NUTRITIONAL PROFILE OF THE RURAL ELDERLY AND IMPACT OF FOOD SUPPLEMENTATION AND NUTRITION EDUCATION

By

N. SABITHA

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CERTIFICATE

CERTIFICATE

This is to certify that the dissertation entitled **'Nutritional Profile of the Rural Elderly and Impact of Food Supplementation and Nutrition Education'** submitted to the Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, in partial fulfilment of the requirements for the award of the **Degree of Doctor of Philosophy in Food Science and Nutrition** is a record of original research work done by **N. SABITHA**, during the period of her study in the **Department of Food Science and Nutrition, Avinashilingam Institute for Home Science and Higher Education for Women, (Deemed University), Coimbatore,** under my supervision and guidance and the dissertation has not formed the basis for the award of any Degree/Diploma/Associateship/Fellowship or similar title to any candidate of any other University and it represents entirely an independent work on the part of the candidate.

N. Bhooma 31/10/03

Signature of the Guide

Forwarded

S. [illegible] 31.10.03.

Signature of the

Head of the Department

DECLARATION

I hereby declare that the dissertation entitled **'Nutritional Profile of the Rural Elderly and Impact of Food Supplementation and Nutrition Education'** submitted to the Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, in partial fulfilment of the requirements for the award of the **Degree of Doctor of Philosophy in Food Science and Nutrition** is a record of original research work done by me under the supervision and guidance of **Dr. (Mrs). N.BHOOMA, M.Sc., M.Phil., Ph.D. (Madras),** Reader, Department of Food Science and Nutrition and it has not formed the basis for the award of any Degree/Diploma/ Associateship/Fellowship or similar title to any candidate of any other University.

N. Sabitha 31/10/03.
Signature of the Candidate

N. Bhooma 31/10/03
Signature of the Guide

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INTRODUCTION

I INTRODUCTION

"There is many a good tune played on an old fiddle"

- Samuel Butler (2003)

Ageing is universal, affects every individual and family, community and society. The number of older persons is growing steadily (Saibaba, 2002). Graying population is one of the most significant characteristics of the 20th century and quite often the first quarter of the 21st century is called "The Age of Ageing" (Vijayakumar, 2001).

Age is a social construction and the experience of growing old, is culturally mitigated. Elderly are assets to the society. The global effort today is, not to heal but to protect and prolong ageing. The World Health Organisation's slogan is, "It is not sufficient to add years to life but the more important objective is to add life to years" (Bagchi, 2000).

The terminology 'geriatrics' derived from Greek word 'gerios' meaning old age and 'iatros' meaning medicine refers to the science of elderly. British Geriatric Society defines 'geriatrics' as that branch of general medicine concerned with the clinical, preventive, medical and social aspects of illness in the elderly (Natarajan, 1998 and Sivaramakrishna, 2000).

With increasing longevity, the proportion and number of persons in the age group of 60 years and beyond, is rapidly increasing both in terms of absolute number and as proportion of the total population. In geriatric population women out number men (Tenth Five Year Plan, 2002-2007). The proportion of the elderly has been increasing in the world. In India the current elderly population is 70 million constituting about seven per cent of total population (Ariappa et al., 2001).

Eventhough old age has been defined as last stage of one's life, ageing process is inevitable, but it can be made smooth and beautiful by adhering certain qualities in life (Natarajan, 1997 and Vidyasagar, 2000).

In early 20th century, all individuals above 60 years irrespective of their specific age category were classified as elderly. However, recent studies carefully conducted in physiology, biochemistry and epidemiology have confirmed that all aged individuals cannot be put in one homogenous group. They can be categorised into "young-old", between the age of 60 to 75 years, "old-old", between 75 to 85 years and "very old", between 86 years and above. The first (60-75 years of age) category are physically active and mentally alert, and in most cases they are not dependent on others, while the third category needs all types of support, due to their health problems (Bagchi, 2000).

In view of the projections of the United Nations, our elderly population, which according to "World Population, Prospects, Estimates and Projections" estimated at 5.3 per cent in 1980, is expected to jump to 13.3 per cent by the year 2025. According to United Nations Projections, in the year 2025 a projected 1.2 billion elderly people will be living in the world; 71 per cent of them are likely to be in the developing regions. The average life expectancy in 1947 was 32 years followed by 62 years in 1994 and projected as 75 years by the year 2015. People born in this century have greater chances to live beyond 100 years. Six per cent of India's population today is above 60 years of age. In India 88 per cent of elderly population live in rural areas and only 12 per cent live in urban areas (Mani and Malathy, 2000).

There are three major factors on which ageing depends. These are heredity factors, lifestyle factors and environmental factors. While the hereditary factors cannot be modified, lifestyle factors and environmental factors can be modified (Bansal, 2000). Ageing is multifactoral, and the various systems of the body do not deteriorate at the same time, but it is to be inferred that individual ageing depends on prior living conditions and quality of life lived and these vary from place to place and person to person.

The ageing process cannot be reversed or stopped, but its effects can certainly be minimised by changing food habits, taking regular walks and other exercises depending on one's condition (Vidyasagar, 2000). Our challenge is to work toward a society and environment that enable the greatest number of our elders to lead vigorous, fulfilling and independent lives. Nutrition must play an important part in meeting this challenge.

Diet is possibly the most important factor in controlling the ageing process and even in its onset. Numerous studies throughout the world are bringing a large number of findings which indicate that nutrition possibly holds an important key to the solutions of the riddles of ageing.

The food we take shows in everything, from our stamina and strength to the sheen of the hair and the glow of the cheeks. Eating well helps us to live well and look well. Both body and mind need good nutrition to function efficiently (Prabhakaran, 2003).

As with other age groups, the elderly also need to be given a balanced diet. The fact is that, often the concept of balanced diet is ignored

among elderly. Foods that are nutrient dense in vitamins and minerals, for example, whole grain is preferred to refined grain products in the diet of elderly people. In the fruit and vegetable category, elderly should choose those that are deeply coloured for provision of folate and antioxidant nutrients (Russell, 1999).

Antioxidants are defined as substances whose presence in relatively low concentrations significantly inhibits the oxidative damage induced by free radicals. Sources of natural antioxidants are vitamin C in citrus fruits and dark green leafy vegetables; vitamin E in oils from soyabean and sunflower, germs of whole grains, nuts; β-carotene in dark green leafy vegetables, yellow orange fruits like papaya, mango, and yellow-orange vegetables like carrots, pumpkins. Whole grain-cereal product, fruit and vegetables all contribute significant amounts of antioxidant to the daily diet. Natural antioxidants in fruits and vegetables helps to reduce diseases of ageing if consumed on a regular basis. Commonly consumed whole-grain products are excellent sources of antioxidant that should complement fibre to reduce cancer and heart disease.

The body's antioxidant defense system includes the major lipid soluble antioxidants vitamin E and ubiquinones; the major water-soluble antioxidants vitamin C and the thiol antioxidants such as lipoic acid and glutathione. Flavanoids, polyphenols, carotenoids and other phytochemicals also act as antioxidants.

Recent years have seen increasing interest in the role of free radical oxidative damage in human diseases. Free radicals are any species capable of independent existence that contains one or more unpaired electrons.

They are highly reactive and unstable. There is growing evidence that essentially everyone in our society is exposed to free radicals, more now than ever before. Unless free radicals are neutralised they can cause considerable damage to the structures and functions of the cell constituents in the human body (Reddy et al., 1999). There is increasing evidence of the causative role of free radicals and oxidative activity in various diseases. Most of these diseases are associated with old age.

In atherosclerosis, oxidation of the LDL (Low-Density Lipoprotein) particles is a critical event. The sub-endothelial macrophages avidly take up these oxidatively modified forms of LDL leading to plaque formation. One source of free radicals is the oxidative stress in diabetes due to prolonged exposure to hyperglycemia. In addition, diabetic patients also have a defect in antioxidant protection particularly in ascorbic acid metabolism.

Increased free radical activity contributes to the pathophysiology in chronic inflammatory diseases like rheumatoid arthritis and also inflammatory bowel disease. Epidemiological studies have suggested that persons with high antioxidant intake are less likely to develop cancers particularly lung cancer and cancer of gastrointestinal tract. Hypertension has been associated with low levels of antioxidant vitamins particularly ascorbic acid.

In neurological diseases, brain and spinal cord are particularly vulnerable to free radical induced damage due to their high content of lipid and poor iron binding capacity. Free radical oxidative stress has been implicated in the pathophysiology of Parkinson's disease and decreased cognitive function. Free radicals have been implicated in the pathophysiology of two common ocular diseases in the elderly namely senile macular degeneration and cataract. It is also possible that reduced antioxidant defense in the ageing retina could play a role.

Ageing is associated with impaired immune responses and increased infection related morbidity (Chandra, 1992). The threat of coronary heart disease is growing in India and is expected to become a major challenge to the health services in the next century.

Though the preventive measure in elimination of mortality due to communicable diseases and malnutrition is appreciable, it is replaced by cancer, chronic degenerative diseases and diseases associated with an atherogenic diet and over nutrition which constitutes the bulk reason of death in elderly. Data from the life insurance companies indicate that higher the blood pressure, shorter is the life span of an individual (Reddy et al., 1999).

There is an overwhelming body of evidence indicating that increased intake of fruits and vegetables can dramatically reduce the risk of many degenerative diseases of ageing (Singh et al., 1996).

Health, old age and poverty are intimately linked. In most societies, a disproportionate number of the 'poorest poor' are very old. Migration is a phenomenon mostly of the young who leave behind older relations who often have neither physical help nor financial support as they lack the necessary skills to compete successfully in skilled job markets. Such inequalities influence the quality of life of millions of elderly people trapped under the poverty line (Sen and Kalache, 2000).

The majority of poor older people in developing countries enter old age after a lifetime of poverty and deprivation, a diet that is inadequate in quantity and quality and a lifetime of diseases and poor access to health care (Ismail, 1999).

India has been in the past and remains today a predominantly agrarian society. More than sixty per cent of the population are engaged in agricultural activities as labourer, contractor, landlord or agro-industrialist (Gahukar, 2003). The elderly in the rural areas are largely landless labourers, surviving on day-to-day earnings, without any long-term savings. They are no longer physically strong because of their age, and hence their capacity for work is progressively reduced. Understanding the dynamics of the life of our elderly is an essential tool to make their lives better. Older people in rural areas report a poorer quality of life than those in the cities and towns. They are severely disadvantaged by economic hardships, unresolved chronic health problems, functional impairment and illiteracy (Soneja, 2000). Thus in this context nutrition education becomes important.

Nutrition education is of vital importance in alleviating the problems of senior citizens. Ignorance about their health status is directly influenced by the lack of primary and secondary education in their early childhood. Rural elderly are neglected by their families with respect to medical care, on grounds of the economic problems.

Nutrition education is concerned with trying to persuade an individual or a group of people to modify their way of life with a view of improving their health and nutrition by the better use of available resources, both traditional and modern and both man made and natural. It can serve as an effective tool to modify dietary habits of population groups (Devadas, 2000[a]).

Nutrition education has undergone rapid changes through technological developments. New communication and computing technologies have profound implications in everyday research activities (Swaminathan, 1999[b]). The field of nutrition education has begun to use computers over the last seven to eight years. Using audio, video and graphics decreases the literacy requirement of the user compared to text based computer programs (Jantz et al., 2002).

A healthy older person is more likely to be an active contributor to society–an asset for the process of socioeconomic development. What is most needed in the country is the need to strengthen health care system both in the private and public sector for providing health care of various types to the rapidly increasing elderly population (Bagchi, 2000).

Gerontological and geriatric research are still in their infancy in India. What they reveal and don't reveal are equally disturbing and call for action and further research (Bali, 2000). Research on the ageing process is being carried out extensively but causes for ageing are yet to be pin-pointed. The demand for geriatric services will be definitely felt more in the future as the population of persons aged 60 and over is increasing at a faster pace than the general population itself (Natarajan, 1996).

Hence, the increasing number of senior citizens who survive to enjoy their renaissance years has created enormous interest among the nutritionists and health care personnel regarding the nutritional needs of elderly persons (Devadas, 2000[b]).

The broad objectives of this study were therefore focussed to assess the lifestyle and nutritional profile of elderly, living in rural areas of Tamilnadu and to study the impact of food supplementation and nutrition education. Hence, a detailed study on "Nutritional Profile of the Rural Elderly and Impact of Food Supplementation and Nutrition Education" has been undertaken with the following objectives:

1. Assess the life pattern of elderly in rural areas.
2. Assess their nutritional profile.
3. Formulate a supplementary food consisting a mixture of a cereal, millet, pulse, vegetable and fruit and evaluate its quality and acceptability.
4. Evaluate the impact of food supplementation on selected elderly.
5. Identify the characteristic changes related to ageing on selected adults and study the impact of food supplementation.
6. Study the outcomes of nutrition education.

REVIEW OF LITERATURE

II REVIEW OF LITERATURE

The literature pertaining to the present study entitled "Nutritional Profile of the Rural Elderly and Impact of Food Supplementation and Nutrition Education" is presented under the following headings:

A. Ageing – Definitions, Demography and Theories

B. Nutritional Profile and Requirements of Elderly

C. Health and Nutritional Problems of Elderly

D. Antioxidants and Ageing

E. Impact of Supplementation on Elderly

F. Psycho-Social Problems of Elderly

A. AGEING – DEFINITIONS, DEMOGRAPHY AND THEORIES

1. Definitions:

Ageing refers to normal progressive and irreversible biological changes that occur over the individual's life span (Posner et al., 1997). At the molecular level, ageing manifests when the orderly sequence of the double strand DNA start getting mixed up while being replaced or repaired (Ghosh, 1998). According to Venkataraman (1998) ageing is a gradual development process of biological, psychological, sociological and behavioural changes that begins at conception.

From a sociological perspective, Natarajan (1999) defined old age as the age of retirement for it is at that time the combined effect of ageing, social changes and diseases are likely to cause a breakdown in

health. Ageing may best be defined as the survival of a growing number of people who have completed the traditional adult roles of making a living and child bearing (Gurusamy, 2001).

The age of 60 has been accepted as the cut off for old age in most developing countries, based on the socioeconomic situation, age of retirement and life expectancy. In India also, the age of 60 is accepted as the cut off for old age (Dey et al., 2002).

Ageing is a complex phenomenon that is accompanied by physiological, psychological and social changes which contributes to decline in health status (Hemalatha, 1999). According to Dube (1999) ageing process and health are intimately related and the laws of nature tend to make old age more complicated and uneasy. Pattanaik (1999) stated that the aged should be considered as a valuable cultural resource and as role models for young generation.

Ageing in the broadest sense, are those changes occurring in an individual, as a result of the passage of time (Backer, 2001). Improved nutrition and health care have increased the number of people living above the age 60. Traditionally, the 'elderly' age group has been defined as 65 and beyond (Devadas, 2000[b]). Ageing is a complex biological process is accompanied by changes in socioeconomic status, which may have a great impact on the physical and nutritional status of the elderly (Meydani, 2002).

There is no precise definition of elderly, generally all those above the age of 65 years are considered to be elderly (Sreeramulu and Raghuramulu 1999). Ageing is a natural phenomenon and is invariable and elderly are the people above the age of 60 years (Vijayalakshmi et al., 2000).

Kamalamma and Selsa (2000) opined that ageing is a natural phenomenon that makes people move from independent adulthood to a stage of dependency. Tessari (2000) had reported that the ageing process is characterized by a modification of body composition with an increase in fat mass and a decrease in lean body mass. According to Jit (2000) old age is an important time of life because at this stage people are dependent on their own resources for their happiness. According to Gokhale (2001) ageing has to be recognized as a developmental issue and addressed at social, political and economic levels.

"Normal ageing" refers to inexorable and universal physiological changes that occur with ageing. "Usual ageing" includes age-related diseases, which result from the interaction between genetic, environmental and behavioural factors. "Successful ageing" refers to modification of behavioural process to achieve the best possible outcome to ageing. The "rule of thirds" states that one third of functional decline is due to actual ageing, another one third is attributable to disease and the remaining is due to disuse (Sunil, 2002).

A recent American survey showed that, on an average, across all the age groups questioned, a person was considered to be 'old' at 69. But those aged 18-24 thought someone was old at 58, while those aged 65 or older thought that 75 could be considered old. Young people are also more likely to see being old as a physical thing- having grey hair or wrinkles, whereas older people describe being young not in physical terms but more in attitudinal characteristics such as being fun loving. (MacNair, 2003).

2. Demography

The alarming situation is that the world's elderly population is increasing monthly by about one million persons. (Troisi,1998). In 1950, there were about 200 million persons aged 60 and above in the world. This figure now stands at 550 million and is expected to reach a billion by the year 2020 (Singh,1999).

The twentieth century has seen an unprecedented transition from high birth and death rates to low fertility and mortality. In 1950, there were about 200 million people over 60 years; by 2025 there will be 1.2 billion, of whom nearly 70 per cent will live in developing countries. (Ismail, 1999).

According to United Nations, a population may be defined as aged when the proportion of persons above the age of 64 in the population exceeds seven per cent (Jayashree, 1997). An interesting observation from United Nation's Demographic Estimations is that in 1985 there were 427 million persons aged 60 and over, constituting 8.83 per cent of the world's total population. By the year 2025, these figures are projected to rise to 1,171 million, an increase of 174 per cent. In other words the elderly by the year 2025, will constitute 14.28 per cent of the world's population. In 1985, 241 million persons aged above 60 years (i.e. 56.5 per cent of the world's elderly) lived in developing countries and this proportion is further projected to reach 61.5 per cent by the turn of the century and 71.9 per cent by the year 2025 (Vijayakumar, 2001).

