilet and electricity. More than one third of the elderly are widowed and 3% of them are staying alone, with no one to look after.

The Indian family system is often held high for its qualities like support and care of elderly. The responsibility of adult children for their parent's well being is not only morally, socially recognized in India but it is a part of legal code in many states. But urbanization, modernization and globalization have brought major structural transformation in the family. Therefore, all over a rapidly ageing population continues to stretch the ability of families to provide support for the elderly (Kaplan and Chadha, 2004).

Western industrialized countries have developed social security, pension, and public health systems to support older adults and supplement their personal and family resources. In contrast, in many developing countries little or no such government-funded institutional support is available. Older adults in developing countries of Africa, Asia and Latin America often require social, economic and physical assistance, but many are ill equipped to provide for themselves because of poor health and a lack of private savings. As a result, they tend to rely heavily on members of their household and family for their well-being and survival. Households throughout the developing world represent the main institution

responsible for the distribution of goods and services between generations, and they are the principal venue through which age and kinship roles are expressed (Thornton, Chang and Sun 1984; Becker, 1991).

Native Americans are a distinctive group among the minority aged. Their socioeconomic situations are generally inferior, and they have high rates of diseases associated with disability in old age (especially diabetes, hypertension, and alcoholism). Many are still segregated to remote rural reservations in which access to short-term and long-term health services are poor. For those who survive, institutionalization is relatively rare (2.3 percent) with living alone (23.9 percent), living with only a spouse (30.2 percent), living with spouse and other kin (19.2 percent) and living only with other kin (20.7 percent) (Himes et. al., 1996).

The living arrangements of older people are usually an important determinant of their quality of life in the developing world, where formal welfare systems are less extensive. Policy debates in developing countries often allege that extended families and cultural values of respect for elders have been more resilient than in the West (Contreras de Lehr, 1989). However, it is likely that rapid processes of social and economic transformation have had important impacts on household structures and on the positions of elders within them. Till date, these issues remain very lightly researched, and empirical data are scanty.

While the elderly populations of many developing countries are not as feminized as those in the developed world, it is clear that old age is highly gendered. The economic disadvantage faced by most women during earlier stages of the life course usually continues into old age for a variety of reasons, including large disparities in pension entitlements. These reflect on their living arrangements (Ofstedal et. al., 1999).

Brown et. al. (2002) studied 2,200 Japanese people over aged 60 years and older for a period of 9 years. They saw the effects of demographic characteristics, socio-economic status, and health on changes in living arrangements. The findings showed that living arrangements among the Japanese elderly people remained

quite stable over the 9-year period. Physical and mental health conditions were found to exert both direct and indirect effects on transitions in living arrangements.

A study by Liang et. al. (2005) examined if physical and mental health influence living arrangements among older Americans and whether these effects differ for married and unmarried persons. They found that functional status and cognitive functioning are significantly associated with living arrangements among those not married. Health conditions exert no significant effects among those married. The finding showed that when given the same functional status, unmarried elders are significantly more likely than their married counterparts to reside with their children or with others.

A high degree of inertia in living arrangements was observed among elderly during the four-years study period in Taiwan. Among those who changed their living arrangements, living with the family or with a spouse was the most popular destination. In addition, three mechanisms for transition in living arrangements were identified. They were: (1) The elderly move to reunite with their children for the sake of assisting them; (2) The elderly may move away from their family for their own sake; (3) Marriage dissolution will lead to a transition from living with a spouse to living alone. On the other hand, when income decreases, the elderly choose to stay with their families (Chen, 1998).

Co-residence with children is a mutually beneficial arrangement in rural India. On the one hand, children may provide financial and other personal assistance to their elderly parents. On the other hand, the elderly persons too continue to contribute to the family both financially and otherwise well into their old age.

The most consistent findings from the research carried out by Asis et. al., (1995) were that older adults rarely live alone and usually reside with a spouse and/or adult child. Older males are more likely than older females to live with a spouse. Coresidence of older adults with one of their adult children is most common in the least developed societies because levels of parent–child coresidence are inversely related to socioeconomic development.

Devanzo and Chan (1994) found that higher parental income was associated with lower co-residency in Malaysia whereas Cameron (2000) argued that co-residency was a desirable state for elderly Indonesians despite their income levels while higher income of children was likely to lower co-residency perhaps against the parental wish.

According to Zimmer (2005) who did a survey of oldest old Chinese population relating health and living arrangement found that functional limitations are more strongly associated with living arrangements than are other health indicators. Health indicators are more strongly related for those who were not married. Gender interactions showed that health event was most likely to trigger a living arrangement response for a woman.

PSYCHO-SOCIAL ASPECTS OF AGEING

The onset of psychological problems starts appearing in old age, which may further tend to increase as the process of ageing continues. Morgan et al. (1997) conducted a longitudinal study on 1042 elderly aged 65 years and over. He concluded that physical activity contributes independently to the promotion and maintenance of psychological well being in later life.

Prevalence rate of mental morbidity among those 60+ was estimated at 89 per 1000 population, about 4 million for the country as a whole. The risk of specific geriatric illness increases with age. Overall prevalence rate rises to 71.5% for those over 60 years (Indira Jaiprakash, 1999).

As per WHO (2004) report, already now, older persons make major contributions to society. For instance, throughout Africa and elsewhere, millions of adult AIDS patients are cared at home by their parents. On their death, orphaned children left behind (currently, 14 million under the age of 15 in African countries alone) are mainly looked after by their grandparents.

Buono (1997) conducted a study on centenarians. They studied three groups having 38 subjects in each. The first group was of centenarians and the other two

groups had subjects aged between 75-85 years and 86-99 years respectively. They concluded that the centenarians seemed to be well adapted to their lives and maintained more positive attitude than the subjects in two other age groups.

Chaddha et. al. (1995) carried out a study to find out if there was any significant difference between institutionalized and non-institutionalized elderly with reference to life satisfaction and social support network. It was found that non-institutionalized subjects were more satisfied with life and had a larger social support network compared to the institutionalized subjects.

In a study conducted by Andres et. al. (1996) on 260 elderly people aged 65-90 years to know the association between dietary intake and cognitive performance, it was found that a diet with less fat and cholesterol and more carbohydrate, fibre, vitamin-C, E and β -carotene may be advisable not only to improve the general health of the elderly but also to improve cognitive function.

Johnson (1998) conducted a study on 445 elderly aged 65 years and over. It was reported that most elderly people consumed less than recommended servings of fruits and vegetables. Low fruit and vegetable consumption was particularly associated with being male, smoking and social isolation.

There is increasing awareness of the importance of depression as a cause of severe weight loss in older persons. (Morley, 1997).

Ayyar S, (2000) in her study on 60 elderly subjects above 70 years of age and belonging to local region compared elderly women with the pre-geriatric age group (45-59 years). The findings showed that 25% of the pre-geriatric women remained depressed and withdrawn, primarily due to menopause.

Heller et. al. (1993) conducted a cross section study on 880 elderly subjects to assess their mental status. It was found that depression was more prevalent in these subjects aged 74-79 years and that higher plasma levels of certain vitamins like B-12, C and carotenoids were associated with lower risk of developing dementia.

Associations between dietary intake and cognitive performance were examined in 260 elderly people aged 65-90 y that was free of significant cognitive impairment. Dietary intake was monitored with a weighed-food record for 7 consecutive days. The subjects' cognitive capacity was tested by using Folstein et al's Mini-Mental State Examination (MMSE) and Pfeiffer's Mental Status Questionnaire (PMSQ). Subjects with adequate MMSE results (> or = 28 points) had lower intakes of monounsaturated fatty acids, saturated fatty acids and cholesterol and higher intakes of total food, fruit, carbohydrate, thiamine, folate and vitamin C compared with those with less satisfactory results. Subjects who made no errors on the PMSQ had greater intakes of total food, vegetables, fruit, carbohydrate, fiber, folate, vitamin C, beta-carotene, iron, and zinc, and lower intakes of saturated fatty acids compared with those who made errors. Unmeasured confounding factors may also affect both dietary intake and risk of cognitive impairment. A diet with less fat, saturated fat, and cholesterol, and more carbohydrate, fiber, vitamins (especially folate, vitamins C and E, and beta- carotenes) and minerals (iron and zinc) may be advisable not only to improve the general health of the elderly but also to improve cognitive function (Ortega et. al., 1997).

Mental performance in later life is affected by environmental factors, some of which may prove relevant to dementia. Nutrient supplements of micronutrients [eg, antioxidant vitamins (Willett WC and Stampfer MJ, 2001) or macronutrients [eg, n–3 polyunsaturated fatty acids (PUFAs) (Khan et. al., 2003) are widely accepted personal choices intended to improve diets and contribute to the maintenance of good health across the life span. Assessments of the cognitive benefits of food supplement use have been limited by a lack of information on the characteristics of food supplement users and the paradox that those who seem healthier also seem more likely to use supplements, including fish oil (Brustad M et al., 2004). The suggested association, for example, between better retention of cognitive function in old age and supplement use could be explained by better lifelong cognitive function informing health choices in late life.

Whalley et. al. (2004) carried out a study that examined the effects of food supplement use on cognitive ageing. This was an observational study of subjects

born in 1936 whose mental ability was tested in 1947 and who were followed up in 2000–2001, at which time cognition, diet, food supplement used and risk factors for vascular diseases were assessed. Fish-oil users were matched with nonusers, and cognitive function was related to erythrocyte n–3 fatty acid composition. They found that childhood intelligence quotient (IQ) did not differ significantly by category of food supplement use (i.e., none, fish oil, vitamins, and other). At the age of 64 y, cognitive function was higher in food supplement users than in nonusers before adjustment for childhood IQ. After adjustment for childhood IQ, digit symbol (mental speed) test scores were higher in food supplement users. Fish-oil supplement users consumed more vitamin C and vegetable and cereal fiber erythrocyte than did non-supplement-users. Therefore, it was concluded that food supplement use and erythrocyte n–3 content are associated with better cognitive ageing.

HEALTH AND MORBIDITY IN AGED:

The process of biological ageing brings with it several accompanying health problems or disease. The decline in the efficient functioning of the organ systems of the body including the immune system renders the elderly particularly vulnerable to several diseases.

Degenerative diseases such as cardiovascular and cerebrovascular diseases, diabetes, osteoporosis and cancer, which are among the most common diseases affecting older persons, are all diet-affected. Increasingly in the diet/disease debate, the role that micronutrients play in promoting health and preventing non-communicable disease is receiving considerable attention. Micronutrient deficiencies are often common in elderly people due to a number of factors such as their reduced food intake and a lack of variety in the foods they eat.

Elderly frequently suffer from multiple co-existent chronic conditions upon which acute illnesses are superimposed and diseases, which are self-limited in young often, produce devastating, dysfunction, disability and sometimes death (Sharma, 1998).

In India, sporadic data has been collected on different health problems of elderly while epidemiological studies specifically targeted at elderly population are rare. The Indian Council of Medical Research (ICMR) has carried out several studies on specific chronic problems such as hearing impairment, blindness, cardio-vascular diseases, cancer, etc.

The major age related morbidities among the elderly are related to visual and hearing impairment. The number of elderly who are visually impaired were 11 millions and those with hearing impairment were 38 millions in 1996 (ICMR, 1997).

From the old studies to the latest studies the commonest findings are prevalence of oral cavity problems, cardio-vascular related problem, gastrointestinal system related problems, respiratory tract problems, which ranges from 19% to 80% in the elderly subjects (Mehta P, 1999).

In a recent study carried out by Ray (2005) in the department of Foods and Nutrition, The M. S. University of Baroda, on 50 elderly women aged 65 years and above showed higher occurrence of oral cavity problems (84%), GIT problems (46%) and locomotor problems (40%).

Pathak et. al. (1997), showed in his study on 449 elderly men and women aged 60 years and above in Bombay, that the common disorders were the ones related to cardio-vascular system (19%), gastrointestinal system (22%), locomotor system (24%) and respiratory system (9%).

Niranjan (1995) conducted a study on health status of 409 aged persons in Banglore, which showed that majority (82.9%) of the aged suffered from one or more illnesses during the survey period. The important causes of illness reported were cataract (72.9%), anemia (12.6%), osteoarthritis (6.2%), chronic bronchitis (6.1%), hypertension (5.1%), constipation (4.2%) and peptic ulcer (3.1%).

In a study done by Gustafsson et al (1998) on 421 elderly subjects above 75 years of age showed that 65% subjects had heart problems, 60% had diabetes and 23% subjects had respiratory problems.

Morbidities acquired at each stage accentuate those in the next, the old age being the manifestation of all morbidities compounded with each other. In addition, the tell-tale signs of old age impairment of vision and hearing, osteoarthritis with impairment of mobility and osteoporosis with vulnerability to hip and femur fractures, are the common complaints among aged women (Bagchi K, 1999).

In a study, the health and nutritional status of the elderly geriatric male population (60-70 years) belonging to middle and higher income group were studied. The study included 120 elderly subjects, 60 each from the middle and high-income group. It was observed that the prevalence of oral cavity problem was highest followed by gastrointestinal, cardiovascular and respiratory problems (Kikani U, 1993).

Prakash et al., (2004) studied morbidity profile of 300 elderly subjects (60+) in Udaipur. Study showed that 70% elderly were suffering from one or other ophthalmic problems followed by 48% with hypertension and 42% had psycho-social problems and in this case number of females was high (49%) and 36% were suffering from respiratory diseases and the others were living with musculo-skeletal, GIT, ENT and nervous system problems.

Joshi et al (2003) conducted a study on 200 elderly. They found that 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 anemia, followed by dental problems, hypertension, chronic obstructive airway disease (COAD), cataract, and osteoarthritis.

NUTRITIONAL STATUS OF THE ELDERLY

Despite the increase in body fat and obesity that occurs with ageing, there is a linear decrease in food intake over the life span. This conundrum is explained by decreased physical activity and altered metabolism with ageing. Thus, older persons fail to adequately regulate food intake and develop a physiological anorexia of ageing. This physiological anorexia depends not only on decreased hedonic qualities of feeding with ageing but also on altered hormonal and

neurotransmitter regulation of food intake. The physiologic anorexia of ageing puts older persons at high risk for developing protein-energy malnutrition when they develop either psychological or physical disease processes. Despite its high prevalence, however, protein-energy malnutrition in older persons is rarely recognized and even more rarely treated appropriately.

Poor nutritional status and malnutrition in the elderly population are important areas of concern. Malnutrition and unintentional weight loss contribute to progressive decline in health, reduced physical and cognitive functional status and increased utilization of health care services, premature institutionalization and increased mortality. Nonetheless, many health care practitioners inadequately address the multifactorial issues that contribute to nutritional risk and to malnutrition. A common assumption is that nutritional deficiencies are an inevitable consequence of ageing and disease and that intervention for these deficiencies are only minimally effective. Nutritional assessment and treatment should be a routine part of care for all elderly persons, whether in the outpatient setting, acute care hospital, or long-term institutional care setting. Following table shows the factors influencing nutritional inadequacy in the elderly population.

Table 2.2: Factors influencing nutritional inadequacy in elderly population.

Physiological	Pathological	Sociological	Psychological
Decreased Taste	Dentition	Ability to shop for food	Depression
Decreased Smell	Dysphagia, swallowing problems	Ability to prepare Food	Anxiety
Deregulation of satiation	Diseases (cancer, COPD, diabetes, typhoid)	Financial status low socioeconomic	Loneliness
Delayed gastric emptying	Medications (diuretics, anti-hypertensives, anti-depressant, antibiotics, antihistamine)	Impaired activities of daily living skills	Emotionally stressful life events
Decreased gastric acid	Alcoholism	Lack of interactions with others at meal time	Grief
Decreased lean body mass	Dementia	--	Dysphria

Posner et. al., (1984) carried out a study on 53 elderly in Boston and showed that nutrient intake failed to meet the RDAs for major nutrient in 40-80% of the subjects.

Gary et. al., (1982) showed that from 135 free living healthy male elderly above 60 years of age, 30% of the men received less than 75% RDA for calcium and 9% of them received less than 50%.

Woo et. al., (1998) studied nutritional status of 100 elderly Chinese and reported that energy, protein, fat, thiamine, riboflavin and niacin intakes were lower in vegetarian Chinese than the non-vegetarians.

In a study by Incalzi et. al., (1998) on acute care hospital patients (age 70+) found that nutritional support to geriatric patients was frequently inadequate in surgical as well as medical wards and concluded that inadequate calorie intake was a co-contributor to the risk of hospital mortality.

Gloth and Tobin (1995) studied 80 subjects, 65 years and above, comparing nutrient intake of frail home bound elderly population in community vs. elderly living in nursing home. They concluded that iron and vitamin–A deficiency was seen in frail homebound elderly.

Lee and Frongillo (2001) observed that food-insecure elderly persons have poorer dietary intake, nutritional status and health status than do food-secure elderly persons.