The elderly population world over, is showing a gradual increase at the rate of 2.5 per cent annually resulting in a geriatric boom (Kamalamma

and Selsa, 2000). The above statistical description shows that growth rate of elderly population in terms of its absolute number and proportion is faster; which is a great challenge to the health systems. This has significant implication on socioeconomic factors and overall welfare of the elderly.

Dey et al., (2002) states that, globally the percentage of people over age sixty is increasing rapidly and will reach thirty per cent in 2050. In India, about 7 per cent of the population is over the age 60 and the number of senior citizens is expected to increase rapidly. Currently there are about 580 million in the world, aged 60 years and over, and this figure is expected to rise to over 1000 million within the next 20 years. By 2020, approximately 70 per cent of the elderly population will be living in developing countries. These changes represent an unprecedented demographic revolution and require the immediate attention of policy makers worldwide (Kalache, 1999).

Dey et al., (2002) points out the emerging ageing scenario in the first 50 years of the twenty first century which is shown in Table I.

TABLE I

PROJECTED NUMBER OF OLDER PERSONS, THEIR PERCENTAGE IN POPULATION, SEX RATIO AND OLD AGE DEPENDENCY IN INDIA: 2001–2051

Age	Population in millions and (%)					
	2001	2011	2021	2031	2041	2051
60 +	70.78 (7.1)	96.30 (8.2)	133.2 (9..9)	178.59 (11.9)	236.01 (14.5)	300.96 (17.3)
70 +	27.07 (2.7)	35.90 (3.1)	50.55 (3.8)	73.13 (4.8)	97.90 (6.0)	133.31 (7.6)
80 +	5.37 (0.5)	7.88 (0.7)	10.75 (0.8)	15.69 (1.0)	23.17 (1.4)	31.98 (1.8)
Dependency	11.9	13.4	16.0	19.0	23.2	28.2
Male:Female ratio x 1000						
Age 60 +	1036	1034	1004	964	1008	1007
Age 80 +	998	884	866	843	774	732

Future projections for different parts of the country, by dividing the country into six major regions: south, west, central, east, north and north east have also been carried out by Dey et al., (2002). Such estimates reveal that the southern and western part of the country will have a higher proportion of older population and higher proportion of older women in comparison to the national average.

In India, the proportion of elderly has risen from 5.6 per cent in 1960 to 6.3 per cent in 1980 and is projected to be 9.5 per cent by 2020 (Rajan et al., 1999). The percentage of population above 60 years of age as per 1991 census is the highest in Kerala (8.8 per cent) and lowest in Assam

(5.2 per cent). Kerala and Tamilnadu will have more than 13 per cent of its population in the age group of 60 years by 2016 (Kulkarni, 1999).

Modern health, medicine, sanitation and lifestyle has done remarkably little to extend the overall maximum life span of the human species. The average life span is still about 75-80 for women and 70-75 for men. This seems fairly fixed at an average of around 80 years, with a few people living to a maximum of 120 years. With current developments in healthcare and public health, more young people today might expect to live longer (Macnair, 2003).

The demographic ageing of the population has serious implications both at the macro and the household level, as the country would soon be facing a progressive increase in the proportion of elderly persons when it becomes imperative to provide facilities and support for their well being (Joshi, 1999).

Natarajan and Sivakumar (2002) opines that India is facing an enormous challenge with the ageing of its population and with the success of population control, there are fewer children available to support ageing parents. Hence the role of society and the government in making up the deficits will need to be explored.

3. Theories

a. Sociologic Theories of Ageing

The basic presumption of this approach is that successful adjustment to old age rests with the ability of the person to continue life span or patterns across a lifetime. It is important to retain a continuity or connection to the past. Old habits, values and interests are integral to a person's present life.

b. Genetic Theories

These theories concentrate on genetic programme that sets the upper limit of the life span of all species. Although loss of replicability may be a good model of the finite characteristics of cell in vitro, it does not appear to be a complete model of ageing. The life span of cell populations in vivo may be very different (Hickey, 1992). The DNA damage theory, somatic mutation theory and cellular error theory of ageing are genetic theories (Chadha, 1997).

The evolutionary theory of ageing explains why ageing occurs, giving valuable insight into the mechanisms underlying the complex cellular and molecular changes that contribute to senescence. Such understanding also helps to clarify how the genome shapes the ageing process, thereby aiding the study of the genetic factors that influence longevity and age-associated diseases (Kirkwood and Austad, 2000).

c. Normal Biologic Theories of Ageing (Brunner and Suddath, 1996)

i) Intrinsic Ageing: This refers to those changes caused by the normal ageing process that are gradually genetically programmed and essentially universal within a species. Universality is the major criterion to use in distinguishing normal from abnormal ageing.

ii) Extrinsic changes of Ageing: This results from influences outside the person like illness and disease, air pollution and sunlight are examples of extrinsic factors that may hasten the ageing process. These abnormal ageing processes can be eliminated or reduced through effective health care interventions.

d. Physiological Theories

Chadha (1997) stated that this set of theories try to understand the effects of ageing on the whole body instead of dealing with merely the

cellular origins of ageing. The homeostatic imbalance theory suggested that ageing is due to increased homeostatic failure and the reduced immunological capability of immune system in old age.

There are other biological perspectives of interest like the food restriction theories which suggest that varying caloric intake may be a useful tool for examining ageing changes (Fujita, 1992).

B. NUTRITIONAL PROFILE AND REQUIREMENTS OF ELDERLY

(i) Nutritional Profile

Arulmani and Sarojini (2000) indicated that nutrition is imperative for good health at all stages of human life, more so in advanced age. Nutrition plays an important role in ageing process and it influences the development and cause of many diseases that often accompany old age (Sharadha, 1999). Natarajan (2003) said that what is important for an aged person is quality of the diet rather than the quantity.

Nutrition, health and ageing are inextricably linked. Good nutrition is ageless and the message to older people must be – "the quality of your nutrition is basic to the quality of your life". Evidence from numerous sources indicate that a significant number of elderly fail to get the amounts and types of food necessary to meet essential energy and nutrient needs. A well-balanced diet and adequate exercise can counteract some of the physiologic changes attributed to ageing and promote successful ageing (Prabhu and Singh, 2002).

As we age, an inadequate nutrition contributes to the loss of function and the development and progression of disease. A range of medical,

physiological, psychological, social and situational variables influences nutritional status. Adequate nutrition and physical activity are aspects of a health promoting lifestyle. Better nutrition and exercise is a cost-effective way of decreasing the incidence and progression of age related diseases (Bates et al., 2002).

Food contributes to the quality of life through psychological, social and physical mechanism (Chandrasekhar and Bhooma, 1998). Nutrition in the aged is an outcome of the earlier food habits, food choices, food likes and also the consumption pattern (Vijayalakshmi et al., 2000).

Nutrition plays a role in the ageing process, but there is still a lack of knowledge about nutrition related risk factors in cognitive impairment (Gross et al., 2001). In recent years, evidence has been accumulating that the diet of elderly has an impact on morbidity and mortality. Several studies have shown that dietary pattern that confirms to healthy eating guidelines are associated with increased overall survival (Neill et al., 2002).

According to Russel (2000) elderly adults have distinct metabolic characteristics that alter various nutrient requirements. Gastro intestinal function is well preserved with ageing regarding the digestion and absorption of macronutrients, but the ageing gastro intestinal tract become less efficient in absorbing vitamin B_{12}, vitamin D and calcium.

According to Chitra and Kannappan (2002) nutritional status and dietary pattern of elderly has direct bearing on the age related degenerative changes resulting in functional decline.

Ageing is associated with the reduction in energy requirements due to loss of lean tissue mass and a decline in physical activity. As a result, older people may be able to maintain body weight on a low energy intakes, but will be at risk of specific deficiencies unless their diet includes foods that are rich in micronutrients (Neill et al., 2002).

Meeting protein needs is especially important for older adults to help to preserve muscle mass and bone health. Older adult's low physical activity may contribute to their higher needs for dietary protein, although different types of physical activity have unique influences on protein metabolism (Bean et al., 2001).

According to Kaplan et al., (2001) dietary protein, carbohydrate and fat enhance memory performance in the healthy elderly. The prevalence of overweight and obesity, the anorexia of ageing or decrease in energy intake are health concerns between the ages of 60 and 80.

Heseker and Schneider (1994) suggested that elderly men need more vitamin C in their diet to achieve comparable plasma levels of young adults. Hence with age, the requirement for vitamin C and possibly for β-carotene increases and the requirement for vitamin E is not altered by age.

Supplementation of the elderly with vitamin E has been shown to enhance immune response, delay onset of Alzheimer's disease and increase resistance to oxidative injury associated with exercise (Meydani, 2002).

Vitamin K has a role in blood clotting and for maintaining bone and cardiovascular health (Thane et al., 2002). Surveys of nutrient intake of

elderly in India showed that a considerable proportion of population receive vitamin A less than the recommended allowances (Chandrasekhar and Bhooma, 1999).

Trace minerals are no less in importance to antioxidants during the process of ageing. However, there is a general lack of information about mineral nutriture and metabolism in the elderly. Zinc is an essential element, important for immune function, wound healing, taste acuity and functions in at least 70 different enzymes (Smolin and Grosvenor, 2000). Copper plays an important role in iron transport, connective tissue synthesis, immune response and resistance to infection (Kelley, 1995 and Percival, 1998). Manganese protects against oxidative damage by functioning in the enzyme superoxide dismutase (Smolin and Grosvenor, 2000). Selenium functions in the antioxidant enzyme glutathione peroxide. A low selenium intake is associated with an increased risk of developing heart disease. (Huttenen, 1997). Iron is a trace mineral used by brain cells for normal function at all ages while chromium potentiates insulin action and influences carbohydrate, lipid and protein metabolism (Lee and Reasner, 1994).

Elderly individuals have a higher risk of developing trace element deficiencies due to modified dietary habits and requirement, age related physiological changes, drug therapy and chronic diseases leading to or associated with enhanced consumption or excretion of trace element (Ekmekcioglur, 2002). The intake of many nutrients including protein, calcium, zinc, vitamin A, riboflavin, folic acid and cobalamine were deficient among elderly (Ahari and Kimiagar,1997).

Studies conducted by National Institute of Nutrition (1999) in various parts of the country have shown that most of the elderly people suffer from micronutrient deficiency diseases. They should be encouraged to eat foods rich in micro nutrients such as vitamins A, C, E and minerals such as calcium, zinc and selenium.

Prabhu (1999) reported that an increased calcium intake reduced and even prevented the development of osteoporosis. Low dose supplementation of zinc and selenium provides significant improvement in elderly patients by increasing the humoral response after vaccination and could have considerable public health importance by reducing morbidity from respiratory tract infections (Girodon et al., 1999). Copper deficiency can cause central nervous system disorders (Sing et al., 2001).

Poor nutrition in early life may programme accelerated ageing and predispose to a variety of age related changes. Ageing can be influenced by events throughout life. . Further work in this field will promote understanding of ageing itself (Sayer and Cooper, 1997).

The risk factors for poor nutritional status of older people are summarized in Figure 1.

(ii) Nutrient Requirements

Many research and surveys have been carried out over the years to determine the levels of various nutrient intakes among the elderly. The 'ideal' requirements are difficult to define. In old age consumption of

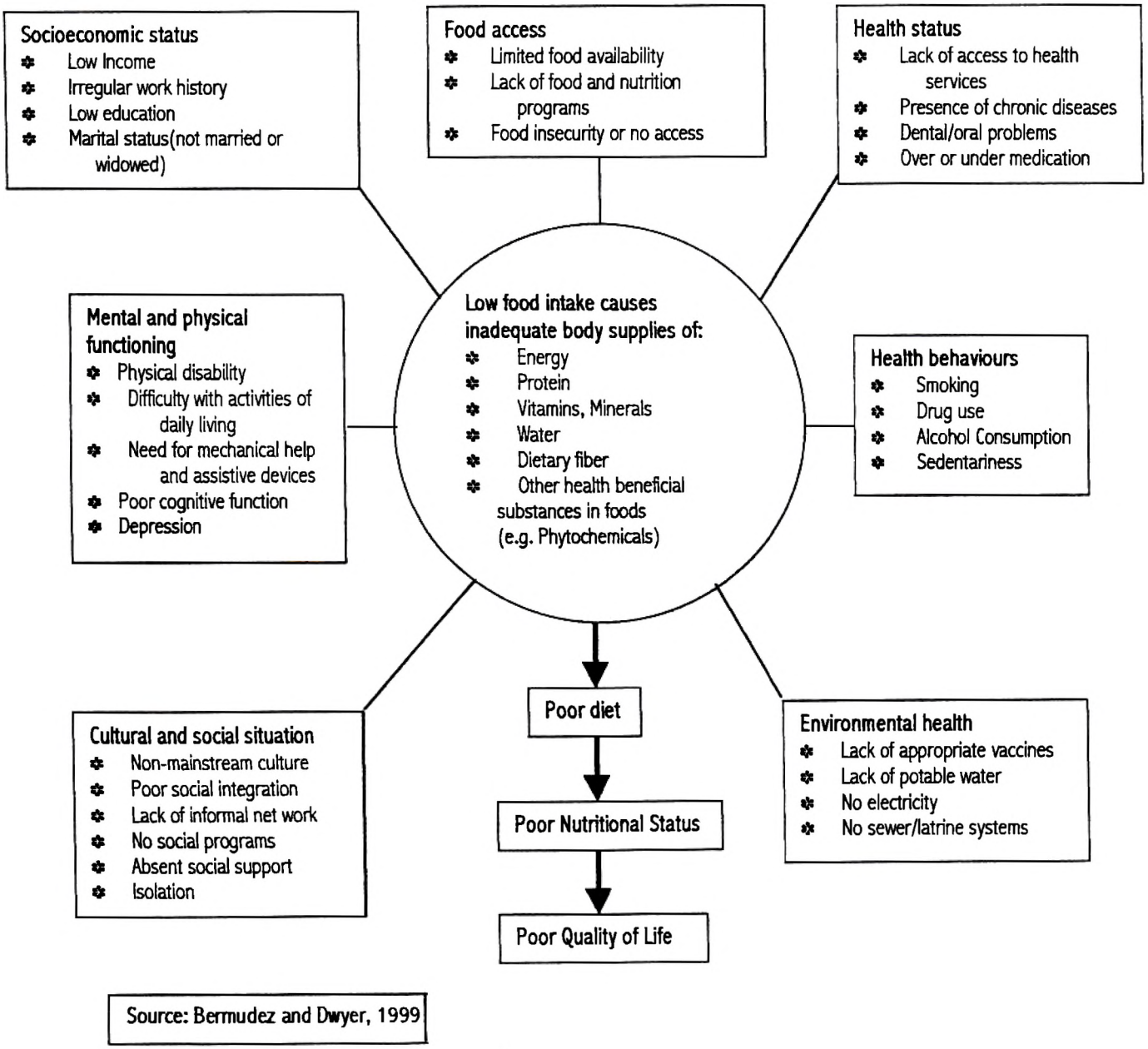


FIGURE 1

RISK FACTORS FOR POOR NUTRITIONAL STATUS IN OLDER PERSONS

suitable diet is the greatest single factor in preventing senility, increasing life span and the period of vigorous activity. Hence proteins, fats, carbohydrates, vitamins and minerals have their place in the diet of the aged. The nutrient requirements of elderly are discussed below:

1. Energy

An important bodily change taking place with advancing age is decrease in the number of functioning cells which results in decrease in the metabolic processes of the body. This also includes activities of the heart, respiratory and urinary system. Therefore, as age advances, energy needs of the body are reduced. The level of energy expenditure will determine energy requirements, and the dietary intake needed to meet them. There is a reduction of Basal Metabolic Rate of about 10 per cent probably between the age of young adulthood and about 60 years, and another 10 per cent of decline by 75 years. Maintaining an active lifestyle has many potential benefits for the elderly. Calorie requirements decrease with age, being about 25 per cent less than those of normal adults doing sedentary work. There is no exact data about calorie requirement in the elderly in India. According to the Recommended Dietary Allowance, published by Indian Council of Medical Research (ICMR), after a 25 per cent reduction the calorie requirement for elderly men is 1800 kcal/day and for elderly women is 1400 kcal/day. Weindruch and Sohal (1997) reported that energy restriction prolongs life and evokes an array of responses including a decrease in oxidative stress and damage and may retard the ageing process in humans.

2. Protein

The recommended allowance for protein is 60g/day and 50 g/day for the male and female adults respectively. However the elderly

may require a safe protein intake in the range of 1.0 to 1.25g/kg body weight/ day to maintain protein stores. Protein is important for elderly to maintain their muscle mass and bone health. Elderly women especially need dietary protein to maintain bone mass (Bell and Whiting, 2002).

3. Fat

The diets should include atleast 40-50g of fat/day and half this quantity should be in the form of vegetable oils rich in Essential Fatty Acids (EFA). According to Dramadi et al., (2002) a higher intake of n-3 polyunsaturated fatty acids from both plant and marine sources might have a beneficial effect on life expectancy in older Japanese, in particular for those who are not chronically energy deficient.

4. Vitamins

The requirement for vitamins is not markedly changed in old age, but apparently, greater attention must be paid to an adequate diet supply, since a diminished total food intake and poor selection of foods may lead to less efficient absorption. There is no differentiation in the recommended allowances for vitamins A and ascorbic acid but there is a decrease in the need for thiamine, riboflavin and niacin due to lower energy need. It is essential to have 400 IU of vitamin D in the diet as it will help in the absorption of calcium to prevent osteoporosis to some extent. Vitamin B_{12} absorption does not decline with age, and healthy older populations in general do not seem to have lower serum B_{12} levels than younger groups. The Panel on Dietary Antioxidants and Related Compounds recommended levels for vitamin E for both elderly men and women as 15mg per day (Monson, 2000).