In a cross sectional study carried out in Israel by Shahar et al., (2003) on 377 people over age of 65 years, 224 aged 65-74 years and 153 elderly above 75 years showed that older age group had lower food intake, consumed significantly less energy, fat, carbohydrates, vitamin C and B vitamins per day.

A study conducted by Sabharwal et. al., (1996) on Indian Institutionalized elderly above 65 years of age revealed adequate energy, protein, calcium and vitamin–C intake compared to their RDA, while iron and vitamin – A intakes were lower.

A study carried out by Limaye (1999) on institutionalized elderly living in Baroda city concluded that there was gross deficiency of nutrients like iron, calcium and β–carotene because of poor supply of green leafy vegetables and fruits in the institution.

A team of research workers from the Department of Foods and Nutrition, M.S.University of Baroda, has conducted a number of studies, on free-living geriatric population from the HIG, MIG and LIG belonging to the local region. The finding of these studies has been reported by Mehta et al., (1997). The dietary pattern data revealed that the consumption of major nutrients like energy, protein, iron, β-carotene and fibre were less than the RDA, whereas the intake of fat, calcium and vitamin–C were greater than the RDA in both the HIG and MIG elderly men and women. The studies conducted on LIG men and women revealed low intake of all the nutrients when compared to the RDA.

Vailas et. at., (1998) studied 180 elderly subjects above 60 years of age and found that quality of life and quality of health were positively correlated ($p<0.001$). Nutritional risk, food insecurity, decreased enjoyment towards food; depression and impaired functional status were all negatively associated with quality of life.

McKie et. al., (2000) did a survey of 152 elderly aged 75years and over to understand dietary beliefs and dietary practices among them. They found that dietary beliefs were firmly rooted in childhood and lifetime experiences and for elderly healthy eating means proper meals or proper foods. Certain times these beliefs lead to the poor nutritional status in the elderly.

Vitamin D deficiency among elderly subjects causes secondary hyperparathyroidism and osteomalacia and exacerbates osteoporosis, resulting in increased risk of skeletal fractures (National Academy Press, 1997).

Patel (1999) studied 50 men and women aged 50 years and above with osteoporotic fractures and found significant positive association with frequent consumption of nuts, oilseeds, cereals and pulses and occurrence of the disease.

Hardasani (1999) carried out a study on 80 osteoarthritic and non-arthritic women aged 50 years and above. Findings showed that frequent consumption of nuts and oilseed (odd's ratio 1.11), high fat sweets (OR=4.5) and non-vegetarian foods (OR=3.3) were found to be positively associated with occurrence of osteoarthritis. Results of NHE on 10 osteoarthitic women showed that knowledge and retention regarding consumption of foods, methods of cooking and activity pattern was similar in young and old women but significant differences ($p<0.05$) were observed in practices of older women.

The prevalence of vitamin D deficiency or insufficiency was estimated from National Health and Nutrition Examination Survey (NHANES) III data for non-institutionalized individuals according to northern or southern latitude, as well as age and sex (Looker et. al., 2002). Among women living in latitudes of 25–41°N, 5% of those >60 y of age had serum 25-hydroxyvitamin D concentrations of <25 nmol/L. Another 15% of women 60–79 y of age and 18% of women ≥80 y of age had serum 25-hydroxyvitamin D concentrations of <37.5 nmol/L; 36% and 37% of similarly aged women had serum 25-hydroxyvitamin D concentrations of <50 nmol/L and 52% and 56% had concentrations of <62.5 nmol/L, respectively. Therefore, one-half of the elderly women sample who resided in more northern latitudes had vitamin D insufficiency, although overt deficiency was rare. The incidence of insufficiency was lower among men, with 38% of those 60–79 y of age and 47% of those ≥80 y of age having serum 25-hydroxyvitamin D concentrations of <62.5 nmol/L. The incidence among institutionalized and homebound elderly individuals, who spend less time in the sunshine, and among those living at latitudes above 42°N is potentially greater.

Calcium intake and physical activity level (PAL) were assessed by questionnaire in 124 healthy women aged 52-62 y to determine the effect of calcium intake and PAL on bone mass and turnover. Bone mineral density (BMD) at the spine, hip and left os calcis was measured together with total bone mineral content (TBMC) with dual- energy X-ray absorptiometry. Women with the highest calcium intakes and PALs had the highest BMD at all sites compared with those with the lowest

calcium intakes and PALs ($p<0.001$). Calcium intake and PAL were positively correlated with BMD at all sites (Suleiman et. al., 1997).

The study cohort included 3075 elderly aged 70–79 y (52% women, 42% black) in the Health, Ageing, and Body Composition Study. Dietary intake, anthropometric variables, weight change, and serum albumin and lipid concentrations were compared between edentate and dentate participants by the use of multiple linear and logistic regressions. Edentulism was not associated with total energy or food intake but was associated with the food groups consumed, particularly fat, micronutrients, and hard-to-chew foods. Edentulism was more strongly linked to dietary intake in whites than in blacks. Unlike black edentate elderly, white edentate elderly consumed significantly lower energy-adjusted amounts of vitamin-A and β-carotene, higher amounts of energy-adjusted total and saturated fat and cholesterol, and higher percentages of energy from fat than did white dentate elderly. Anthropometry and biochemical indexes were not significantly different by edentulism status in both races. Edentulism was associated with weight gains of >5% in 1 y in both races (Lee et. al., 2003)

Nowjack-Raymer and Sheiham (2003) studied the dental status and its relationship to diet and nutritional status in a representative sample of the US civilian, non-institutionalized older adult population (NHANES III). Multivariate analyses indicated that intake of carrots and tossed salads among denture-wearers was, respectively, 2.1 and 1.5 times less than for the fully dentate ($p<0.001$) and dietary fiber intake was 1.2 times less ($p<0.05$). Serum levels of β–carotene (9.8 μg/dL), folate (4.7 ng/dL) and vitamin C (0.87 mg/dL) were also lower among denture-wearers ($p < 0.05$). Intakes of some nutrient-rich foods and folate, β–carotene and vitamin C serum levels were significantly lower in denture-wearers.

A Study was conducted by Cesari et. al.,(2004), on 986 Italians aged $\geq$ 65 y. Physical performance was assessed on the basis of walking speed, ability to rise from a chair, and standing balance. Knee extension strength was assessed with a hand-held dynamometer. The European Prospective Investigation into Cancer and

Nutrition (EPIC) questionnaire was used to evaluate the daily dietary intakes of vitamin C, vitamin E, β-carotene, and retinol. Plasma α- and γ–tocopherol concentrations were measured. In adjusted analyses, plasma α-tocopherol was significantly correlated with knee extension (ß = 0.566, *P* = 0.003) and the summary physical performance score (ß = 0.044, *P* = 0.008). Plasma γ-tocopherol was associated only with knee extension strength (ß = 0.327, *P* = 0.04). Of the daily dietary intake measures, vitamin C and ß-carotene were significantly correlated with knee extension strength, and vitamin C was significantly associated with physical performance (ß = 0.029, *P* = 0.04). Plasma antioxidant concentrations correlate positively with physical performance and strength. Higher dietary intakes of most antioxidants, especially vitamin C, appear to be associated with higher skeletal muscular strength in elderly persons.

McCabe et. al., (2004) carried out a study related to cross-sectional nutrient and dairy product consumption to hip BMD in white and black men and women aged >60 y and evaluated the influence of nutrient and dairy product consumption on changes in BMD in a white cohort participating in a calcium, vitamin D, or placebo trial. In the study 289 white women and 116 white men participated in the trial and in 265 black women and 75 black men to predict total hip and femoral neck BMD or changes in BMD. Blacks had higher calcium intakes than did whites (700 and 654 mg/d, respectively; *P* = 0.0094), and men had higher calcium intakes than did women (735 and 655 mg/d, respectively; *P* = 0.0007). For men, the correlation between total hip BMD and dairy calcium intake after adjustment for age, race, and weight was 0.23 ($p<0.005$); this relation was not significant in women ($r = 0.02$, *P* = 0.12). Similar results were found for femoral neck BMD. In the longitudinal study, calcium supplementation reduced bone loss from the total hip and femoral neck in those who consumed <1.5 servings of dairy products/d and were <72 y old. Cross-sectional results indicated that higher dairy product consumption is associated with greater hip BMD in men, but not in women. Calcium supplementation protected both men and women from bone loss in the longitudinal study of whites.