5. Minerals

The requirement for minerals do not increase because of age and they remain the same as for the younger adult. Since demineralisation of bone is present among aged persons calcium intake should not be less than 500mg. By contrast, most international organisations suggest an intake between 1000-1200mg/day for elderly men and women, to maintain bone mass and reduce osteoporotic fracture risk. Iron needs of women lessen after menopause but even mild anaemia affects the health of old people. Since iron is essential for the formation of haemoglobin in the blood, it is necessary to have 20-30mg of iron per day (Pasricha and Thimmayamma, 1997). Trace elements like zinc, iodine, copper, magnesium and so on should also be considered, as these are valuable components of several enzymes and hormones and influence the body's immune status.

6. Water

Water is an important nutrient that is frequently overlooked. Since the thirst response decreases with age, the elderly may not drink enough for their daily needs. The kidney can function more adequately when there is sufficient fluid and hence to eliminate the waste solids. It also helps the skin from drying out and cracking and it is necessary for cooling the body. Older adults should be encouraged to make a habit of drinking water and other fluids throughout the day, even if they do not feel thirsty (Srilakshmi, 2002). Although not a provider of energy, adequate fluid and water intake is essential. The fluid requirement of older adult is calculated as 30ml/kg body weight per day with a minimum requirement of 1500 ml per day.

7. Fibre

Dietary fibre or roughage is the name given collectively to indigestible carbohydrates present in the food. Many elders select diets that lack adequate fibre content. This choice together with an inadequate fluid intake leads to persistent constipation and often to the use of harmful laxatives and mineral oils. There is plenty of roughage in wheat, millets, spices and condiments, greens, vegetables and fruits. The elderly should try to include 20-40gram of dietary fibre in their diet each day (Prabhu and Singh, 2002). Adequate dietary fibre helps older people to prevent constipation and diverticular disease.

C. HEALTH AND NUTRITIONAL PROBLEMS OF ELDERLY

Hayflick (2000) indicated that the goal of research on ageing is not to increase human longevity regardless of the consequences, but to increase active longevity free from disability and functional dependence.

Diet restriction during adulthood is a well-recognized method of slowing ageing and prolonging life span. Reducing nutrition at the earlier stage of life has opposite effects, resulting in accelerated ageing, a reduction of life span and to a variety of age related diseases (Sayer and Cooper, 1997).

The health of elderly people is often affected by inadequate nutritional intake. Psychological determinants and the higher prevalence of acute and chronic illness are risk factors for nutritional deficiencies in the elderly (Salva and Pera, 2000).

According to Mody (2002) malnutrition is a common finding in older adults. Various studies in the west have shown that the prevalence of malnutrition remains high, with 15 per cent of community dwelling, almost 50 per cent of hospitalized and 12 to 85 per cent of institutionalized older adults being malnourished. Prevalence of malnutrition among seniors in India, is probably just as high, if not higher. The factors that are responsible for poor nutrition in older adults are social isolation, poverty, depression, cognitive and functional decline, chronic medical conditions, medications and immobility. Apart from these, sensory loss, particularly in taste and smell, can lead to decreased appetite and a predisposition to malnutrition.

Malnutrition in combination with zinc deficiency is one of the most frequent co-morbidities of old age (Seiler et al., 2002). Protein energy malnutrition is common in the elderly especially in hospitalized patients. The malnutrition arises due to combination of factors including poor diet, social isolation, poverty, physical and psychological illness and in some case, malabsorption syndrome (Warland et al., 2000, Philip and Greenwood, 2000 and Allison, 2002).

A high rate of malnutrition in elderly patients has been noted in various clinical settings by many investigators over the last few decades and is accompanied by a high mortality rate (Persson et al., 2002).

Saibaba (1998) states that an important bodily change taking place with advancing age is decrease in the number of functioning cells, which in turn decrease the energy needs of the body. Food intake has, therefore, to be suitably modified.

Ismail, (1999) observed that under-nutrition was most marked with increase in age among women. This was most marked in India where it rose to nearly 60 per cent among women over 70 years. The prevalence of anaemia was high in 38 per cent among men (<13g/dl) and 52 per cent among women (<12g/dl). Similarly, Gopalan (2003) indicated that anaemia was a public health problem in poor elderly, especially elderly women were worse sufferers.

A study conducted by Devi and Premakumari (1998) among the aged above 60 years from urban and rural areas indicated that anaemia is a major nutritional problem which was found to be wide spread among the rural subjects than the urban subjects.

It was also observed that the prevalence of angular stomatitis, bleeding gums, phrynoderma, glossitis and dry and rough skin, was more among the elderly people living in rural areas than in urban areas.

A micro study conducted by Kabir (1992) on the effect of social change on the health of the elderly revealed that more than half (52.2%) of the respondents were suffering from various diseases and 41.3 per cent had no complaints. The most common ailments were heart disease/blood pressure/ paralysis (23%), fever, cough and cold (11.5%) and gastric ulcers (10.1%). Attack rates for tuberculosis are several fold higher in old age than among the young (Chandra, 1990 and Gates, 1993).

Ageing is associated with a decline in lean body mass.

Weight loss in elderly leads to cachexia, with a preferential loss of fat free mass and body cell mass (Schneider et al., 2002).

Loss of appetite or anorexia is common among the elderly. Anorexia that lead to weight loss is highly suggestive of malaise, depression, worries, anxiety or organic disease (Casper, 1995).

Dysphagia and anorexia are among the nutritional problems that exist in elderly patients. These result to malnutrition, a decrease in immune function and a shortened life span (Komatsu, 2001 and Potter, 2002).

Ageing is associated with decline in immune response, which contributes to increased incidence of infections and neoplastic diseases (Meydani and Hayek, 1995).

According to Dube (1999) there is a greater susceptibility to infection among elderly and they are prone to degenerative diseases like arthritis, atherosclerosis, malignancies, blindness due to cataract, hearing loss, dementia and slowing down of intellect.

Cataracts are a leading cause of blindness, and occur more frequently and become more severe as people get older. Decreased vitamin C levels in the lens of the eye have been associated with increased severity of cataracts in humans. Some studies have observed increased dietary vitamin C intake (Jacques et al., 2001) and increased blood levels of vitamin C (Simon and Hudes, 1999) to be associated with a decreased risk of cataracts.

Brain and Taylor (2001) states that cataract prevalence increases with age. As the world's population ages, cataract-induced visual dysfunction and blindness is on the increase. This is a significant global problem.

Due to prolongation of life span our elderly people suffer from several degenerative diseases like cardiovascular diseases, cancer, diabetes and osteoporosis (Polasa, 1998).

Natarajan (1999) states that cardiovascular disease is becoming the leading health problem in elderly and most of the risk factors are associated with nutrition and can be reduced by changing the food and lifestyle habits.

According to Sabharwal and Sharma (2003) cardiovascular disease and hypertension were more prevalent among elderly men than elderly women. High blood pressure is associated with higher incidence of cardiovascular disease with ageing, blood pressure increases and body build changes. Higher blood pressure is associated with cardiac enlargement, which may cause a change of chest size, resulting in a change of body build (Hong et al., 2003).

Bodily functions such as cardiac output, lung capacity and kidney function declines with advancing age. The functioning of gastro intestinal tract also declines with ageing (Russell, 2000). Constipation is one of the most common gastro intestinal complaints in the elderly. As ageing occurs, the digestive system slows down a bit, making it harder to break down food and eliminate waste. Apart from this, hormonal changes during menopause can cause occasional bouts of constipation (Dodd, 1999).

Johnebnezar (2003) states that knee pain is a common problem in elderly and it can be prevented by self-care. They should use a cane while walking, in which the cane functions like a third limb and takes one third of the body weight, thereby reducing the load on the knee joints. The elderly

could also adapt proper postural habits, keep a check on the body weight, avoid squatting on the ground and sitting cross-legged on the ground, use proper foot wear and avoid high heeled slippers, and standing for long durations to prevent knee pain.

Ailments such as pneumonia, tuberculosis and rheumatoid arthritis are significantly more common in the elderly. Problems with chewing and swallowing, difficulties in munching foods due to dental decay, immobility and mental restrictions are responsible for reduced food intake and malnutrition (Chithra and Kannappan 2002).

Dental problems are as frequent among elderly as among children and younger adults and dental problems in old age could be due to change in diet, decrease in oral hygiene, self care and diminished salivary flow (Prakash, 1999).

Alzheimer's disease is a degenerative brain disorder that usually begins in old age causing a person to forget recent events or familiar tasks (Mohandas and Suvarna, 2002).

Older people constitute a small but significant proportion of HIV (Human Immune Deficiency Virus) /AIDS (Acquired Immune Deficiency Syndrome) cases. In India, 11 per cent of the total HIV cases involves people over 50 years of age. Pneumonia, common secondary infection caused by HIV, is often diagnosed in older people as a simple lung disease (Manmohan, 1998).

Melatonin, a hormone secreted from the pineal gland in humans during the night, is a highly efficient free radical scavenger and antioxidant. However, the night time production of melatonin falls markedly with ageing. The loss of this potent antioxidant during ageing may be consequential in terms of cellular and organismal ageing, as well as the onset of age related diseases (Reiter, 1995).

A study by Napoli et al., (1997) showed that the levels of lipid peroxides in Low Density Lipoproteins from elderly men were higher under basal conditions than were those both of adult and of young men.

Natarajan (2003) opines that senior citizens could ensure good health for themselves by following the maxim 'prevention is better than cure'. He also pointed out that old age is associated with disease but does not cause it. Death is no doubt inevitable but disease is not. Diseases in old age are either preventable or treatable. Periodic health check-ups would help in detection of silent diseases. Early diagnosis prevents complications at later stages.

D. ANTIOXIDANTS AND AGEING

The body utilizes oxygen and its metabolites in energy conversion, to oxidise endogenous compounds and to detoxify xenobiotics. During these processes, a series of reactive chemical intermediates called "Reactive Oxygen Species" (ROS) are produced (Krishnaswamy and Neelam, 1998). ROS generation in body may occur accidentally or deliberately. The ROS have been implicated in the etiology of a host of degenerative diseases including cardiovascular disease, diabetes, cancer, neurodegenerative disorders

and ageing. The ROS or free radicals of biological importance include nitric oxide, dioxygen, superoxide and lipid hydroperoxyl radicals.

Dietary antioxidants like vitamins C, E, β-carotene, zinc, selenium, copper and so on are looked at from the point of view of preventing lipid oxidation, disease prevention and health protection. These antioxidants avidly react with annihilate active oxygen species before they could inflict oxidative damage to vital components, such as DNA or cell membranes.

Maskarinec et al., (1999) states that lipid peroxides are produced in membranes from unsaturated fatty acids as a result of exposure to oxidants and free radicals and may be involved in tumor promotion. Antioxidants such as carotenoids, other micro nutrients such as flavonoids, isoflavones, folic acid and vitamins E and C react with a variety of oxidants, thus protecting the cells against oxidative damage. The measurement of serum lipid peroxide levels might provide a useful marker of endogenous oxidation or of susceptibility to oxidation. The results of studies conducted by the same author suggest that motivated women can substantially increase their fruit and vegetable intake, which leads to an increase in plasma carotenoid levels.

In recent years nutritionists have advocated diets rich in fruits and vegetables and high in antioxidants which are believed to sop up free radicals and remove them from the system. (Kluger, 1997). Older people should be encouraged to increase the variety of foods they eat, especially nutrient rich foods such as fruits, vegetables and whole grains (Brody, 2001). Natural antioxidants such as vitamins C and E and β-carotene, as well as an optimal calorie and protein intake, should be corner stones of treatment and prevention of degenerative diseases for the ageing patient (Goldstein, 1993).

Meydani (2002) supported that the consumption of fruits and vegetables, which contain several forms of phytochemicals with antioxidant activity, may reduce the risk of cardiovascular disease and cancer, the leading causes of morbidity and mortality among the elderly.

Certain vitamins and minerals offer protection against cancer, cataract, Parkinson's disease, rheumatoid arthritis, cardiovascular disease and those diseases caused by radical damage. Extra doses of these nutrients may slow ageing process. The most recommended vitamins are antioxidants such as vitamins C, E and β-carotene. These inactivate free radicals in damaged cells and doses for preventing disease are higher than the RDA. These extra vitamins can easily be obtained from the diet itself. Carrots are rich in β-carotenes which act as antioxidants (Saibaba and Ramamoorthy, 1996).

Ascorbic acid as an antioxidant inhibits lipid peroxidation by haemoglobin or myoglobin-hydrogen peroxide mixtures and prevents heme breakdown to release iron ions, by being preferentially oxidized. Ascorbic acid also protects plasma lipids against peroxidation induced by activated neutrophils (Halliwel, 1994). To enhance the antioxidant properties, it is best to take vitamin C with the other antioxidants, as there is strong evidence of synergy between various antioxidants.

Finkel and Holbrook (2000) observed that enhancement of antioxidant defenses through dietary supplementation would seem to provide a more reasonable and practical approach to reduce the level of oxidative stress.

Antioxidants have been linked to protection against degenerative diseases associated with ageing (Hallfrisch, et al., 1994). Oxidative damage may be involved in atherogenesis. Dietary antioxidants such as β-carotene may reduce the risks of cardiovascular disease (Gaziano et al., 1995).

Cross-sectional observations on older persons revealed that β-carotene rich foods might protect against cognitive impairment in older people (Jama,et al. 1996). The ability of β-carotene to reduce lipid peroxidation in humans was observed on the change in plasma β-carotene concentrations, which increased significantly (Allard, et al., 1994).

Lycopene is a carotenoid pigment that gives tomatoes their characteristic red colour. In the body, these pigments capture electrically - charged oxygen molecules that can damage tissue. So they are called antioxidants. Subsequent research has found that lycopene also reduces the amount of oxidized low-density lipoprotein, the so-called bad cholesterol and so may reduce heart disease risk. As an antioxidant, lycopene is able to capture twice as many oxygen ions in the body as is β-carotene (Health Action, 2002).

Mc Alindon et al., (1996) suggest that high intake of antioxidant micronutrients, especially vitamin C may reduce the risk of cartilage loss and disease progression in people with osteoarthritis. People who have low-nutrient diets are at risk for vitamin C deficiency. In addition, elderly men who consume few fruits and vegetables are at risk.

Kossi and Zakhary (2000) investigated the status of oxidant stress in the acute phase of thrombotic cerebrovascular stroke and the possible role

of homocystine. Statistically significant elevation of homocystine, lipid peroxide and nitric oxide plasma levels were observed in stroke patients compared with healthy controls, whereas, the antioxidant ascorbic acid plasma levels were significantly lower in the patient group compared with healthy control subjects. The significant reduction in patients' plasma ascorbic acid matches that reported by Sharp et al., (1994). Mortality from stroke in elderly people was highest in these with the lowest vitamin C status, whether measured by dietary intake or plasma concentration of vitamin C (Gale, et al., 1995).

Vitamin C can enhance the immune function in a number of ways. Healthy adults received 1gram of vitamin C intravenously. One hour later, the neutrophil motility and leucocyte transformation in the subjects' blood had increased significantly. Vitamin C also enhances the leukocyte function and it is shown to decrease bacteriological activity (Gaby and Singh, 1991).

The results of research done by West et al., (1994) suggested that alpha-tocopherol was associated with a protective effect for AMD (Age-related Macular Degeneration). An antioxidant index, including ascorbic acid, alpha-tocopherol and β-carotene, was also protective for AMD, but vitamin supplements showed no protective effect.

Jialal et al., (1995) have shown that supplementation with high doses of vitamin E decreases the susceptibility of low density lipoproteins to oxidation–an effect that is believed to be important in the prevention of atherosclerosis.

Burton et al., (1998) proved that natural vitamin E supplements are better than synthetic forms, since the body retained it twice as sufficiently

as the synthetic version. Antioxidants in the lung have a protective role against oxidative damage. The results of studies conducted by Dow et al., (1996) suggest that dietary intake of vitamin E may influence lung function in the elderly. Deucher (1992) observed good results in majority of patients with age-related diseases and persons in diminished health without apparent disease who were treated with antioxidants such as vitamins C, and E, β-carotene, selenium, zinc and chromium.

Reddy et al., (1997) states that industrialisation and urbanisation cause exposure to environmental pollutants, reactive compounds of smog and free metal ions, all of which induce free radicals that lead to lipid peroxidation and peroxidative damage results.

Wise et al., (1996) stated that highest consumption of mixed fruits and vegetables reduced risk of CHD, stroke, cataracts and cancer at multiple sites. High levels of natural antioxidants, including the carotenoids, tocopherols and ascorbic acid appear to be responsible for these reductions in risk. However, long-term intervention studies to alter chronic disease outcomes have generally used a single nutrient such as β-carotene at high doses, and results have been disappointing. Because antioxidants have multiple and synergistic interactions, it is desirable to use supplementation that increases blood levels by the use of chemoprotective substances in amounts more closely approximating amounts of mixed diets.

There is increasing scientific interest in the role of free radical oxidants in a number of diseases associated with older age. There seems no reason to discourage older people who wish to ingest extra vitamin E and

vitamin C. A diet with adequate vegetables and fruits should provide these antioxidants (Ward, 1994).

E. IMPACT OF SUPPLEMENTATION ON ELDERLY

Low food intake and increased incidence of physical diseases interferes with intake, absorption, metabolism and utilization of nutrients leading to nutritional deficiencies in the elderly. These nutritional deficiencies can lead to impaired immune function. Several studies have proved the beneficial effects of nutritional intervention on elderly (Chandra, 1997).

A study of immune function in elderly persons in New Jersey showed that taking a daily multivitamin for one year resulted in a stronger immune system and higher blood levels of several vitamins. The researchers suggested that current recommendations for some micronutrients may be too low to support optimal immune function in healthy, independently living older adults (Bogden, 1994).

Chandra (2001) reported that vitamin and trace element supplementation should be provided to all elderly subjects because it should significantly improve cognition and thus quality of life and the ability to perform activities of daily living. Such a nutritional support or approach may delay the onset of Alzheimer's disease.

Bendich et al., (1997) reported that long term vitamin E supplementation had the potential to reduce the incidence of heart disease in elderly. Studies conducted on elderly by Gariballa and Sinclair (1998) revealed an association between increased risk of coronary heart disease and low plasma concentration of antioxidants. Gray-Donald et al., (1995) observed

that frail elderly can gain weight through oral supplementation, indicating the reversibility of weight loss in this group, but changes in functional status indicators may require, a longer period of supplementation.

Wise et al., (1996) studied the changes in plasma carotenoid, alpha-tocopherol and lipid peroxide levels in response to supplementation with concentrated fruit and vegetable extracts. The results revealed that after 28 days, plasma antioxidant levels increased significantly whereas serum lipid peroxides decreased fourfold after 7 days and remain significantly lower than baseline at 28 days. Decreases in lipid peroxide levels were coincident with increases in carotenoids and alpha-tocopherol and reflect functionally improved oxidative defense mechanisms. Because these bioactive compounds can act synergistically, the effect cannot be attributed to any one component, but it may reflect a combined mechanism of antioxidant defence.

Vitamin C's antioxidant mechanisms may help to prevent cancer in several ways. Vitamin C combats the peroxidation of lipids, for example, which has been linked to degeneration and the ageing process. One study of elderly people found that 400mg of vitamin C per day (for a one-year period) reduced serum lipid peroxide levels. Vitamin C can also work inside the cells to protect the DNA from the damage caused by free radicals (Gaby and Singh 1991).

There is also good evidence that adequate intakes of antioxidant nutrients including vitamin C, vitamin E and β-carotene could substantially delay or prevent development of cataracts (Jacques et al., 1997). There is also increasing evidence that generous intakes of carotenoids such as lutein and zeaxanthin may reduce the risk of macular degeneration, the leading

cause of age-related blindness in the United States (Snodderly, 1995 and Landrum et al., 1997).

Lee et al., (2000) suggested that supplementation with natural carotenoids may partially protect human skin from ultraviolet A (UVA: 320-400nm) and ultraviolet B (UVB: 290 – 320nm) radiation–induced erythema, although the magnitude of the protective effect is modest. In this study, the α and β-carotene levels increased whereas serum lipid peroxidation was inhibited during natural carotenoid supplementation.

Most people do not consume enough calcium from diet alone, and calcium supplements have been shown to be effective in boosting calcium intake and maintaining or increasing bone density (Dickinson, 1998).

Supplementation with antioxidants, especially vitamin E on elderly women agricultural labourers revealed that the peroxide levels are reduced after vitamin E supplementation. This reduction in peroxide values can be related to a delay in the process of ageing due to reduction in the free radicals due to ageing (Chandrasekhar, 2000).

Nutritional deficiency states are associated with age. Such deficiencies can be corrected by supplementation with specific vitamins. When low plasma levels of vitamins occur in elderly, they can be reversed by the administration of the specific nutrient. In one of the studies, vitamin C supplementation for a period of 12 weeks increased blood levels of vitamin C. Serum carotenoid concentration was associated with life span energy and a good correlation has been established with age and serum carotenoid levels. Vitamin E was also associated with maximum life span potential for

longevity. The results of various studies suggest that elderly individuals might benefit by vitamin supplementation (Bhatia, 1997)

Researches at the Royal London School of Medicine report that supplementation with vitamin E markedly reduces arthritis pain. Sixty per cent of the patients treated with natural vitamin E reported a marked decrease in pain after 2 weeks period of supplementation (Alive Magazine, 1998). A new research suggests that lycopene another carotenoid found in tomatoes may be more protective than α and β-carotene (Eating Well Magazine, 1998).

Mol et al., (1997) showed that increased invivo oxidative stress and inflammation in Diabetes mellitus and smoking is partly overcome by vitamin E supplementation. In another study by Paolisso et al., (1993) daily vitamin E supplements seemed to produce a minimal but significant improvement in the metabolic control in type II diabetic patients.

Aspirin-like compounds and certain vitamins successfully prevented the sugar-induced molecular changes from occurring in corneal and scleral collagen, suggesting that such compounds could have a useful role in this aspect of ageing (Malik and Meek, 1996).

Pierce (2002) suggested that nutrition programmes should reexamine and perhaps refocus objectives to better match the perceptions of elders regarding nutrition stress and nutrition support. Klesges (2002) also reported that nutrition assistance programmes for the elderly should reexamine their effectiveness in preventing nutritional deficits in older disabled women.

Wouters - Wesseling (2002) reported that nutritional supplementation is well accepted and can improve the nutritional status of elderly people. Kyunghea (2002) suggested that for successful ageing, programmes for rural elderly are needed, i.e., actions to provide minimum economic life, food delivery and psychological or physical health care through regional public health center. Mc Cool (2002) reported that, even though nutrition education and policies change, older persons must continue to focus on nutrient dense foods. Martin (2001) reported that preventive measures should provide voice of the older consumer information which will enable policy makers, research and development workers and consumer groups who support the elderly to provide foods appreciated by older people.

A study conducted by Reddy et al., (1999) reveals that the urban elderly population had higher serum lipid peroxides, serum lipids and lower antioxidant status than rural elderly men. Proper nutrition, combined with supplementation to strengthen antioxidant network may lead to improved lifestyle and enhance the general feeling of well being.

F. PSYCHO SOCIAL PROBLEMS OF THE ELDERLY

1. Ageism:

Ageing is a biological process, experienced by mankind in all times. However, concern for ageing of population is a relatively new phenomenon, which has risen due to significantly large increase in the number and proportion of aged persons in the society. Ageing is not only biological in nature but also a cultural process. Physical, social and emotional changes at this age require readjustment in interpersonal relations in different situations with the members of the family and society (Husain, 1997).

Ageism is stereotyping and discriminating against people because of their age. Old people are thought to be senile, rigid in thought and manner, old fashioned in morality and skills. Ageism allows younger people to see old people as different from themselves (Ivers and Meade, 1999).

The contributions of aged in the field of education, socialization, social control, transmission of cultural values and social heritage to the future generation cannot be underestimated. In most Asian countries in general, and in India in particular, the elderly were considered an asset within the joint family structure wherein they were ensured of familial care and support. But gradually with the advent of industrialization, migration to the cities, more employment opportunities in urban sector, the joint family structure began to change and switch over to the smaller nuclear family which was more mobile and more suitable to the needs of the new techno-sphere. The so called nuclear family became the standard, socially approved, modern models and an identifiable feature of all contemporary societies. This made the sharp decline in the status and position of the aged in the family and shift of authoritarian power to the young (Singh, 1995).

2. Family Structure

The family has generally been considered the traditional primary source of social, economic, psychological and physical support for the elderly. It is crucial even today. In developed countries, where the state has assumed responsibility for the welfare of the aged, there is growing evidence of family being called to assume responsibility (Pattanaik, 1999).

3. Financial Insecurity

The biological, psychological and social problems in old age interact to accelerate the ageing process by speeding up the rate of decline. The loss of self esteem and feelings of being neglected and unwanted at home arises due to economic insecurity. Financial dependence upon the younger generation compel to stay with them under one roof. The two sides, thus, keep having problems with each other, though they do not like to admit, partly because of the emotional bond between parents and children and partly because of the perpetuating myth of respect and reverence towards the elders. There is almost always a generation gap between the two generations which precipitates the problems already existing between them (Chadha and Sinha, 1997).

4. Urbanisation

In pre-industrial times, people had no sudden break from the work they had been doing for decades. Those living off the land could adjust their activities to their physical capabilities. They continued to tend cattle, mend fences, go to market and help with harvest. In stable rural communities, the experience and wisdom which older people had accumulated were widely respected. The time at which work stopped varied from person to person and usually coincided with biological ageing. Unlike their rural forefathers, retired industrial workers were obliged to stop work suddenly on a specific day. As the skills they had acquired over a working life were mechanised or became obsolete, so also their status declined. Retirement is thus largely a product of our times and because it still has strong associations with old age, it tends to be viewed negatively (Mulley, 1995).

5. Social insecurity

The aged feel a sense of social isolation because of break from work relationships, demise of relatives and friends and mobility of children to far off places for jobs. The situation worsens when there is physical incapacity and financial stringency. Retirement from active service, declining work efficiency, prevalence of disease, feeling of loneliness and neglect, dependence on the successive generation are the factors catalytic to create psychological problems of the urban aged (Arora, 1993).

6. Rural living

A positive feature of aged population in rural India is that most of them are economically active, presumably because most of them are engaged in those sectors of economy in which there is no specific retirement. However, female labour participation is low in aged population with 15.82 per 100 persons at 60+ age as against 68.92 in the case of men. It means women withdraw themselves from the active labour force comparatively earlier and in this process lose their economic independence also. Microlevel study undertaken on aged population spread over four villages of Athur block, Dindigul district revealed that health problems and economic insecurity are the major problems being faced by the majority of the aged. Inspite of their physical inability and mental agony, the aged males who belong to agricultural and non-agricultural labour class continue to work for earning their livelihood in the absence of any economic security during old age. Disengagement from work is very rare in the age group of 60-70 among the males. A high incidence of single member households among the aged rural women is indicative of distress and destitution (Prakash, 1991 and Lalitha, 1999).

Aged people in rural areas have less facilities than the aged of urban areas; the aged in rural areas are economically more vulnerable; and the majority of the elderly in rural areas are without any income (Goyal, 1992 and Ranade, 1993). Apart from the basic problems like food, housing and health, the aged people also face social, psychological, family, personal and occupational problems.

However, Rao (1999) opines that the population of elders in the Indian villages are in a better shape. They are more content so far as emotional security and economic self reliance is concerned. Traditional value and family bonds are still very strong, unlike in the urban milieu.

7. Mental status

Old age brings a reduction in memory and subjects the aged, to varied kind of mental illness. Old age comes with worry over finance, anxiety over health, feelings of being unwanted, isolated and lonely, feeling of guilt, irritation, untidiness, inability to adjust to changed conditions and decreased social contacts and participation. The old persons begin to feel that even his children do not look upon him with that degree of respect which he used to get few years earlier. The old person feels neglected and humiliated. This may lead to the development of psychology of shunning the company of others. Loneliness in turn may give rise to depression and may eventually lead to worsening of sickness (Husain, 1997).

8. Social status

Surender and Khan (1996) reported that in India the number of elderly widows are more than widowers. With the increase in the number of

widows or widowers, more people are forced to live alone and also face social neglect. The widows are meted out a harsher treatment than widowers. For instance, a widow cannot attend any social ceremonies, but a widower can, which again lead to the development of the psychology of shunning the company of the society.

According to Kvale and Kumar (2002) older persons have developmental issues unique to their age. Understanding the developmental issues of the elderly related to psychological changes provides a context for understanding the kind of behaviours and thinking that are observed. The experience of repeatedly dealing with loss is the first developmental issue. The second developmental issue for the elderly is to come to personal terms with the meaning of their lives. The third developmental issue for the elderly is coming to terms with one's own death. What most persons fear is the experience of disability, loss of function, loss of control of decision making and being forced to be dependent on family or other care providers. These developmental issues are of spiritual concern. The final years of life are a time of bringing to closure, which is called the spiritual journey.

Psycho-social changes will affect a very large segment of the elderly population, especially among the female population, and characterised by depression, dementia and Alzheimer's disease. Hence, the national health care system has to get geared to meet this challenge in the new millennium (Bagchi, 1999).

G. IMPORTANCE OF NUTRITION EDUCATION

Nutrition education has been defined as educational measures for inducing desirable behavioral changes for the ultimate improvement in the nutritional status of individuals and family. (Bagchi, 1987). It is the process of imparting to the public the knowledge which is aimed at general improvement of nutritional status through promotion of adequate food habits, elimination of unsatisfactory dietary practices, introduction of better food hygiene and more efficient use of food resources.

The aim of nutrition education is to bridge the gap between nutrition research and its application by translating scientific findings into everyday terms. The importance of nutrition education as a means for improving the nutrition of the community in the developing countries has been increasingly realized during recent years. Mridula et al., (2003) stated that it is generally seen that education has its impact on the life style of a person.

An affluent but nutritionally illiterate population that faces more and more malnutrition is evidence enough to show a need for nutrition education. It is an integral part of all nutrition intervention programmes. Its has been well recognized that one of the weakest links in intervention programmes to control malnutrition is absence of proper nutrition education. Scarcity of appropriate location specific education materials is the weakness of nutrition education endeavors. (Saibaba and Raghuram, 1999). Therefore preparation of local specific nutrition education material is the need of the hour.

Computers are being used by dietitians internationally and will continue to be used in all aspects from data storage to nutrition education. The major areas of computer applications in the field of nutrition include studies on food and nutrient intake, food service management and menu planning, clinical nutrition and nutrition education programmes. The latest means of disseminating nutrition education is through the means of computers and several studies indicate that instruction in a computer resulted in higher test scores compared to conventional methods. (Cartwright, 1993).

Hence an attempt was made in this study to impart nutrition education to the elderly using conventional methods and computers.

METHODOLOGY

III METHODOLOGY

The methodology pertaining to the study entitled "Nutritional Profile of the Rural Elderly and Impact of Food Supplementation and Nutrition Education" is discussed under the following phases.

Phase I

1. Selection of area and elderly.
2. Methods and tools used for the study.

Phase II

Formulation and evaluation of a food supplement.

Phases III

1. Preparations of the food supplement for feeding.
2. Feeding Trial.
3. Evaluation of the food supplement on the selected elderly.
4. Feeding trials with adults.

Phase IV

1. Nutrition education for elderly.
2. Analysis and interpretation of the data.

The detailed procedure involved in each phase is given below.

Phase I

1.Selection of area and elderly

Rural areas belonging to Appakudal and Jambai Panchayat of Bhavani block in Erode District of Tamilnadu were selected for the study. These areas were situated approximately about 25 to 30km from Erode town (Figure 2).

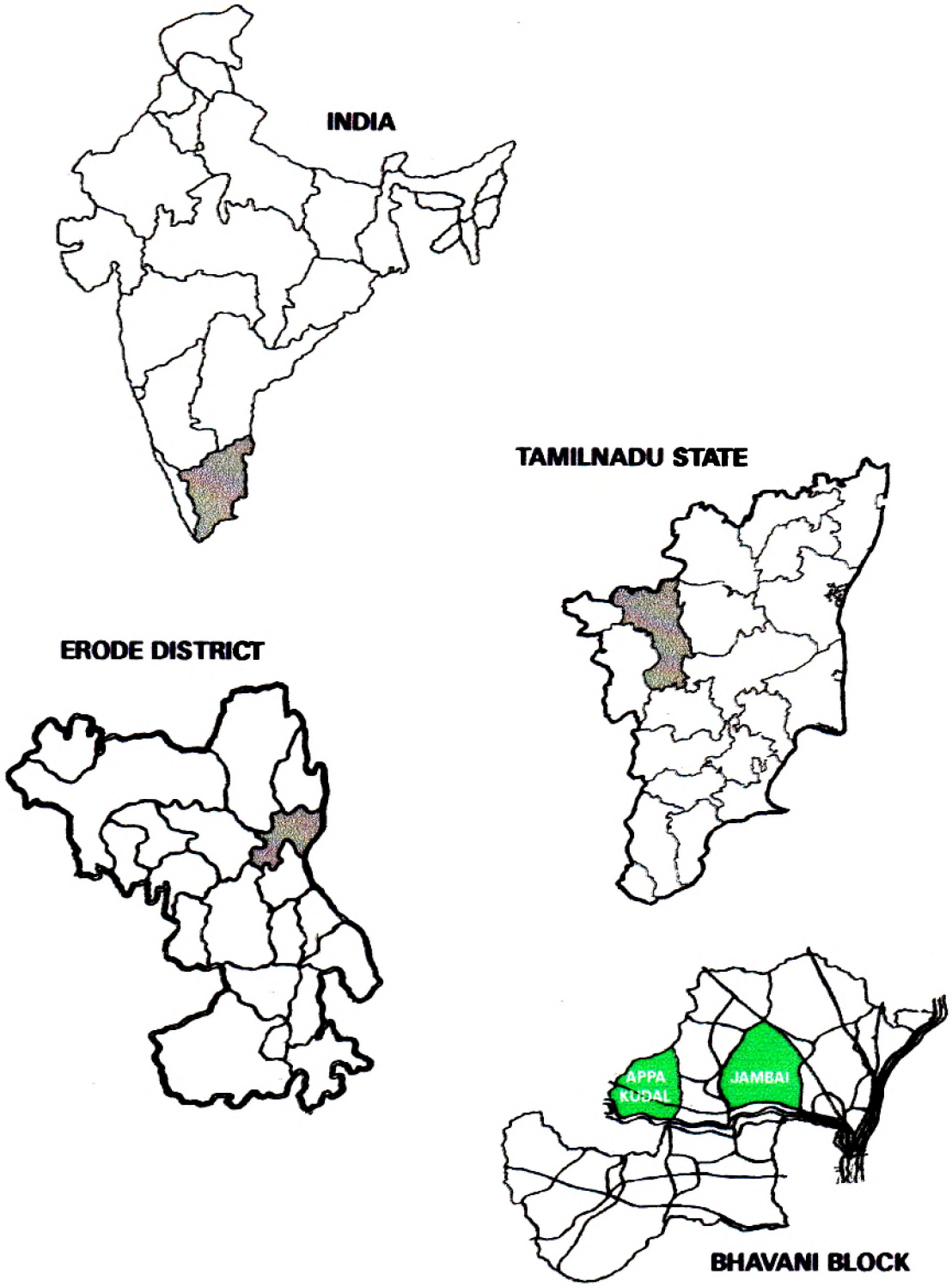


FIGURE 2

LOCALE OF THE STUDY

The reasons for selecting these areas for the study was that the investigator was hailing from the same area and it was possible for her to reach the study areas regularly and muster co-operation from the elderly for the smooth conduct of the study.