A prospective, community-based cohort included 2708 elderly persons aged 70–79 y at baseline. Twenty-seven percent of participants reported an intention to lose

weight, and 67% of those participants had an indication for weight loss. Participants who reported a weight-loss intention were heavier than those who did not, had more depressive symptoms, and were more likely to be dissatisfied with their weight, regardless of weight-loss indication. Participants with an intention to lose weight reported better eating behaviors and a more active lifestyle than did participants without a weight-loss intention, independent of other health conditions. No significant difference in actual weight loss was found between participants intending and not intending to lose weight, regardless of indication for weight loss (Lee et. al., 2004).

Total Energy Expenditure (measured by the doubly labeled water method), resting metabolic rate (RMR), activity-related energy expenditure (AEE), and body composition were measured in 288 persons aged 70–79 y selected from the Health, Ageing, and Body Composition Study. TEE was lower in women (≈530 kcal/d; $P < 0.0001$) than in men because of the women's lower RMR and AEE. Fat-free mass explained the sex difference in RMR, but body weight failed to account for the women's lower AEE (≈1 kcal · kg/d; $P = 0.007$). Blacks had lower TEE than did whites (≈100 kcal/d, $P = 0.03$), and that was explained by blacks' lower RMR. Physical activity level (TEE/RMR) did not differ significantly between sexes and races (1.70 ± 0.23). The World Health Organization (WHO) recommendations overestimated TEE by 10 ± 15% ($P < 0.0001$) in women but not in men, and the dietary reference intakes (DRIs) were accurate to 0 ± 14% ($P = 0.1$) (Blanc et. al., 2004).

To identify risk factors for development of malnutrition in very old hospitalized patients and to evaluate the total Mini Nutritional Assessment (MNA) score and MNA sub scores as predictors of in-hospital and long-term mortality, a cohort study of patients aged ≥75 y was conducted in a geriatric hospital. Assessment included demographic, clinical, and laboratory data and cognitive, functional, and nutritional status. Follow-up was conducted for ≤2.7 y. Of the 414 patients studied, only 73 (17.6%) were well nourished. Low serum albumin and phosphorus concentrations, dementia, and cerebrovascular accident (CVA) were significant risk factors for malnutrition. Survival was significantly lower in malnourished patients and patients

at risk of malnutrition than in well-nourished patients ($P<0.0001$). Low MNA-3 sub scores (dietary habits) were significantly correlated with laboratory indexes of malnutrition and were significantly lower in patients with infections, malignancy, pressure ulcers, dementia, recent orthopedic surgery, and CVA. Multivariate analysis showed that a low MNA-3 score was an independent predictor of mortality; scores <7.5 increased the risk of death 2.05-fold. The prevalence of malnutrition was high in elderly hospitalized patients. Dietary habits were significant predictors of poor hospitalization outcome. A questionnaire on dietary habits can serve as a useful tool in assessing nutritional status and prognosis in elderly patients (Kagansky et. al., 2006).

Dormenval et al., (1998) studied 99 hospitalized elderly patients and found significant association between reduced salivary flow rate, malnutrition and reduced serum albumin levels and between complaints of oral dryness, loss of appetite and low BMI.

Russell (2000) who was working on metabolic aspect of elderly reviewed in his article that elderly people are not simply older versions of younger adults, rather they have unique metabolic characteristics, therefore it is important to find out specific nutrient requirements and how it is affected by physical stress and diseases.

The nutritional requirements of older women is an area of great interest because the extended life expectancy leads to an increase in women living into their 80s, 90s, and longer. The recommended dietary allowances (RDAs) and dietary reference intakes (DRIs) are not specific for women living to advanced ages, and little research has been conducted specifically on the micronutrient needs of elderly women by Chernoff, (2005). Older adults are at greater risk for nutritional deficiencies than are younger adults due to physiological changes associated with ageing, acute and chronic illnesses, prescription and over-the-counter medications, financial and social status, and functional decline. Among the significant age-associated changes in nutrient requirements, the need for energy decreases and

the requirements for protein increases with age. Among the micronutrients, the significant ones that may be associated with deficiencies in elderly women include vitamin B-12, vitamin A, vitamin C, vitamin D, calcium, iron, zinc, and other trace minerals. In old and very old women, these are micronutrients of interest but there is a great need for research to determine appropriate recommendations.

Ageing is often associated with a deregulation of immune function. Iron deficiency may further impair immunity in older adults. Published reports on iron deficiency and immune response in humans are inconsistent. Most studies are focused on young children in developing countries and are often confounded by comorbid conditions, infections, and nutrient deficiencies.

Nutritional anemia is defined as a condition in which the hemoglobin concentration is below the level that is normal for a given individual due to deficiency of one or more of the nutrients required for hemopoiesis.

Anemia is common in elderly and its prevalence increases with age. The most common causes of anemia in elderly are anemia of chronic disease and iron deficiency anemia (Smith, 2000).

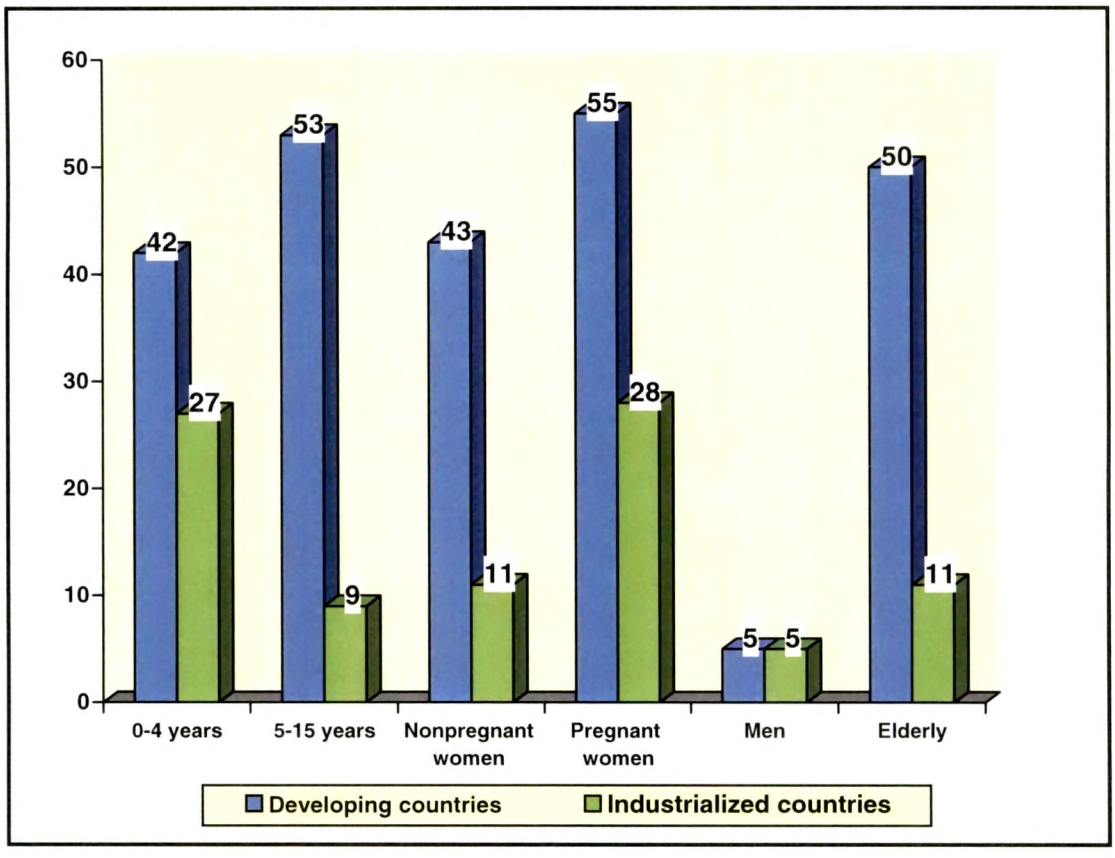
According to Demaeyer and Adiels (1985) the prevelance of anemia was found to be 12% and 18.65% in developed and less developed regions respectively. However, the prevalence and etiology of anemia in free-living elderly people of developing countries is not well established (Olivares et. al., 1999).

In a study carried out by Ania et. al., (2001) indicated prevalence of anemia in Spain. Out of total 198 subjects, 82 were men and 116 were women aged 75 $\pm$ 8.8 years. Anemia was diagnosed in 31% males and 44% women.

All the iron needed for biological functions come from diet. Iron is found in the diet as heme iron and in form of various salts and complexes. As such there is poor intake of iron rich foods in the diet of the elderly, besides poor bioavailability of iron in the body (Nair, 1999).

Prevalence of anemia by age group in industrialized and countries as reported by World Nutrition Situation survey is presented in figure 2.2.