The local Panchayat leaders of the selected areas were contacted, appraised of the objectives of the study and necessary formalities were completed for conducting the study. The electoral roll details were collected from the two Panchayat boards to locate the elderly (above 60 years of age) for the study. From the total population of 2390 families of the selected areas, 1270 families had elderly members. The number of elderly men and women in these families were 712 and 842 respectively. From the total 1554 elderly members 500 elderly (250 Elderly Men and 250 Elderly Women) were selected using random sampling method. In sample selection equal weightage was given for both the sexes. The research design of the study is given in Figure 3.

2. Methods and tools used for the study

The following methods were used to collect the data.

a. Interview method

b. Body measurements namely height and weight.

c. Functional and Clinical assessment

d. Biochemical tests

e. Food weighment survey.

a. Interview Method

An interview schedule was developed (Appendix I) to elicit information on the following aspects of the elderly:

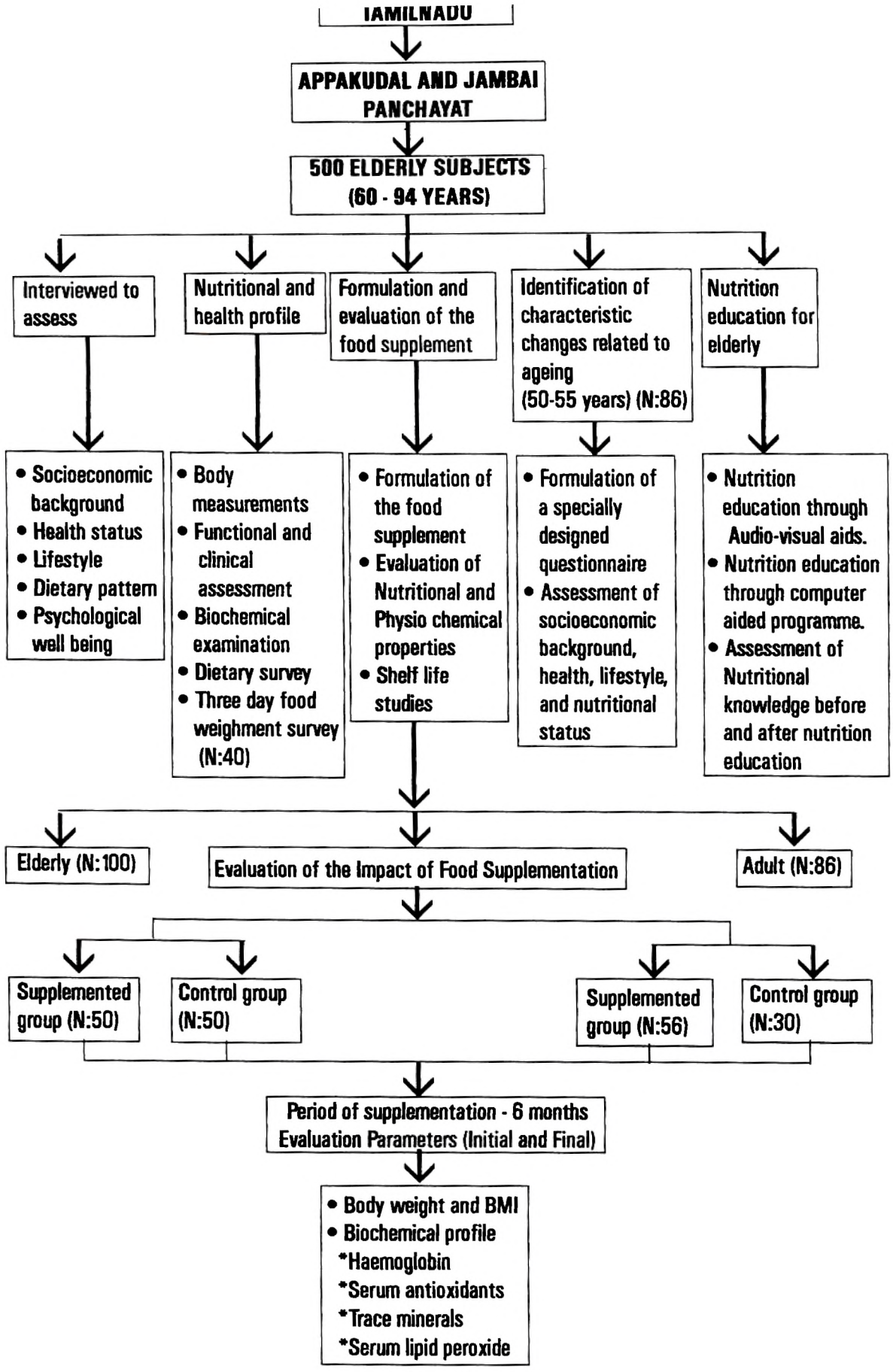


FIGURE 3

RESEARCH DESIGN

- ❖ Demographic particulars such as age, sex, marital status, type of family, number of children, educational level, erstwhile occupation and income.

- ❖ Details like regular exercise, personal habits, leisure time activities and physiological problems.

- ❖ Psychological well being in terms of the current status in their families and mental state of the elderly.

- ❖ A dietary survey schedule was framed (Appendix II) to obtain information on dietary practices such as diet and meal pattern, preference of food forms and taste, foods included and avoided, food beliefs and taboos, frequency of food consumption and problems while eating food.

- ❖ Extent of depression was studied using the Geriatric Depression Scale (Appendix III) developed by Verma, et al., (1993). The answers have to be obtained as 'Yes' or 'No'. All the questions are marked positively except for question numbers 1,7, 13, 17 and 20, which are marked negatively. A score of 1 to 7 indicates mild depression, 7 to 14 indicate moderate depression and 14 to 20 indicates severe depression.

b. Body measurements - height and weight

Anthropometry is the single most universally applicable method available to assess the size, proportions and composition of human body. It reflects both health and nutritional status and predicts performance, health and survival (WHO 1995). According to Jelliffe and Jelliffe (1991) anthropometric measurements are a valuable technique in the assessment of nutritional status. Nutritional anthropomertry is also used to assess an individual's response to nutritional rehabilitation (Rao and Vijayaraghavan, 1998).

Height measurements of the elderly were recorded in metric scale to the nearest 0.1cm. The elderly were asked to stand barefoot with heels, buttocks, shoulders and back of the head touching the wall and the arms hanging at the sides in a natural manner. A wooden scale was placed gently on the head perpendicular to the wall and the height was recorded. The body weight was recorded using a portable balance. Weight without footwear and with minimal clothing was determined and recorded in kilograms to the nearest 0.5kg.

The Body Mass Index (BMI) of the elderly was calculated using the following formula.

$$\text{Body Mass Index} = \frac{\text{Weight (in kilograms)}}{(\text{Height in meter})^2}$$

c. Functional and Clinical Assessment

Functional assessment is defined as a systematic, multi-dimensional, detailed evaluation of an individual's ability to perform various tasks associated with independent living (Rosenblatt and Jothydev, 2002).

The clinical examination is a method of ascertaining the nutritional status from which direct information of the signs and symptoms of dietary deficiencies prevalent among people are obtained (Swaminathan, 1999[a]).

The functional assessment regarding posture, gait, hearing, vision and speech were also gathered. All these details were recorded with the help of a trained physician (Appendix IVa). The clinical schedule designed by ICMR was used to diagnose the deficiency symptoms and other disorders prevailing among the elderly (Appendix IVb).

Phase II

Formulation and Evaluation of a Food Supplement

a. Selection of ingredients

Locally available, commonly used cereal, millet and pulse namely wheat, ragi and green gram were used in the food supplement. Vegetables namely carrot and Amaranthus (Amaranthus gangeticus) and ripe tomato were also processed and added to the mix. These foods were selected for inclusion in the supplementary food formulation because of their inclusion in the common dietaries and also for their macro/micro nutrient contribution and the presence of specific antioxidants and fibre.

The processing techniques used for the various food items and the composition of the food supplement are given in Table II.

TABLE II

PROCESSING OF FOOD ITEMS AND COMPOSITION OF THE FOOD SUPPLEMENT

Food items	Processing methods	Quantity (g)
Wheat (W)	Malting	20
Ragi (R)	Malting	15
Greengram (G)	Malting	5
Ripe Tomato (T)	Blanching	35
Carrot (C)	Pressure cooking	15
Amaranthus (A)	Blanching	10

To arrive at the final composition of the food supplement indicated in Table II, totally three different combinations namely I - W:R:G:T:C:A:25:20:30:10:10; II – 20:15:5:35:15:10 and III – 20:25:10:35:5:5

were tried out and through sensory evaluation, combination II with the ratio 20:15:5:35:15:10 was selected for further supplementation.

b. Processing of the ingredients

Figure 4 gives the stepwise procedure involved in the processing of the ingredients used in the preparation of the food supplement (Plate I).

Germination or sprouting is a method by which the stored ingredients are converted into simpler and free forms from their embryo, thereby improving the digestibility as well as availability of most of the nutrients like carbohydrates, protein, thiamine, riboflavin, niacin, vitamin C and some of the mineral elements (Sharma et al., 2002). Hence, Wheat, Ragi and Green gram were germinated and powdered and thus the malted flours were obtained. Carrot was pressure-cooked and Tomato and Amaranthus were blanched. These were then sun dried and powdered. The three malted powders and processed vegetable powders were then mixed together thoroughly to form the ***food supplement***.

c. Evaluation of the developed food supplement

The food supplement was organoleptically evaluated using sensory analysis procedure. It was also subjected to routine nutrient analysis to estimate the energy, protein, iron, calcium, phosphorus, β–carotene, vitamin C and vitamin E present in it. The nutrients were estimated using standard procedures (NIN, 1983 and Ranganna, 1995). The food supplement was packed in 200 gauge low density polyethylene bags, heat sealed and stored for its keeping quality evaluation. The shelf life of the sample was also assessed through organoleptic parameters, moisture content, peroxide value and total bacterial count over a period of sixty days.

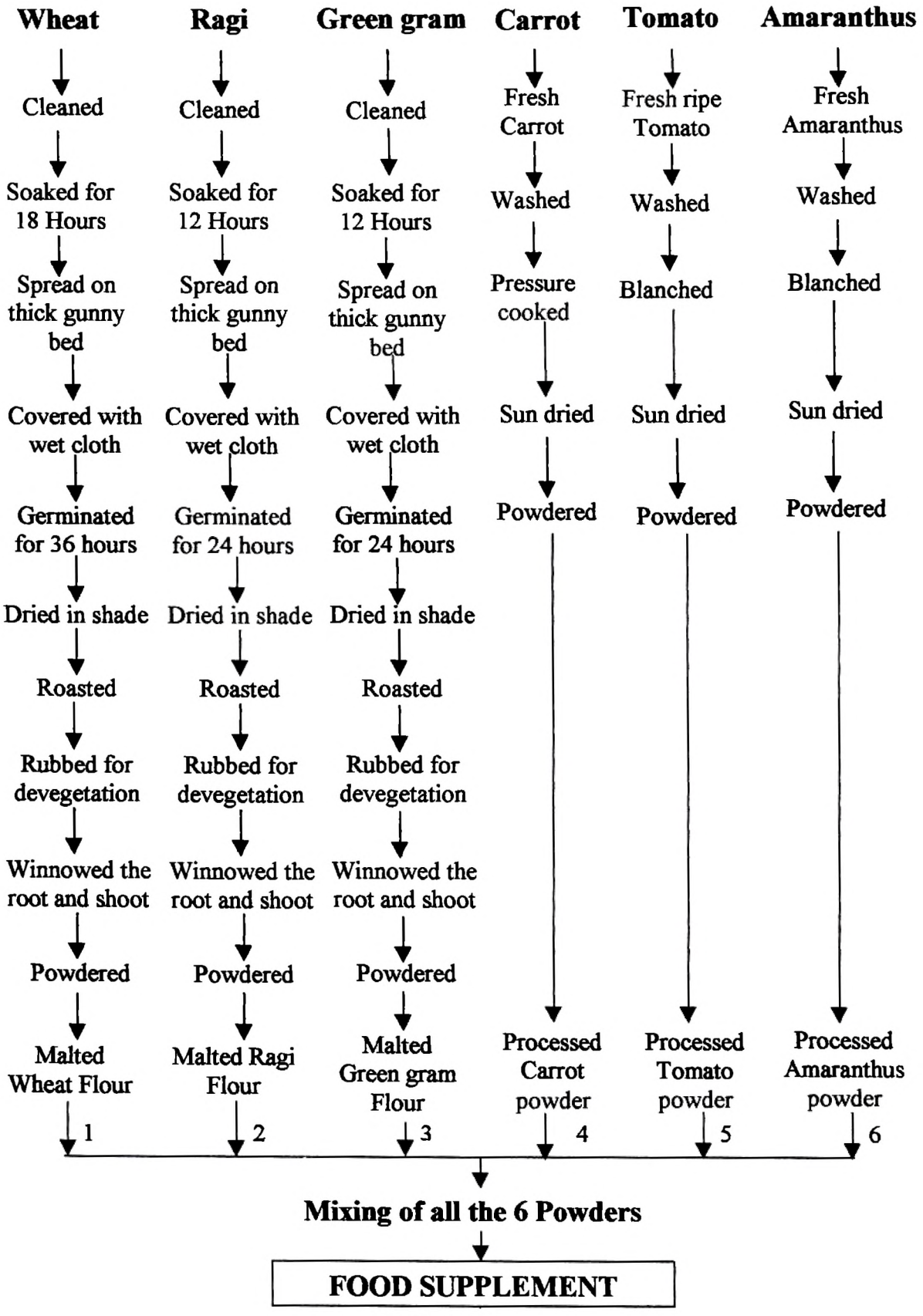
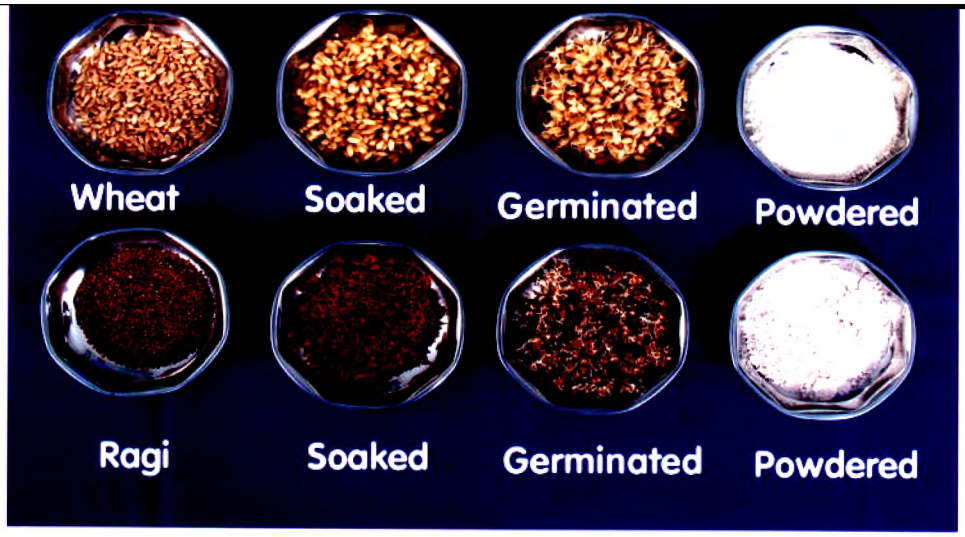
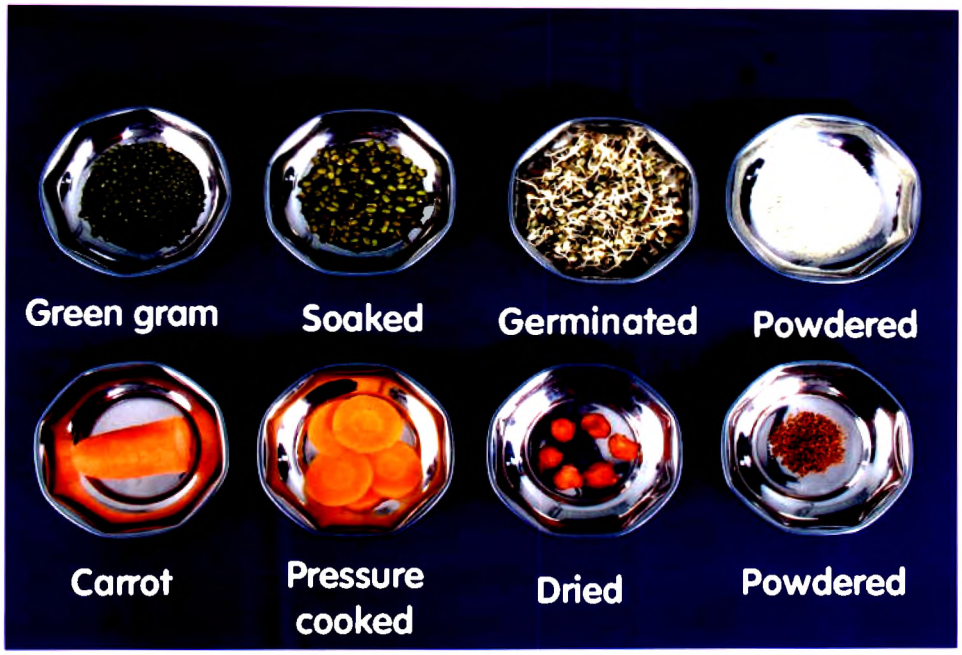


FIGURE 4

PROCESS OF PREPARATION OF FOOD SUPPLEMENT





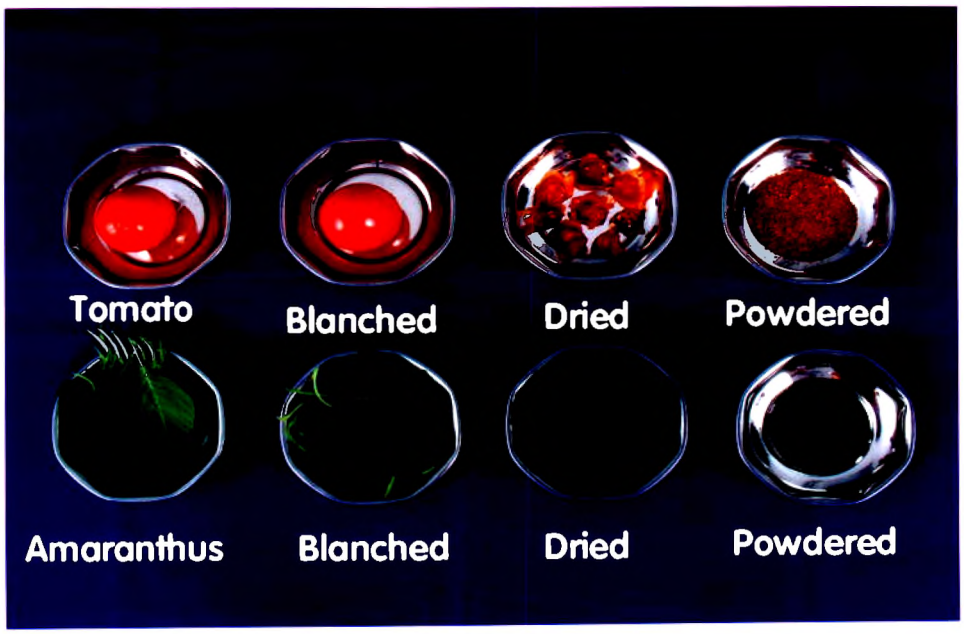


PLATE I

PROCESS OF PREPARATION OF FOOD SUPPLEMENT

Phase III

1. Preparations of the food supplement for feeding

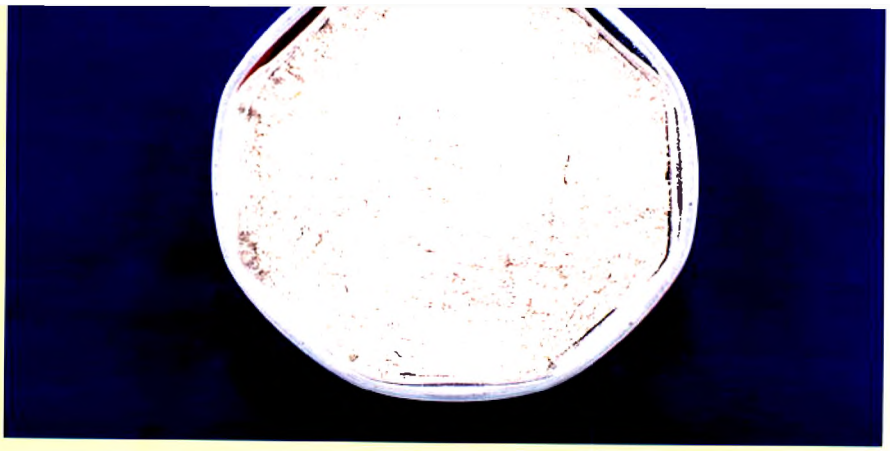
The developed food supplement was provided to the selected elderly and they consumed it in the form of porridge and balls (Plate II). The porridge was prepared by mixing the food supplement with lukewarm water to the desired consistency. Lukewarm water was sprinkled over the mix and balls were prepared. One teaspoon of jaggery was used as a sweetening agent irrespective of the preparation.

2. Feeding trial

For feeding trial a sub sample of 50 elderly in the age group 60 to 67 years (25 elderly men and 25 elderly women) who were apparently healthy were selected from the total sample of 500 elderly and was designated as supplemented group. Daily one hundred grams of the food supplement were provided to these elderly for a period of six months. A comparable control group was maintained and studied. These subjects were selected based on their willingness to participate in the study.

3. Evaluation of the food supplement on the selected elderly

The evaluation of the food supplement on the selected elderly was assessed through the changes in body weight and BMI and certain blood parameters namely haemoglobin, serum antioxidants (vitamins A, C and E), trace minerals (iron, zinc, and copper) and lipid peroxide levels. These tests were carried out before and after the supplementation study using the standard procedures (NIN, 1983).



FOOD SUPPLEMENT

PORRIDGE

BALLS

PLATE II
FOOD SUPPLEMENT - USED IN THE PREPARATION OF PORRIDGE AND BALLS

4. Feeding trials with adults (50 to 55 years of age)

a. Identification of adults and tracing the characteristic changes related to ageing

While preparing the food supplement, especially providing considerable amount of phytochemicals, it was thought of interest to provide such a food supplement to the adults between the age group of 50 to 55 years who are in the stages of late adulthood and in the verge of entering into senior citizen stream. The thought behind this is whether such a supplementation would help these members to delay their ageing characteristics and also allow them to age gracefully without any degenerative diseases. Accordingly, exploration was done to identify adults between the age group of 50 to 55 years among the 500 families selected for the main study. (Siblings of the elderly men/women, eldest sons/daughters of the elderly men/ women selected for the main study). A group of 56 adults (30 men and 26 women - supplemented group) and 30 adults (16 men and 14 women - control group), between the age of 50 and 55 years, who were apparently healthy were available and they were selected for this aspect of the study. Certain specific characteristics related to ageing namely reduction in memory power, appearance of grey hair, changes in dentition, impairment in vision and hearing was assessed through interview cum observations. In the case of women details regarding the onset of menopause and its implications were gathered. Trained physician's help was sought for assessing the specific characteristics of ageing (Appendix V).

b. Feeding trial and its outcomes

In order to ascertain the process of productive and graceful ageing these selected 56 adults (30 men and 26 women) were also provided

for six months with one hundred grams of the same food supplement which was formulated and evaluated for the elderly of the present study. The feeding trial was evaluated through blood parameters. A comparable control group (16 men and 14 women) was also maintained and studied.

Phase IV

1. Nutrition education for elderly

Nutrition education programme should target rural elderly, especially elderly belonging to the low income group and living alone, who normally neglect adequate diet due to their poverty and ignorance. Hence, nutrition education was also planned in this study and the procedure followed for this aspect is given under the following headings.

a. Selection of elderly for nutrition education

Fifty elderly (25 men and 25 women) who were involved in the supplementation study were selected for receipt of nutrition education using the common audio-visual aids.

Computers are used for many purpose and their use in nutrition field is emerging especially in nutrition education and research areas. Hence, an effort was taken in this study to use computers in teaching nutrition messages in the form of PowerPoint presentation. For this purpose twenty five elderly men (who were also part of the main study) were selected. These twenty five elderly men were literates and they were able to understand the minimum operation of computers. The mother tongue of the elderly (Tamil) was used for communicating the nutrition messages through computers. Totally seventy five elderly were given nutrition education through conventional methods/ computer aided programme.

b. Planning nutrition education

Nutrition education was planned for the fifty elderly using the common audio-visual aids. The nutrition concepts taught during the education is given in Table III.

TABLE III

NUTRITION CONCEPTS TAUGHT DURING NUTRITION EDUCATION

S.No	Nutrition Concepts	Methods used
1.	An introduction about elderly and their health	Lecture
2.	Need for balanced diet during old age	Poster
3.	Importance of physical exercise and relaxation for elderly	Charts
4.	Common nutrition problems of elderly	Lecture
5.	Nutrient requirements for elderly	Charts
6.	Major food source of nutrients	Charts
7.	Dietary tips for elderly	Lecture cum demonstration

The same concepts were taught to the twenty five literate elderly using the computer. For this purpose, PowerPoint presentation was adopted. Slides covering the nutrition aspects to be taught were prepared (Appendix VII) (Compact Disc (CD)).

c. Conducting nutrition education

Nutrition education programme was conducted during the course of the supplementation study. Initially a lecture was given informally covering the nutrition concepts to be taught. The posters and charts prepared for this purpose was explained in detail to the fifty selected elderly (Plate III). The doubts raised by the audience were cleared by the investigator.

PLATE III

NUTRITION EDUCATION FOR THE ELDERLY USING POSTERS

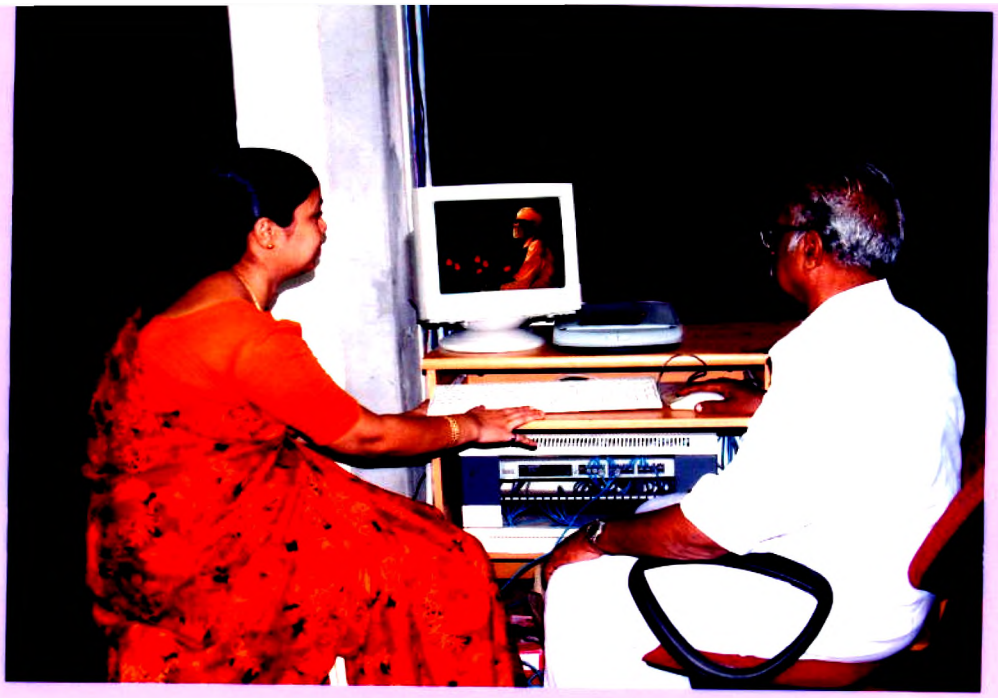
For the twenty five literate elderly, before starting nutrition education, they were taught about the minimum operation of a computer to learn the nutrition messages (Plate IV) through PowerPoint presentation. The steps involved were:

1. Switch on the computer
2. Insert the CD
3. Click-My Computer
4. CD-Symbol, Press Enter key
5. Click-File Name - Nutri_M
6. The slide show is displayed
7. After each slide, either click the mouse or press enter key for the next slide to appear on the screen.

This would enable them to take their own time to view, read and learn the messages.

d. Evaluation of nutrition education

In order to study the impact of the education imparted it was essential to find out their knowledge on nutrition before and after the education programme. For this purpose a questionnaire covering the important knowledge aspects of nutrition was developed in the form of a scoring schedule (30 point scale) as given in Appendix VI. The questionnaire was administered to all the seventy five selected elderly before attending the programme and the required data were collected from them prior to education. After the education, the same questionnaire was administered to all those who attended the education programme. From the data collected, the impact of the education programme was evaluated.



LEARNING THE MINIMUM OPERATION OF A COMPUTER

ELDERLY LEARNING THE NUTRITION MESSAGE

PLATE IV
NUTRITION EDUCATION THROUGH COMPUTER

2. Analysis and Interpretation of the data

The data obtained by means of the interview schedule were tabulated. The results obtained from the height, weight and BMI, functional and clinical examination and biochemical analysis were tabulated.

The age, gender, body weight, BMI and biochemical indices of the supplemented group and the control group were tested for their comparability at baseline.

The impact of food supplementation was found out by comparing the body weight, BMI and biochemical parameters of the elderly before and after the supplementation study using appropriate statistical tools. Similarly the impact of nutrition education was studied by comparing the scores of initial and final nutrition knowledge of the elderly which was obtained before and after nutrition education.

RESULTS AND DISCUSSION

IV RESULTS AND DISCUSSION

The results of the study on "Nutritional Profile of the Rural Elderly and Impact of Food Supplementation and Nutrition Education" is discussed under the following headings:

A. General profile of the Rural elderly

   1. Socioeconomic Background
   2. Dietary Practices
   3. Nutritional Profile
   4. Psychological Well Being

B. Nutritional Profile of the Selected Elderly involved in the Supplementation Study.

C. Quality Parameters of the Food Supplement.

D. Impact of Food Supplementation on Selected Elderly.

E. Characteristics of Ageing observed on Selected Adults and Impact of Food Supplementation.

F. Impact of Nutrition Education on Selected Elderly.

A. General Profile of the Rural Elderly

The general profile of 500 elderly men and women living in the rural areas of Appakudal and Jambai Panchayat of Erode district of Tamilnadu was obtained by interview method. Through this method, information like education, occupation, income, number of children, leisure time activities,

personal habits, dietary practices and psychological well being of the elderly men and women were gathered. The results of these aspects are presented in the following pages.

1. Socioeconomic Background

a. Age and Genderwise distribution

The age and genderwise distribution of the 500 elderly men and women is given in Table IV and Figure 5.

TABLE IV

AGE AND GENDERWISE DISTRIBUTION OF THE ELDERLY (N: 500)

Age group (years)	Gender				Total	
	Men		Women			
	Number	Per cent	Number	Per cent	Number	Per cent
60-64	102	40.8	63	25.2	165	33
65-69	74	29.6	93	37.2	167	33.4
70-74	22	8.8	28	11.2	50	10
75-79	15	6.0	37	14.8	52	10.4
80-84	17	6.8	9	3.6	26	5.2
85-89	11	4.4	13	5.2	24	4.8
90-94	9	3.6	7	2.8	16	3.2
Total	**250**	**100**	**250**	**100**	**500**	**100**

Majority of the elderly selected for the study belonged to an age range of 60 to 69 years. The elderly men in the age group 60 to 64 years were 40.8 per cent followed by 29.6 per cent in the age group 65 to 69 years. Only 8.8 per cent and six per cent of the elderly men belonged to the age group 70 to 74 years and 75 to 79 years respectively. The remaining percentage of men was in the age between 80 to 94 years. Among the elderly

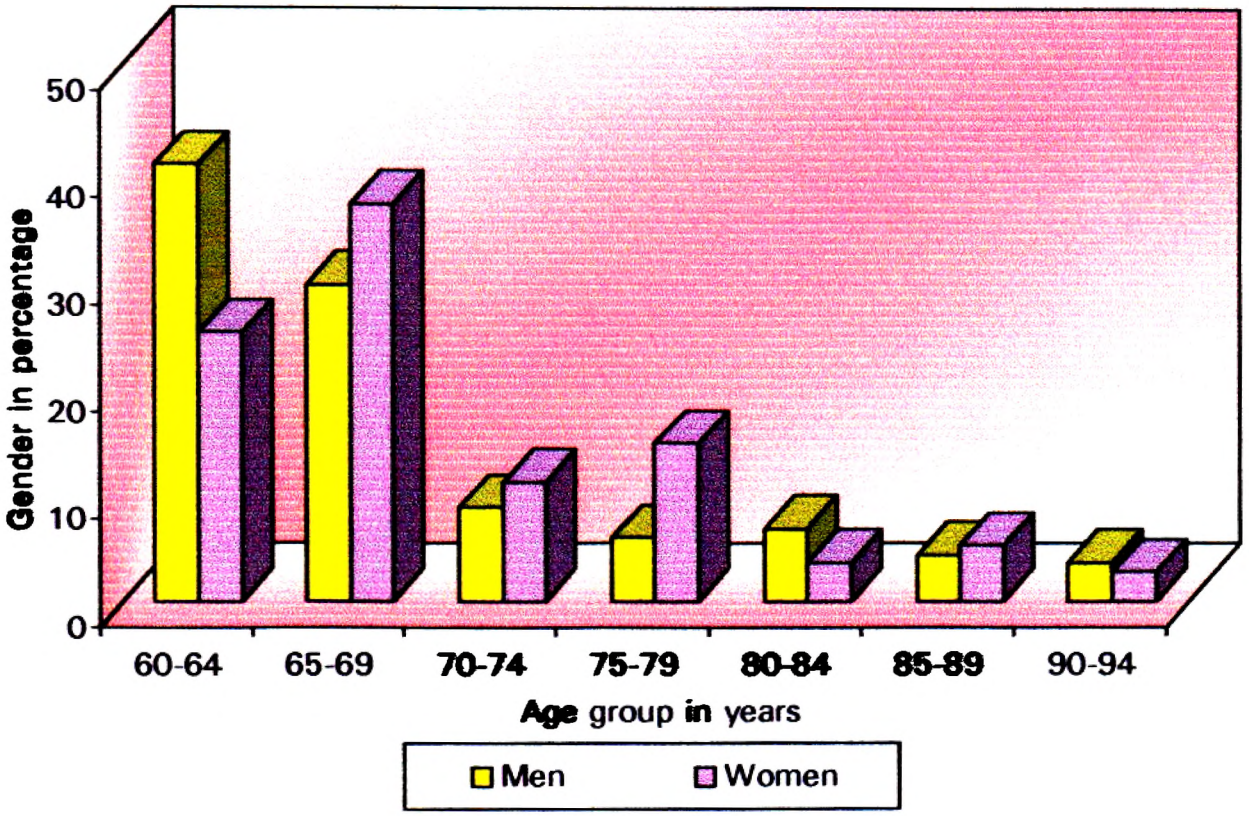


FIGURE 5

AGE AND GENDERWISE DISTRIBUTION OF THE ELDERLY

women, 25.2 per cent and 37.2 per cent were in the age group 60 to 64 years and 65 to 69 years respectively. The elderly women in the age group 70 to 74 years and 75 to 79 years formed 11.2 per cent and 14.8 per cent respectively. The least number of elderly women fell into the age category of 80 to 94 years.

b. Educational status

The educational status of the elderly is given in Table V.