Figure 2.2: Prevalence of anemia by age group in industrialized and developing countries, 1998



Source: 4th report on World Nutrition Situation, in UN-ACC-SCN, 2000.

Iron deficiency anemia is a serious problem of public health significance given its impact on psychological and physical development behavior and work performance. It is the most prevalent nutritional problem in the world today affecting more than 700 million persons (Demaeyer and Adeils Tegman, 1985).

The summary of database of iron deficiency anemia (IDA) reported by Seshadri in 1996 showed that the consequences of IDA included reduced physical work capacity and productivity, impaired cognitive functions and brain metabolism, reduced immuno-competence and increased morbidities. She clearly has mentioned that there is a linear relationship between hemoglobin and physical work capacity indicating reduced ability to perform strenuous work.

A cohort study carried out by Pennix et al. (2004) included 1146 participants aged 71 years older living in Lowa and Washington city. An assessment of standing balance, a timed 2.4m walk and a timed test of five-chair rise were combined into 0 to 12 summary scales. Results revealed that anemia was associated with 2.3 mean declines in physical performance in subjects with anemia and 1.4 mean score in those without anemia.

Ferruci et. al., (2001) of women's health and ageing study (WHAS) carried out physical performance measures on established populations for epidemiological studies on elderly. Results of balance tests showed that 40% women aged 65 to 74 years maintained the tandem stand for the full 10 seconds in contrast to 4% oldest women. Walking speed was found inversely related to age and level of disability.

Beard and colleagues (1997) compared 302 patients with Alzheimer's disease (AD) with healthy age and gender matched controls aged 65≥ years, found an almost twofold increase in the incidence of AD when anemia was present, where as Milward et al., (1999) failed to confirm an association between anemia and AD but noted a significant association between anemia and vascular dementia (VAD). Nearly 45% of VAD subjects were anemic compared with 17% of non-anemic controls, enrolled in a community based study of elderly individuals. In hospital,

delirium was increased in older patients with postoperative anemia, according to findings of a study conducted by Marcantonio and colleagues (1998).

In a study to determine the relation of iron status with immune function, homebound older women, who often have impairments in both iron status and immune response were selected. The subjects were selected according to rigorous exclusion criteria for disease, infection, and deficiencies in key nutrients known to affect immuno competence. Women were classified as iron-deficient or iron-sufficient on the basis of multiple abnormal iron status test results. Groups were compared with respect to lymphocyte subsets, phagocytosis, oxidative burst capacity, and T cell proliferation upon stimulation with mitogens. In iron-deficient women, T cell proliferation upon stimulation with concanavalin A and phytohemagglutinin A was only 40-50% of that in iron-sufficient women. Phagocytosis did not differ significantly between the 2 groups, but respiratory burst was significantly less (by 28%) in iron-deficient women than in iron-sufficient women. Iron deficiency is associated with impairments in cell-mediated and innate immunity and may render older adults more vulnerable to infections (Ahluwalia et. al., 2004).

To determine the relation between food and nutrient intakes, *HFE* genotype, and iron status. Foods and nutrients associated with iron stores, with adjustment for gene mutations associated with hemochromatosis, were explored. A prospective cohort of women aged 35–69 y (the UK Women's Cohort Study) provided information on diet through a questionnaire and food diary; 6779 women in the cohort provided cheek cell samples, blood samples, or both, which were genotyped for C282Y and H63D mutations, and 2489 women also had their iron status assessed. Relations between serum ferritin and iron intake were investigated by using multiple linear regression, with adjustment for potential confounders. The strongest dietary association with serum ferritin concentration was a positive association with heme iron and not with non-heme or total iron. Weaker positive associations were seen with red and white meat, and negative associations were seen with total energy and white and brown whole-meal bread, independent of genotype and other potential confounders. The effect of genotype on ferritin concentrations primarily occurred after menopause, at which time a strong

interaction between genotype and heme iron intake was observed. Other factors associated with serum ferritin concentrations were age, body mass index, blood donation, menopausal status, and *HFE* genotype. Postmenopausal women eating a diet rich in heme iron and who were C282Y homozygotes had the highest serum ferritin concentrations (Cade et. al., 2005).

Approaches to combat iron deficiency anemia:
Several approaches are allocated for the control and prevention of iron deficiency anemia. These are:

a) Food based strategies
    i) Dietary modification
    ii) Fortification
b) Non food based strategies
    i) Supplementation
    ii) Parasitic disease control

Iron supplementation is the dominant strategy for prevalence and control of IDA (WHO, 1995). A varied array of interventions exist that are designed to prevent and correct iron deficiency anemia. These include dietary improvement, fortification of foods with iron, iron supplementation and other public health measures such as helminthes control. Iron supplements are essential for the rapid treatment of severe iron deficiency anemia in all sex and age groups. Supplementation with medicinal iron has the advantage of producing rapid improvement in iron status. As a strategy, it also has desirable specificity. It can be targeted at the population groups in greatest need of iron or at greatest risk of becoming iron deficient.

FOOD RELATED PROBLEMS IN THE ELDERLY

Elderly individuals are at increased risk for problems that affect their nutritional status. The nationwide Nutrition Screening Initiative (NSI) categorizes these problems as those affecting functional, social, or financial status and access to food and drink. These problems can affect quality of life and the Elderly people face unique nutritional challenges. Although age can diminish appetite and

physical mobility, the body still requires as many nutrients as a younger adult's ability to perform activities of daily living, including eating. The determine checklist is the NSI tool used by physicians, registered dietitians, other health care providers and social service agencies to assess the impact of various dietary, medical, or physical and social problems: Diseases, Poor food intake, Toothloss/mouthpain, Economic hardship, Reduced social contact, Multiple medications, Involuntary weightloss/gain, needs assistance in self care and Elderly above age 80 years. Recognizing the risk posed by these factors can result in interventions to improve the quality of life and the ability to perform activities of daily living.

Dietary Problems leading to food inadequacy in elderly

Some elderly individuals encounter dietary problems, making them less able to select, purchase, prepare, eat, digest, absorb, and use food. An inability to consume an adequate daily diet places the elderly person at increased risk for medical, physical, and functional problems. Therefore, it is important to intervene to correct any dietary problems that may exist. Examples of dietary problems and interventions to improve the problems are described below (www.pubmed.com):

(a) Difficulty in chewing or swallowing

Lose of teeth and high rate of dental problems in the elderly causes difficulty in chewing and swallowing of foods. To overcome the dietary inadequacy problem due to such reasons one can choose more fruit and vegetable juices, soft canned fruits, and creamed or mashed cooked vegetables; eggs, milk dishes (like creamed soups), cheese, and yogurt; and cooked cereals when chewing meat or fresh fruits and vegetables are difficult. One can chop, stew, steam, or grate hard foods.

(b) Difficulty in digesting

Decrease in the secretion of digestive juices, dental and gastro intestinal tract related problems lead to difficulty in digesting foods. For this one must select more fruit and vegetable juices; soft canned fruits, and non-gas-forming vegetables rather than gas-producing vegetables like cabbage or broccoli. If digesting milk is a

problem, use cultured dairy products like yogurt or add lactaid to milk. If milk continues to be problematic, elderly should consider a daily calcium supplement.

(c) Difficulty in shopping

Elderly who are living alone without any support from any other family members finds it very difficult to shop for the food items. Shopping related activities like counting money, especially in the night, walking in the crowded area, crossing the roads, etc. may lead to avoidance of such activities leading to compromise with food intake. Therefore elderly should shop by phone to find grocery stores that deliver in your area. Find volunteer or paid help in your area. Ask family or neighbors to help. See yellow pages under "Home Health Services" for assistance.

(d) Difficulty in cooking.

Elaborate food preparations, standing position for long period, winding up of kitchen after cooking and eating make elderly feel tired. They could use a microwave. Cook and freeze in batches. Relocate to a facility where other's cook, such as a family member's home or an assisted-living home environment.

(e) Difficulty in appetite

Low gastric tone and digestive juices, too many medications make elderly vulnerable for eating proper food. Increase the flavor of food by adding spices and herbs, lemon juice, or meat sauces. Discuss medications with your physician, particularly if they are causing appetite or taste changes.

(f) Financial Difficulty

Use coupons, unit pricing, and shopping lists. Plan and prepare ahead, freezing several meals at once. Buy more generic or store-brand foods and foods on sale. Find food assistance programs or sources for free and reduced-price meals, such as churches, Meals On Wheels, Congregate Dining, and Food Stamps. Buy more low-cost foods, such as dried beans and peas, rice, pasta, canned tuna and peanut butter.

(g) Social Problems like

(i) Loneliness

This is a problem of an elderly who is living all alone. Invite a friend or neighbor over or have a standing date to eat out with friends or family. Buy smaller sizes to avoid the repetition of leftovers. Set the table attractively and play music softly. Participate in Congregate Dining in your area.

(ii) Living Alone

Research has shown a correlation between living alone and having lower quality diets. Men may be at greater risk because they are less experienced with planning, shopping, and preparing meals. Women may feel less motivated to prepare meals when there is no one to share them with. Ways to improve social interaction during meals and improve the experience of dining alone include: participating with others, such as at churches or Congregate Dining sites, eating by a window, using good china crockery, eating in a park or on one's porch, garnishing meals, and trying various frozen or prepared dinners.

When living alone challenges an elderly person's health, he or she can investigate the continuum of care, including adult day care, in-home care, retirement communities, residential care or assisted living, intermediate care, and nursing homes or convalescent hospitals.

(h) Medical, Physical, and Functional Problems

Many chronic medical conditions, such as osteoporosis, arthritis, depression, and diabetes have nutritional consequences. Loss of body water, lean body mass, and bone mass; decline of the immune response; over and underweight; malnutrition; and declining taste, smell, and thirst are among the problems that affect physical strength, functional ability, and vitality. At times, specialized diets or medical nutrition therapy are needed. There are many elderly people who live alone and

may have less nutritious diets than those living with a partner. Programs such as Meals On Wheels can help prevent poor nutrition caused by loneliness.
Parkinson's disease is associated with motor and eating problems, which, combined with age-related declines in physical functioning, may affect activities of daily living and dietary intake. Following few studies are the reviews of studies done by Sidenvall and coworkers (2001) on food related problems along with related disease among elderly, especially women.

A study was planned to investigate how married and single-living older women diagnosed with Parkinson's disease managed to shop for food, cook and carry out their meals; and to observe whether their nutritional needs were satisfied. Qualitative interviews and food survey were carried out in the homes of 10 women aged 67–80 years. Findings of the study were as follows: Decreased sense of smell, appetite and taste in combination with problems of transporting food to the mouth and swallowing were risks for nutritional well-being. Food shopping was most difficult to manage, but six elderly managed even if their cooking style was changed. Married women with healthy husbands received support from their spouses. Single-living women suffering from motor problems had to call for help, which represented a threat to their well-being. A home-helper should not take over but facilitate procedures so that the woman can manage as long as possible. This gave them self-esteem (Andersson and Sidenvall, 2001).

Another study was carried out with 18 women, aged 65–88, living alone or cohabiting, who independently managed shopping and cooking. The women also gave data on three days' eating and drinking pattern in a food diary. Two themes were found: 'A healthy slimming meal or the usual' and 'Meals – a pleasure or an obligation'. The first theme summarized the women's health perceptions related to food, where the dominating view was fear of fat. Some also had a bad conscience about not eating according to recommendations. Use of low-fat products was not a predominant habit among these women. In the second theme, meals in fellowship were perceived as a pleasure, while women living alone tended to simplify cooking and eating. This was also reflected in their food habits, with fewer cooked meals,

as well as events with coffee with cakes, compared with cohabiting women. Food-related health promotion must pay more attention to women living alone. Women, who have lost their partners, may be at risk for poor nutritional intake as they often simplified the entire meal situation, while cohabiting women perceived food and cooking as a central task in their lives (Gustafsson and Sidenvall, 2002).

Gustafsson, Ekblad and Sidenvall (2005), studied the perceptions of receiving dietary advice, the occurrence and comprehension of such advice and compliance among older women diagnosed with Parkinson's disease, stroke or rheumatoid arthritis. Fifty-four community-dwelling women, 64–88 years of age, were interviewed. Two themes were found: 'dietary advice – occurrence and comprehension' describes whether the women had received dietary advice and, if so, how they understood the information. In the theme 'compliance with dietary advice', two principle reasons for complying or not complying with advice were found: First, women expressed a 'food interest', such that they were either 'interested in disease-related diet' or held a general view of the significance of foods and complied with the advice for their own 'health interest'. Secondly, the women were 'uninterested in food changes'. This could be because of 'poor appetite', 'food and disease ambivalence', 'habitual and preferred foods'. Dietary advice should be based on women's food preferences and habitual foods. It is important to inform about known relations between food and disease, but also to support eating favourite foods, thereby facilitating women's well-being.

Another qualitative study aimed to explore the cultural meaning of accomplishing food-related work by older women, when disease has diminished their abilities and threatens to make them dependent. Seventy-two women with stroke, rheumatoid arthritis, and Parkinson's disease, as well as women without those diseases, were interviewed. All were living at home. Results showed that older women valued independence and feared dependence when declining ability threatened performance of food-related work. They also had strong beliefs about living a "normal life," manageing by oneself as long as possible, and becoming their own masters again. To remain independent, participants used three kinds of strategies: Public health service support, self-manageing, and adaptation. Their beliefs about

dependence included not becoming a burden, retaining self-determination, and maintaining order in life. Implications for nursing included supporting independent cooking, developing care plans with the care recipient, and demonstrating respect for the women's self-determination (Gustafsson et al; 2003).

According to Darton-Hill (1992), physical factors like visual impairment leading to difficulty in not being able to distinguish the different denominations of money or to read prices can be a burden which can complicate shopping for food. Psychological problems like depression cause loss of appetite and loss of enthusiasm for cooking food, preparing tasty food or to eat food, ultimately affecting food intake in the elderly.

HEALTH FOODS FOR THE ELDERLY

The sense of taste has to be one of the most important human senses. It gives an individual the ability to recognize consumables that are encountered on a regular basis such as a favorite steak platter or a favorite wine. However, when that individual reaches a particular age the sense of taste deteriorates, which can result in potentially dangerous conditions such as malnourishment or susceptibility to diseases. This problem of taste loss due to ageing needs to be studied more because it can affect both the physical and mental health of many elderly people.

Kimura S (1992) thought that ageing causes regressive changes in the central nervous system; leading to loss of appetite. These may be unavoidable irreversible changes but later on it found that the free amino acid pattern affecting dietary protein level in the food might show some effect to the CNS by means of nutrition and modifies the changes due to ageing to some extent.

When elderly individuals try to live life with a weakened ability to recognize certain food flavors or any other consumable item, their dietary needs can be greatly affected. A certain grade of foods are not going to taste good enough to satisfy the appetites of the elderly, so they might resort to using unhealthy eating habits. For example, they could lose the motivation to eat certain foods such as vegetables or meats and increase the consumption of foods that are low in nutritional value such

as candies or pastries. This changes can result in health problems such as loss in bone mass, a weakened immune system, weak muscles and high blood pressure.

Elderly citizens need to acquire a specific amount of nutrients in order to maintain a healthy life style. Spence (1989) mentioned that diets, which maintain adequate levels of vitamins and minerals and also consist of 50 to 55% carbohydrates, 12 to 15% proteins, and 25 to 35% fats, are recommended for persons over the age of 50. In order for the elderly to live up to a healthy diet, they need to consume nutritious foods that will taste good to them. The problem with this situation is how to handle the effects of age on the sense of taste

Some governments around the world (e. g. Japan) have attempted to improve nutrition in the elderly by implementing programs that can help encourage food consumption in the elderly despite their ageing ability to taste well. Matsutami (1992) mentioned that the Japanese Ministry of Health and Welfare established the "Eating Habit Guidelines for the Elderly" in 1990, which pointed out the need for the aged to be wary of under-nutrition. Many of these guidelines encouraged regular food consumption in order to live a better life.

As per Solomons NW (2002), the oldest old may be totally functional, both physically and mentally, if a diet with the energy to support basal and physical energy expenditures, normal protein intakes and appropriate accompanying micronutrients is taken in the form of adequate food by the elderly. Problems with healthy food eating practices and remedies are:

(a) The body may not properly use the nutrients it does receive. For example, to process calcium, the body needs vitamin D, which is provided by sunlight. But many elderly people get little exposure to the sun, and when they do, their skin doesn't absorb vitamin D as well as it once did. (b) Food may not be very appealing or enjoyable, because taste and smell become less sharp with age. Disease and medications can affect these senses too. (c) Poor teeth or dentures may ruin the taste of food or make chewing difficult. (d) Shopping and cooking may be painful or difficult because of arthritis, walking problems, or lack of transportation. Cooking for one usually isn't much fun. Loneliness and depression

may add to disinterest and loss of appetite. Limited funds can present problems at the grocery store.