TABLE V

EDUCATIONAL STATUS OF THE ELDERLY (N: 500)

Educational status	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Primary school	38	15.2	24	9.6	62	12.4
Middle school	17	6.8	7	2.8	24	4.8
High school	12	4.8	3	1.2	15	3.0
Graduate	5	2.0	–	–	5	1.0
a. Total literate	**72**	**28.8**	**34**	**13.6**	**106**	**21.2**
b. Illiterate	**178**	**71.2**	**216**	**86.4**	**394**	**78.8**
Total (a+b)	**250**	**100**	**250**	**100**	**500**	**100**

Among the 250 elderly men, 28.8 per cent were literates and 71.2 per cent illiterates. Out of the 250 elderly women, 34(13.6%) were literates and 216 (86.4%) were illiterates. Thirty eight elderly men (15.2%) and 24 elderly women (9.6%) had their education only upto primary school. Totally, 4.8 per cent and 3.0 per cent of the elderly had middle and high school level education respectively. Two per cent of the elderly men only were graduates. Illiteracy was more common among the elderly women (86.4%)

than men (71.2%). This is in line with the literacy trend found in India, where the women's literacy level is lower than that of men.

c. Occupation and Economic status

The occupational status of the elderly studied is given in Table VI.

TABLE VI

OCCUPATIONAL STATUS OF THE ELDERLY (N: 500)

Occupation	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Agricultural Labourer	86	34.4	49	19.6	135	27
Household worker	5	2.0	85	34.0	90	18
Labourer	24	9.6	38	15.2	62	12.4
Mill worker	37	14.8	24	9.6	61	12.2
Street Vendor	15	6.0	19	7.6	34	6.8
Petty shop holder	8	3.2	6	2.4	14	2.8
Professional	4	1.6	–	–	4	0.8
Masanary	17	6.8	–	–	17	3.4
Farmer	54	21.6	29	11.6	83	16.6
Total	**250**	**100**	**250**	**100**	**500**	**100**

The details given are the erstwhile occupation of the elderly. Among the elderly men, majority (34.4%) of them were agricultural labourers. They were also employed as mill workers (14.8%), six per cent of them as street vendors and 3.2 per cent were petty shop holders. A few were employed as school teachers (1.6%) and 6.8 per cent of them were doing masanary work. Some of the elderly men (21.6%) were involved in farming in their own land.

Majority of the elderly women (34.0%) was involved in household work and 19.6 per cent of women were working as agricultural labourers. About 15.2 per cent were labourers, 9.6 per cent mill workers and 7.6 per cent as street vendors selling bangles, flowers, fruits and vegetables. A few elderly women (11.6%) were working in their own farms.

The erstwhile occupations of the elderly were classified as sedentary, moderate and heavy, based on the physical activity involved in that job (Sathyanarayana, 1989). The details of the categorised occupation is given in Table VII.

TABLE VII

CATEGORIES OF THE OCCUPATION OF THE ELDERLY (N : 500)

Occupation	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Sedentary	17	6.8	91	36.4	108	21.6
Moderate	147	58.8	110	44.0	257	51.4
Heavy	86	34.4	49	19.6	135	27.0
Total	**250**	**100.00**	**250**	**100.00**	**500**	**100.00**

Majority of the elderly (51.4%) was involved in moderate work like labourers in textile industry, carpentry and mill workers. Many of the women were either housewives or domestic servants and were classified as sedentary workers. Some of the elderly men were involved in sedentary work like household work (as cooks/gardeners), petty shop holders and professionals. The sedentary (21.6%) and heavy workers (27.0%) formed 48.60 per cent of the elderly surveyed. Workers who were involved in non-mechanised agricultural work like ploughing and threshing, masons, street vendors carrying

headload or pushing cartload of merchandise were classified as heavy workers. Weavers, gardeners and carpenters using manual tools were classified as moderate workers as per the classification of Sathyanarayana (1989).

Based on the erstwhile income of the selected elderly, they were grouped as those belonging to low income (Rs.300 and below per month) and middle income (Rs. 301 to Rs.1000 per month) groups. It was observed that 397 elderly (79.4%) belonged to low income group and 103 (20.6%) were of middle income group.

d. Marital status and number of children in the families of the elderly

Out of 250 men, 14 (5.6%) were bachelors and among the 250 women, 6 (2.4%) were spinsters. Among the 250 men, 236 and among the 250 women, 244 were married. Among the married men, 14.8 per cent of them were widowers and 28.8 per cent of the women were widows.

Details regarding the number of children in the families of the elderly are given in Table VIII.

TABLE VIII

CHILDREN IN THE FAMILIES OF THE ELDERLY (N : 480)

Number of Childern	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
No Child	19	8.05	7	2.87	26	5.42
One Child	34	14.41	29	11.88	63	13.12
Two children	68	28.81	74	30.33	142	29.58
Three children	73	30.93	66	27.05	139	28.96
Four children and more	42	17.80	68	27.87	110	22.92
Total	**236**	**100.00**	**244**	**100.00**	**480**	**100.00**

It was observed that 8.05 per cent of the married elderly men and 2.87 per cent of the married elderly women had no children. There was only one child in the families of 34 men (14.41%) and 29 women (11.88%).

In each of the families of 28.81 per cent and 30.93 per cent elderly men there were two and three children respectively. Likewise in the families of 30.33 per cent and 27.05 per cent elderly women, there were two and three children respectively. There were four children and more in 17.80 per cent and 27.87 per cent families of elderly men and women respectively.

e. Type of family of the elderly

Table IX reveals the type of family that the elderly were dwelling.

TABLE IX

TYPE OF FAMILY OF THE ELDERLY

Type of Family	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Elderly living with spouse	43	17.2	41	16.4	84	16.8
Elderly living alone	8	3.2	7	2.8	15	3.0
Elderly living with son	162	64.8	174	69.6	336	67.2
Elderly living with daughter	26	10.4	23	9.2	49	9.8
Elderly living with relatives/friends	11	4.4	5	2.0	16	3.2
Total	**250**	**100.00**	**250**	**100.00**	**500**	**100.00**

Forty three elderly men (17.2%) and 41 elderly women (16.4%) were living with spouse. Majority of the elderly (64.8% men and 69.6% women) were living with their son. Only 10.4 per cent and 9.2 per cent of the elderly men and women were living with their daughters respectively.

A few elderly (4.4% elderly men and 2.0% elderly women) were also living with their relatives and friends. It is evident that among the elderly studied, nobody chose old age homes for their living, either they lived with their children, relatives or friends, establishing their liking for family living.

f. Leisure time activities

The elderly men and women selected for the study were also involved in some leisure time activities. The details are given in Table X and Figure 6 (Plate V).

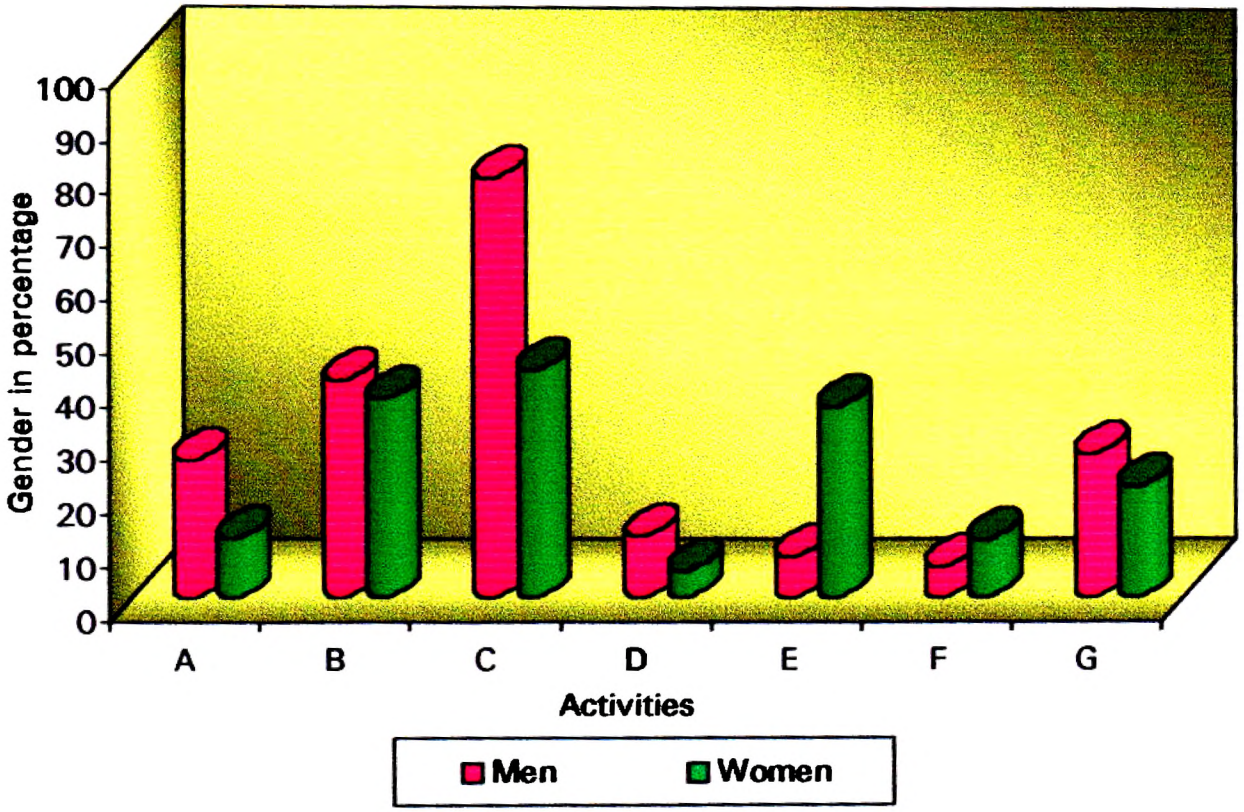
TABLE X

LEISURE TIME ACTIVITIES

Activities	Men (N:250)		Women (N:250)		Total	
	Number	Percent	Number	Percent	Number	Percent
Reading	64	25.6	28	11.2	92	18.4
Listening to radio	102	40.8	93	37.2	195	39.0
Watching Television	197	78.8	107	42.8	304	60.8
Gardening	29	11.6	12	4.8	41	8.2
Helping in the house hold work	19	7.6	89	35.6	108	21.6
Cleaning	14	5.6	27	10.8	41	8.2
Chatting with friends	67	26.8	52	20.8	119	23.8

* Multiple responses

Sixty four elderly men (25.6%) and 28 elderly women (11.2%) had the habit of reading newspaper and local magazines during their leisure time. Thirty nine percent of the elderly were listening to radio, especially the news and folksongs. Majority of the elderly men and women (78.8% and 42.8%) were watching Television. Some of them had their own TV whereas the others viewed the TV programs from the Panchayat TV. Media has become part and parcel of day to day life for all age groups. It is evident from the present study even elderly are not exceptional from this fact and majority of men and women were watching TV during their leisure time. Only 8.2 percent of them were involved in gardening work. The elderly men (7.6%) and women (35.6%) were also engaged in helping the household activities.



A - Reading

B - Listening to Radio

C - Watching Television

D - Gardening

E - Helping in the House hold Work

F - Cleaning

G - Chatting with Friends

FIGURE 6

LEISURE TIME ACTIVITIES

ELDERLY MAN ENGAGED IN AGRICULTURAL WORK

ELDERLY WOMAN REARING CATTLE

ELDERLY WOMEN AT THEIR LEISURE TIME

PLATE V
ACTIVITIES OF THE ELDERLY

Only 14 elderly men (5.6%) and 27 elderly women (10.8%) were involved in their household cleaning during their leisure time. Even now, some elderly men were involved in slight agricultural work and elderly women were rearing cattle as part of their leisure time activity. The elderly men (26.8%) and elderly women (20.8%) were enjoying by chatting with their friends during their leisure time. In olden times the elderly people were sitting and chatting. But in the present study 26.8 per cent of elderly men and 20.8 per cent of elderly women only were engaged in such types of chatting during their leisure time.

g. Personal habits

The personal habits of the selected elderly are given in Table XI.

TABLE XI

PERSONAL HABITS OF THE ELDERLY N: 500

Personal Habits	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Smoking	68	27.2	-	-	68	13.6
Alcohol drinking	36	14.4	-	-	36	7.2
Chewing Tobacco alone	14	5.6	18	7.2	32	6.4
Chewing betal leaves	39	15.6	72	28.8	111	22.2
Using snuff	7	2.8	4	1.6	11	2.2
None	86	34.4	156	62.4	242	48.4
Total	**250**	**100.00**	**250**	**10.00**	**500**	**100.00**

Among the elderly men, 27.2 per cent and 14.4 per cent had the habit of smoking and drinking alcohol respectively. Fourteen elderly men (5.6%) and 18 elderly women (7.2%) had the habit of chewing tobacco alone. Chewing betal leaves was found in 15.6 per cent of elderly men and 28.8 per cent of elderly women. Snuff was used by 2.8 per cent of elderly men and 1.6 per cent of elderly women. Among the elderly men only 34.4 per cent and elderly women 62.4 per cent did not have any of the above habits.

2. Dietary Practices

Details regarding the diet and meal pattern, preference of food forms and taste, foods included and avoided, food beliefs and taboos, the frequency of consumption of foods and problems in food intake were gathered from the elderly through personal interview. The results are given in the following pages.

a. (i) Dietary pattern of the elderly

Table XII reveals the dietary pattern of the elderly.

TABLE XII

DIETARY PATTERN OF THE ELDERLY (N:500)

Diet Pattern	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Vegetarian	21	8.4	32	12.8	53	10.6
Non-vegetarian	229	91.6	218	87.2	447	89.4
Total	**250**	**100.00**	**250**	**100.00**	**500**	**100.00**
Number of Meals/Day						
Two	43	17.2	38	15.2	81	16.2
Three	207	82.8	212	84.8	419	83.8
Total	**250**	**100.00**	**250**	**100.00**	**500**	**100.00**

Majority of the elderly men (91.6%) and elderly women (87.2%) were non-vegetarians. Only 8.4 per cent and 12.8 per cent of the elderly men and women were vegetarians respectively. Of the elderly men, 17.2 per cent and 15.2 per cent of elderly women had two meals per day. Most of the elderly men (82.8%) and elderly women (84.8%) had three meals a day.

Table XIII gives the meal pattern followed by the elderly in the selected rural areas. Most of the elderly had breakfast in the form of dhal rice or tomato rice. Some of them had tiffin items like uppuma, idli or dosai. A few elderly had black coffee or tea during the mid-morning. For lunch, along with rice they consumed some of the locally available vegetables like cabbage, brinjal and drumstick. Some of the elderly had snack items like puffed rice along with their evening tea. It was observed that not much of fruits, vegetables especially green leafy vegetables were used in their meals.

TABLE XIII

MEAL PATTERN OF THE ELDERLY

Meal	Items
On rising	Cofee / Tea / Ragi porridge [1]
Break fast	**Main foods:** Wheat uppuma [2] / Idli [3] / Dosai [4] / Dhal rice [5] / Tomato rice [6] / Vermicelli uppuma. **Side dishes:** Coconut chutney [7] / Tomato Subji [8] / Sugar / Lime or Mango pickle [9] /Butter milk.
Mid-morning	Black coffee / Tea
Lunch	**Main food:** White Rice / Variety rice [10] **Gravy:** Red gram dhal curry [11] / Brinjal / Drumsitick sambar [12] / Tomato subji. **Side dishes:** Cabbage or Brinjal Poriyal [13] / Rasam [14] / Sundakkai or Chilly vathal [15] / Butter milk.
Tea	Coffee / Tea Puffed rice / Roasted ground nut / Boiled Tapioca / Popcorn.
Supper	**Main Foods:** Rice / wheat uppuma / Dosai **Side dishes:** Brinjal or Bitter gourd kulambu [16] / Rasam / Onion chutney [17] / Pickles.