For improving the nutritional status of the elderly following factors may be considered. Increasing the amount of exercise might be a good way to start. Mild exercise, such as walking, not only gets the appetite going, it helps maintain muscle strength and control blood sugar levels. These tips might also help: (a) Sit down to a prepared meal at regular times each day. (b) Pay attention to portions and food groups and increase them where needed. (c) Go out with a friend or eat at a community-dining center on certain days or at certain meals to add variety and companionship. (d) Try new recipes and foods. Liven up familiar ones with crunch and color. (e) Drink at least 1 glass of water with meals. Include foods with high water content (watermelon, flavored-ice treats). (f) Take only two or three bites of a food and then switch to another, to emphasize the various flavors and textures.

Frail elderly people are particularly at risk for nutritional deficiencies that can contribute to cardiovascular disease, functional decline and neurological disorders. Moderately increased homocysteine (Hcy) and methylmalonic acid (MMA) are markers of folate, vitamin B6 or B12 deficiency. Jong et al., (2001) conducted a series of controlled interventions to determine if supplementation with nutrient-dense foods, an exercise program, or a combination of the two would benefit elderly subjects' nutritional status and neurological functioning. The study population was composed of 130 free-living Dutch frail elderly, 72% of them female, with an average age of 78 years and with borderline-normal vitamin levels. None of the subjects exercised regularly or used multivitamin supplements, and all subjects had a below average body mass index. They were randomly assigned either to a control group or to an intervention group that included supplementation with nutrient-dense foods containing 100% of the requirements for folic acid, vitamin B12 and vitamin B6; an exercise program; or a combination of the two. After 17 weeks of the intervention trial, serum concentrations of these vitamins rose in the supplemented groups, and both Hcy and MMA were significantly decreased by 25% and 30% respectively.

Variety is probably the most important ingredient. No single food provides everything, so the best diet is a mix of dairy items, whole grains, fruits, vegetables, and protein. (Patient Notes, 1997). Further it says that consuming sufficient supply of more than 40 nutrients needed for good health can be hard for elderly people who are eating small amounts. Many other factors may also contribute to poor nutrition in the elderly.

Role of soy protein

Many different heart protective mechanisms of soy phytoesterogens have been reported by researchers, such as improved lipid profiles, arterial compliance, prevention of LDL oxidation and lowering blood pressure. Soy foods and soy phytoesterogen supplements promise many heart to health benefits, which can be seen in the following literature.

Soy phytoesterogen appear to lower low-density lipoprotein concentrations while increasing plasma concentrations of the high-density lipoproteins. Particularly noteworthy with respect to the high-density lipoprotein effects are the increases in apolipoprotein A-1 (Maroli et al., 2001)

Effect on CardioVascular Diseases:

The role of protein in CVD and in particular the ability of plant proteins to reduce CVD risks was first advanced in Russia by Ignatowski in 1908.

A study by Washburn et al. (1999) showed that 20gm of soy protein containing 34mg of phytoesterogens in the diet of non-hypercholesterolemic, non-hypertensive, perimenopausal women resulted in significant improvements in lipid and lipoprotein levels, blood pressure and perceived severity of vasomotor symptoms. These data corroborated the potential importance of soy supplementation in reducing chronic disease risk in western population.

Wiseman et al. (2000) mentioned in their study that consumption of soy containing naturally occurring amounts of isoflavone phytoesterogens reduced lipid peroxidation in vivo and increased the resistance of LDL to oxidation. This

antioxidant action might be significant with regard to risk of atherosclerosis, cardio vascular disease in general and cancer.

The usual intake of soy foods was assessed at baseline, and BP was measured 2–3 y after the baseline survey among 45694 participants of the Shanghai Women's Health Study aged 40–70 y who had no history of hypertension, diabetes, or cardiovascular disease at recruitment. Soy protein intake was inversely associated with both systolic BP (*P* for trend = 0.01) and diastolic BP (*P* for trend = 0.009) after adjustment for age, body mass index and lifestyle and other dietary factors. The adjusted mean systolic BP was 1.9 mm Hg lower (95% CI: –3.0, –0.8 mm Hg) and the diastolic BP was 0.9 mm Hg lower (–1.6, –0.2 mm Hg) in women who consumed ≥25 g soy protein/d than in women consuming <2.5 g/d. The inverse associations became stronger with increasing age (*P* for interaction < 0.05 for both BPs). Among women >60 y old, the corresponding differences were –4.9 mm Hg (95% CI: –8.0, –1.9 mm Hg) for systolic BP and –2.2 mm Hg (95% CI: –3.8, –0.6 mm Hg) for diastolic BP. Usual intake of soy foods was inversely associated with both systolic and diastolic BPs, particularly among elderly women (Yang et al., 2005).

In a study carried out by Holguin et. al. (2005), on 58 elderly residing in nursing home, who were given supplementation of fish oil and soy oil to understand its role in CVD. Results showed that supplementation with 2g/day of fish oil were well tolerated and was associated with a significant increase in Heart rate variability (HRV). Supplementation with 2g/day of soy oil was associated with lesser but significant increase in HRV in elderly subjects.

The oxidative modification of LDL is thought to play a crucial role in the initiation of atherosclerosis. Antioxidant vitamins can protect LDL from oxidation, and high intakes or blood concentrations of these vitamins have been linked with a reduced risk of cardiovascular disease. Scarce data are available on the importance of antioxidant vitamins in earlier stages of atherogenesis.

The cross-sectional relation between antioxidant vitamin status and carotid atherosclerosis in a group of elderly persons was studied. The study sample

comprised 468 men and women aged 66–75 y. Thickness and the degree of stenosis in the extracranial carotid arteries were studied. Antioxidant vitamin status was assessed by measuring fasting plasma concentrations of vitamin C, vitamin E, and β-carotene. In the men, after adjustment for age and cardiovascular disease risk factors, a 20% higher plasma vitamin C concentration was associated with a 0.004-mm smaller intima-media thickness; a 20% higher β-carotene concentration was associated with a 0.005-mm smaller intima-media thickness. Compared with men with high blood concentrations of β-carotene or cholesterol-adjusted vitamin E, those with low blood concentrations of these vitamins were 2.5 times as likely to have carotid stenosis of >30%. A high antioxidant vitamin status may help to prevent the initiation and progression of early atherosclerotic lesions in men (Gale et al; 2001).

Widhalm et al., (1993) found that substitution of soy protein for animal protein in the conventional low fat, low cholesterol diet of 23 children with either familial or polygenic hypercholesterolemia more than doubled the response, which resulted in decrease in TC by 16-18% and LDL-C b7 22-25 %.

DiSilivestro RA (1999) showed that antioxidant actions of soy might be able to make a major contribution to health promotion by elevating values for plasma total antioxidant status, depressing values for lipid peroxides, reducing exercise-induced muscle breakdown and oxidative stress, reducing lipoprotein oxidation and elevating endogenous antioxidant concentrations.

Effect on Cancer:

Cassidy et. al. (1994) found that six premenopausal women who consumed 60gm of isolated soy protein containing 45mg of isoflavones daily for one month, significantly ($p<0.01$) increased follicular phase length and/or delayed menstruation, which may be beneficial with regard to risk factors for breast cancer.

Branes (1997) studied the chemopreventive properties of soy isoflavonoids in animal models of breast cancer. Investigator reported that genistein has antiproliferative effects on human breast cancer cell growth in vitro.

In a study by Helferich (1998), it was reported that genistein had paradoxical effects on growth of human breast cancer cells, in vitro and vivo. It was found that higher doses of genistein inhibited growth of both esterogen dependent and esterogen independent human breast cancer cells in vitro, however, these inhibitory activities were not observed in animal studies.

Franke et. al. (1998) showed that breast-feeding by mother who consumed soy foods might contribute to cancer prevention in infants because of exposure to diadzein and genistein, which are potential anti cancer agents.

Lee et. al., (1991) noticed that early adaptation to phytoesterogen exposure might show benefits in later life and could partly explain why the incidence of breast cancer was so much lower in Japan and China where soy was commonly consumed throughout life, than in western population.

Foth and Cline (1998) showed that addition of soy and soy isoflavones to esterogen replacement therapy in post menopausal women, might protect breast and endometrial tissues from the tumor promoting effects of esterogen induced cell proliferation.

Kelly et. al., (1995) figured out the significance of soy protein in premenopausal women. They showed that modification of the diet on a regular basis by the inclusion of soy protein foods containing isoflavones in premenopausal women led to the prolongation of the length of the menstrual cycle. Length of the menstrual cycle is inversely related to breast cancer risk.

Based on studies done in Japan, Adiercreutz et al. (1999) suggested that phytoestrogen might prevent prostate cancer by inhibiting growth during the promotional phase of the disease. This could be the reason for the relatively high incidence of latent prostate cancer but low mortality from this disease in Japan. Epidemiological studies including phytoestrogen analysis in urine and plasma supported this hypothesis.

Effect on Bone Health:

Soy phytoestrogens are the natural source of plant estrogen. Many researchers have reported that soy phytoestrogen improved bone health by preventing bone resorption and by enhancing bone formation, in humans as well as in animal models.

In a study by Madeline et. al. (1999), 267 older Japanese women aged 65-93 years were enrolled. It was observed that femoral neck BMD was higher ($0.680g/cm^2$), for women who consumed high amounts of soy throughout life, compared to $0.628g/cm^2$ for women who consumed very little soy throughout their lifetime. Postmenopausal estrogen users who were high soy consumers had the highest BMD at all sites (hip, spine, femoral neck and lumber spine).

Itoh et. al. (1998) conducted a study in 755 Japanese men and women in which they found a significant positive correlation between calcium excretion and intake of animal protein and no correlation between calcium excretion and plant protein consumption.

Yamaguchi and Gao (1998) studied inhibitory effect of genistein on bone resorption in tissue culture and found that it had a direct inhibitory effect on bone resorption in tissue culture in vitro.

A study conducted by Harrison et. al., (1998) on the effect of soybean protein on bone loss in a rat model of postmenopausal osteoporosis showed that the soy protein based diet was just as effective as daily estrogen in suppressing bone loss due to ovariectomy. They also found that unlike estrogen, soy protein did not have any uterotropic effect and did not decrease the markers of bone turn over they measured, suggesting a possible difference between soy protein and estrogen in mechanism of action.

Effect on menopausal symptoms:

Washburn et. al. (1999) conducted a randomized, double-blind, placebo-controlled crossover study of perimenopausal women who were experiencing menopausal

symptoms and found that consumption of daily supplement of 20gm of isolated soy protein (with 34mg of isoflavones) significantly improved hypoesterogenic symptoms and severity of hot flushes and also caused borderline significant improvements in severity of night sweats and in general health score.

Albertazzi et al. (1998) conducted a double-blind, parallel, multi-center, randomized, placebo-controlled trial to assess the effect of daily supplementation with isolated soy protein on hot flushes in postmenopausal women. They studied the effect of daily supplementation with 40gms of isolated soy protein (containing 76mg of isoflavones) on hot flushes in postmenopausal women and found that at the end of the 12 weeks, the women consuming soy protein had showed a 45% reduction in hot flushes.

In a study by Murkies et. al., (1995) involving 58 postmenopausal women with at least 14 hot flushes per week, symptoms decreased by about 40% in women whose diet were supplemented with soy flour.

Upmalis et. al., (2000), in a double blind, randomized, outpatient, multicentric study, a total of 177 postmenopausal women who were experiencing 5 or more hot flushes per day received either soy isoflavone extract (total of 50mg of genistein and diadzein) or placebo. Decrease in the incidence and severity of hot flushes were observed with in 2 weeks of soy supplementation.

HEALTH ISSUES IN COMMUNITY GERIATRICS

The best preparation for a healthy old age is still a healthy middle age. However the adoption of good health habits even late in life has been shown to be associated not only with an increase in lifespan, but also in 'health span' (Kalache and Keller,1999).

Older people with better health habits live healthier for longer. There are many opportunities to promote health in older age, and the promotion of 'healthy ageing' rather than a 'healthy old age' may be more attractive to all age groups. Older

people require access to information about healthy lifestyles, the ability to assess such information, and a sense of control over their own future. By maintaining healthy lifestyles in old age, there is associated health gain. However, where studies show no significant health gain from initiatives, it should be noted that prevention of deterioration could be just as important a consideration (Powell, 1999).

Ensuring satisfactory health of the Indian elderly would need better medical facilities and ensuring that they receive adequate nutrition and follow a regular regimen of exercise and hygienic practices. A balanced diet of an elderly could be fulfilled if quickly digestible recipes which are easy to prepare from cheap, locally available raw materials can be developed and popularized (Dey, 2003).

Nutrition plays an important role in the health of older people by reducing the susceptibility to some diseases, aiding recovery from illness and delaying the deterioration of some of the physiological functions associated with ageing. Undernourishment may occur through previous poverty, personal or psychological problems, or due to the effect on the appetite of illness or medication. There are significant proportion of older people who are at risk of malnutrition with many experiencing problems with feeding, chewing, swallowing and digestion (British Nutrition Foundation, 1996).

Widowhood can affect nutrition in different ways. For some people there may be a positive impact e.g. being able to follow their own dietary needs. However, most are likely to see a negative impact, associated as it is with changes in eating habits, and the enjoyment of eating and food related activities, such as cooking and shopping. Widowed people are at increased risk for weight loss that may be potentially harmful. (Quandt, 2000 and Shahar, 2001).

Certain strategies suggested by Bales (2001) are like those with low income, the very old, and the chronically ill are also at particular risk of nutritional deficiencies and are a priority for intervention. Partnerships should be built at local and national level with the food industry, relevant agencies for elderly people and with the elderly themselves. Particular emphasis needs to be placed on promoting good

nutritional intakes amongst those in residential care, those of a lower socio-economic status and those lacking their own teeth. Dietary advice should focus on the inclusion of the main food groups in the daily diet. Communities need to develop ways to identify the bereaved and assist them in finding acceptable ways to meet their nutritional needs. Poor oral health can lead to altered dietary habits, which in turn can affect dental status. It has an impact on the ability to eat, affecting food choice and preparation, and ultimately the intake of some key nutrients, thus creating a vicious circle. For them oral health promotion is effective for increasing knowledge levels; however there is no evidence that changes in knowledge are causally related to changes in behavior.

Participation in any kind of activity declines steadily with age with the proportion of people aged 65-74 participating falling to 13% from a peak of 45% at age 16-24 (McMurdo, 2000). However, he tells that no older person should be discouraged from being more physically active and "inactivity and immobility are harbingers of mortality and morbidity".

According to a US summary report on older people nutrition program (1996) adequate nutrition is critical to health, functioning, and quality of life for people of all ages. For elderly people, nutrition can be especially important, because of their vulnerability to health problems and physical and cognitive impairments. Nutrition services help to ensure that older people achieve and maintain optimal nutritional status. The available scientific evidence also suggests that maintaining nutritional well-being in older people helps them mitigate existing health problems, manage chronic conditions, prevent complications associated with acute and chronic disease, and extend the period of healthy living.

Aday and Ronald (2003) says that as the greying of people continues, changes in attitudes and policies toward ageing will be necessary. Inherent in the ageing of America is the absolute need for people to grow old with the highest levels of health, vitality and independence. For this to occur, the concept of health and well-being as it relates to the older segment of the population must include the ability to function effectively in society, to exercise self-reliance, and to achieve a high

quality of life. Social policy related to the delivery of health care can no longer be construed in the traditional manner of medical care or illness management. Preventive programs common in senior centers will serve to empower the elderly and provide a key element in managing the tremendous demand of baby boomers on our health care system. model for the 21st century. Senior centers of the 21st century have the potential to bring together a broad and varied program of services and activities that enable older persons to develop and maintain health-promoting activities.

The promotion of good health practices among older people and their caregivers can enhance the quality of life of our ageing population. Health promotion programs for older adults could be offered by organizations and agencies that have not yet recognized the need for such programs. Nutrition education is the area in which health educators can be helpful to older people and their caregivers. Education about proper nutrition and meal planning and preparation could dramatically improve the lives of many older people. Programs should consider the food preferences and traditional foods of older people in the community (Hosay, 2003).

Our changing demographics suggest that health educators can and should seek to expand their professional horizons to include work with older adults and their caregivers.

Bhattacharyya and Birla (2006) has reviewed in their paper that the state and civil society should recognize the rights and needs of the elderly and make suitable polices, legislations and effective implementation of health and security schemes, that already exists. They added that specific intervention programs are required for the aged women as they are the most vulnerable.

The findings of the studies, outlined by Rowe and Kahn (1998), emphasize the multiple genetic, biomedical, behavioral, and social factors that contribute to a person's ability to retain or even enhance functioning in later life. The studies found that the less important is the role of heredity and more important is the role of personal choice and behavior in successful ageing. According to them the three

components of successful ageing are: avoiding disease and disability, maintaining mental and physical function, and continuing engagement with life.

The methodology that has been used to carry out this study is discussed in the next chapter.