Note:

[1]-A liquid dish prepared using ragi flour.
[2]-Seasoned semisolid preparation using broken wheat/vermicelli.
[3]-Steamed food prepared by fermented batter containing rice and black gram dhal.
[4]-Shallow fried food prepared from the above (3) batter.
[5]-A main dish prepared by cooking rice and red gram dhal together with some spices.

[6]-Rice mixed with seasoned onion, green chilly, spices and tomato.
[7]-Coconut, roasted bengal gram and green chilly ground to a paste.
[8]-A side dish prepared with onion, dry chillies and tomato in the form of gravy.
[9]-A side dish prepared with vegetables which are preserved by salt, oil and spices.
[10]-Rice mixed with either seasoned tamarind, tomato or lime extract or with coconut scrapings.
[11]-Cooked and seasoned red gram dhal without any vegetables in the form of a gravy.
[12]-A gravy prepared using red gram dhal and any vegetable.
[13]-A side dish of cooked and seasoned vegetable.
[14]-Tamarind extract with asafoetida and pepper water.
[15]-Any vegetable soaked in buttermilk, sun dried and then shallow fat fried.
[16]-A side dish prepared with vegetables, the main ingredients being onions and a thick extract of tamarind and coconut.
[17]-Roasted dry chillies, onion and tamarind ground to a paste.

b. Preference of food in terms of texture / consistency and taste

Majority of the elderly subjects preferred liquid, semi solid, soft and solid foods. Only a few liked crunchy foods. Most of the elderly preferred sweet, salt, hot and bland foods. A few did not prefer hot and spicy foods. Some elderly did not prefer sweets.

c. Foods included and avoided in the diet

Most of the elderly included all the food items. Certain foods like brinjal, roots and tubers, organ meats, ghee, nuts and oil seeds were avoided by some elderly. The elderly avoided these foods because of reasons like indigestion, allergy, constipation and financial constraints.

d. Food beliefs and taboos

The food beliefs and taboos expressed by elderly men and women are given in Table XIV.

TABLE XIV

FOOD BELIEFS AND TABOOS OF THE ELDERLY

S.No	Food Beliefs and Taboos of the Elderly	Number*	Per cent
1	Papaya, jackfruit, horse gram and sesame are considered as hot foods.	413	82.6
2	Garlic and Ginger are good for digestion.	386	77.2
3	Green leafy vegetables would cause diarrhoea.	352	70.4
4	Consumption of ladies finger will improve brain development.	285	57.0
5	Banana stem is good for the health of men.	481	96.2
6	Vallarai keerai (a kind of greens) would improve the memory power.	374	74.8
7	Fried foods would cause indigestion if taken during supper.	412	82.4
8	Curd and buttermilk should not be taken druing fever, cough and cold.	468	93.6
9	Roots and tubers are gas producing.	392	78.4
10	Beetroot is good for blood formation.	276	55.2
11	Soup prepared from the legs of goat is good for health.	312	62.4
12	Brinjal would cause mouth ulcers.	382	76.4
13	Excessive usage of turmeric powder leads to jaundice.	238	47.6
14	Bittergourd has deworming properties.	368	73.6
15	Kambu (a kind of millet) is used as a cooling agent during summer.	406	81.2
16	Boil the vegetables with excess water, which should be removed because it is not good for health.	213	42.6

* Multiple responses

Most of the elderly (82.6%) believed that papaya, jackfruit, horse gram and sesame are heat producing foods. The common belief among 77.2 per cent of elderly was that garlic and ginger are good for digestion. About 70.4 per cent of the elderly believed that green leafy vegetables would

cause diarrhoea. Some of the elderly (57.0%) had a belief that ladies finger will improve the brain development and 74.8 per cent stated that vallarai keerai would improve the memory power.

Majority of the elderly (96.2%) believed that banana stem is good for the health of men. Beliefs such as roots and tubers are gas producing and beet root is good for blood formation was expressed by 78.4 per cent and 55.2 per cent of the elderly respectively. The elderly felt that consumption of soup prepared from the legs of goat is good for health. They believed that excessive use of turmeric powder in the diet lead to jaundice. Kambu was believed to be a cold food by 81.2 per cent of the elderly and 42.6 per cent of the elderly believed that after boiling the vegetables with water, it should be drained because it is not good for health.

e. Frequency of food consumption pattern.

The frequency of food consumption of the elderly is given in Table XV.

It was observed that rice was consumed daily by all the elderly men and women. Wheat was taken daily by only two per cent and 0.8 per cent of elderly men and women respectively.

Twenty eight per cent of elderly men and 28.80 per cent of elderly women occasionally consumed wheat whereas 18.4 per cent and 19.20 per cent of elderly men and women respectively never consumed wheat. Ragi was not taken daily by the elderly whereas only 1.60 per cent of elderly men and 1.20 per cent of elderly women consumed on alternate days. The frequency of pulse consumption daily among the elderly men and women

TABLE XV
FREQUENCY OF FOOD CONSUMPTION OF THE ELDERLY (N: 500)

Foods	Daily		Alternate day		Weekly		Bimonthly		Monthly		Occasionally		Never	
	M %	W %	M %	W %	M %	W %	M %	W %	M %	W %	M %	W %	M %	W%
Rice	100.0	100.0	-	-	-	-	-	-	-	-	-	-	-	-
Wheat	2.00	0.80	2.40	1.60	21.20	18.890	12.80	14.00	15.20	16.80	28.00	28.80	18.40	19.20
Ragi	-	-	1.60	1.20	7.20	8.00	4.40	6.00	12.00	16.00	52.80	51.20	22.00	17.60
Pulses	14.40	9.20	16.80	23.60	38.00	41.20	21.60	18.00	8.40	6.00	-	-	0.80	2.00
Green leafy vegetables	-	-	-	-	11.20	13.60	16.80	14.80	18.00	20.80	42.00	35.60	12.00	15.20
Vegetables	28.00	30.40	18.00	20.00	42.80	41.60	8.00	4.40	-	-	3.20	3.60	-	-
Roots and Tubers	-	-	3.60	2.40	12.40	12.80	14.80	15.60	23.60	19.20	33.60	36.40	12.00	13.60
Sea foods	-	-	-	-	1.60	-	2.00	1.20	3.20	2.40	48.00	54.40	45.20	42.00
Fleshy foods and egg	-	-	-	-	12.00	6.00	8.80	4.00	20.00	14.80	39.20	46.80	20.00	28.40
Fruits	4.80	5.60	2.40	2.80	14.40	12.80	24.80	23.20	23.20	18.00	20.00	32.80	10.40	4.80
Milk products	68.00	63.60	-	-	16.00	14.40	-	-	-	-	10.40	15.20	5.60	6.80
Sugar products	95.20	92.80	-	-	-	-	-	-	-	-	3.20	4.80	1.60	2.40
Nuts and oil seeds	9.60	8.00	8.80	7.20	24.40	26.40	16.40	17.20	9.60	8.00	22.40	22.80	8.80	10.40
Fat														
a. Unsaturated fat	100	100	-	-	-	-	-	-	-	-	-	-	-	-
b. Saturated fat	-	-	-	-	-	-	-	-	1.20	2.00	26.40	21.20	72.40	76.80

M- Men
W- Women

was 14.40 per cent and 9.20 per cent respectively. Green leafy vegetables was not consumed neither daily nor on alternate days. It was taken by 11.20 per cent of elderly men and 13.60 per cent of elderly women weekly whereas 12 per cent and 15.20 per cent of elderly men and women respectively never had green leafy vegetables. Twenty per cent of elderly men and 30.40 per cent of elderly women consumed vegetables daily whereas roots and tubers was not taken daily. Sea foods was avoided by 45.20 per cent and 42 per cent of elderly men and women respectively. Flesh foods and eggs was not consumed daily or on alternate days. It was taken weekly by 12 per cent of elderly men and 6 per cent of elderly women. Fruits was consumed daily by 4.80 per cent and 5.60 per cent of elderly men and women respectively.

Milk and its products were taken daily by 68 per cent of elderly men and 63.60 per cent of elderly women, and 5.60 per cent and 6.80 per cent of elderly men and women respectively never consumed it. Sugar and its products was consumed daily by 95.20 per cent and 92.80 per cent of elderly men and women respectively. All the elderly consumed oil daily in the form of unsaturated fat. Saturated fats were taken occasionally by 26.40 per cent and 21.20 per cent of the elderly men and women respectively and majority of them (72.40 per cent and 76.80 per cent) never consumed it.

f. Problems of the elderly while eating

It is a well-known fact that in old age there is difficulty in biting, chewing and swallowing food. The problems faced while eating by the elderly in this study is given in Table XVI.

TABLE XVI

PROBLEMS IN FOOD INTAKE BY THE ELDERLY

Eating Habits	Men (N:250)		Women (N:250)		Total (N:500)*	
	Number	Per cent	Number	Per cent	Number	Per cent
No problem	186	74.4	194	77.6	380	76.0
Difficulty in Biting	51	20.4	42	16.8	93	18.6
Difficulty in Chewing	43	17.2	39	15.6	82	16.4
Difficulty in Swallowing	18	7.2	13	5.2	31	6.2

* Multiple Responses

It was found that 76.0 per cent of the elderly had no problems while eating. This may be due to their good dentition. There were 18.6 per cent of elderly who had difficulty in biting. The elderly who expressed their problem as difficulty in chewing was 16.4 per cent. When chewing is difficult, an elderly person may not only reject certain foods but may also have less desire to eat. Difficulty in swallowing was expressed by 6.2 per cent of the elderly studied. Prakash (1999) and Prabhu (1999) reported that when dental health is poor, eating problems arise and restricted food intake can lead to poor nutrition.

3. Nutritional Profile

The nutritional profile of the elderly is discussed under the following headings.

a. Height, weight and Body Mass Index of the elderly

Table XVII depicts the mean height, weight and Body Mass Index (BMI) of the elderly.

TABLE XVII

MEAN HEIGHT, WEIGHT AND BMI OF THE ELDERLY (N: 500)

S.No	Parameters	MEN (N:250)	WOMEN (N:250)	Literature Value *	
				Men	Women
1	Height (cm)	155.09	146.39	162.6±6.70	150.40±5.95
2	Weight (kg)	52.79	46.04	50.20±7.95	43.10±7.41
3	BMI (kg/m^2)	21.97	21.48	20.91±1.67	20.75±2.75

* - Naidu and Rao (1994).

The mean height of the elderly men was 155.09cm and that of the women was 146.39cm. The mean weights of elderly men and women were 52.79kg and 46.04kg respectively. The mean heights of the elderly men and women reported by and Naidu and Rao (1994) were 162.60 ±6.70 and 150.40 ±5.95cm respectively. These values are slightly higher than those obtained in this study. The mean weights of men and women reported by Naidu and Rao (1994) were 50.20 ±7.95kg and 43.10 ±7.41kg respectively. These values are slightly lower than that found out in this study. The mean BMI values for elderly men and women in the present study were 21.97 and 21.48 respectively. The mean BMI of elderly men was slightly higher than that of elderly women.

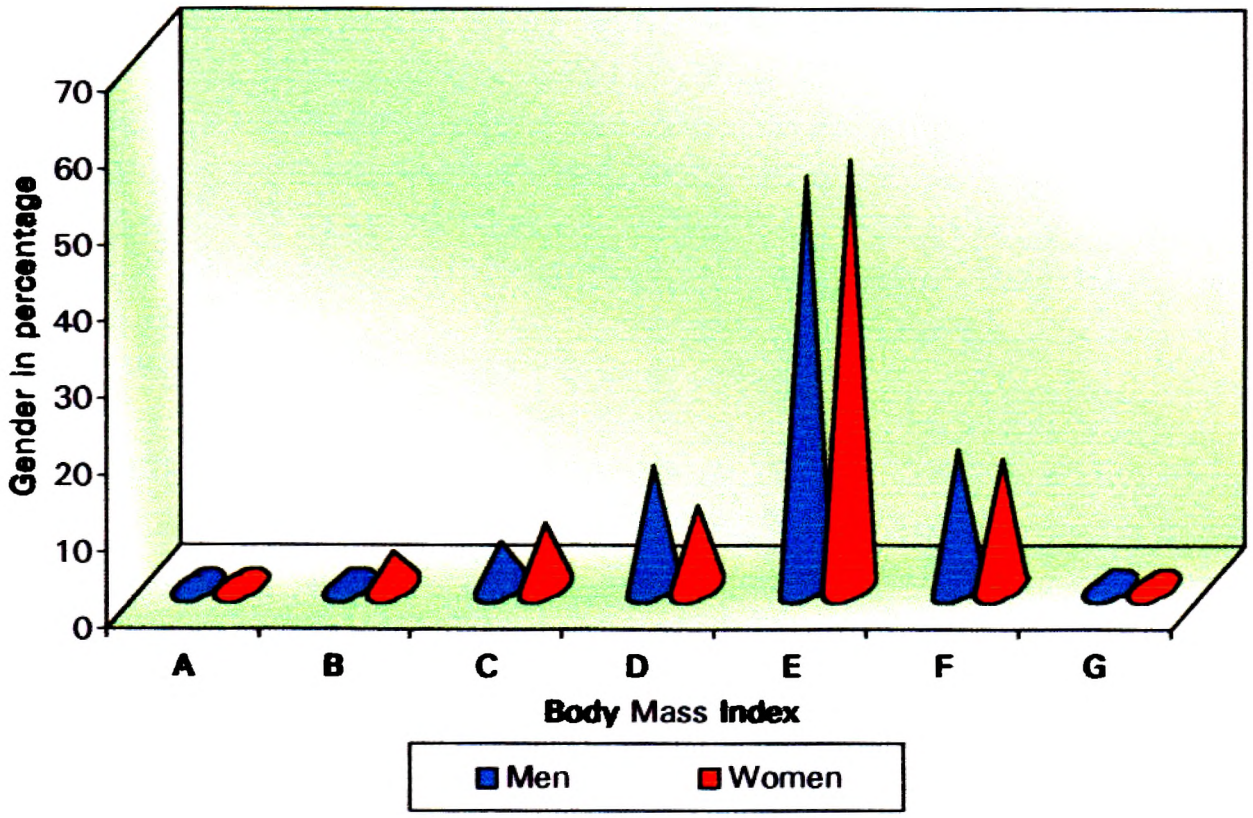
Body Mass Index is considered as a good indicator of percentage fat in the elderly. Bailey and Ferro (1998) have indicated that BMI permits conclusion to be drawn about generalized under nutrition in a community. The distribution of the elderly according to BMI classification suggested by James et al., (1988), Ferro-luzzi et al., (1992) and WHO (1999) is given in the Table XVIII and Figure 7.

TABLE XVIII

DISTRIBUTION OF ELDERLY ACCORDING TO BMI CLASSIFICATION

BMI	Category	MEN (N:250)		WOMEN (N:250)		Total (N:500)	
		Number	Per cent	Number	Per cent	Number	Per cen
< 16	CED-Grade III	3	1.2	4	1.6	7	1.4
16-16.9	CED-Grade II	6	2.4	12	4.8	18	3.6
17-18.4	CED-Grade I	15	6.0	21	8.4	36	7.2
18.5-19.9	Low weight Normal	40	16.0	27	10.8	67	13.4
20-24.9	Normal	135	54.0	140	56.0	275	55.0
25-29.9	Overweight	45	18.0	42	16.8	87	17.4
30+	Obese	6	2.4	4	1.6	10	2.0
Total		**250**	**100.00**	**250**	**10.00**	**500**	**100.00**

Fifty four percent of the elderly men and 56.00 per cent of the elderly women belonged to normal BMI category (20-24.9). Among the elderly men and women, 16.0 per cent and 10.8 per cent belonged to low weight normal category respectively. (BMI 18.5-19.9) The remaining were distributed in Chronic Energy Deficiency (CED) categories of different grades namely BMI 17.0 to 18.4 – mild CED – grade I, 16.0-16.9 moderate CED – grade II and < 16-severe CED – grade III. Thus of the total elderly studied, only 1.40 per cent were in grade III CED. It was observed that 17.4 per cent of the elderly were overweight and only two per cent were obese. Obesity is a problem of energy balance. Too much food would have been eaten by these two per cent elderly over an extended period of their life time relative to their low energy needs due to ageing and their sedentary life style.



A	-	<16	CED - Grade III
B	-	16 - 16.9	CED - Grade II
C	-	17 - 18.4	CED - Grade I
D	-	18.5 - 19.9	Low Weight Normal
E	-	20 - 24.9	Normal
F	-	25 - 29.9	Overweight
G	-	30+	Obese

CED - Chronic Energy Deficiency.

FIGURE 7

DISTRIBUTION OF ELDERLY ACCORDING TO BMI CLASSIFICATION

b. Functional and clinical assessment of the elderly

The details of the functional assessment of the elderly are given in Table XIX.

TABLE XIX

FUNCTIONAL ASSESSMENT OF THE ELDERLY

	Details	Men (N:250)		Women (N:250)		Total (N:500)	
		Number	Per cent	Number	Per cent	Number	Per cent
A	**Posture**						
	Normal	240	96.0	231	92.4	471	94.2
	Bent at waist	8	3.2	12	4.8	20	4.0
	Hunch	2	0.8	7	2.8	9	1.8
B	**Gait**						
	Normal	230	92.0	239	95.6	469	93.8
	Limping	6	2.4	3	1.2	9	1.8
	Shuffling	14	5.6	8	3.2	22	4.4
C	**Hands**						
	Normal	225	90.0	201	80.4	426	85.2
	Tremor	7	2.8	15	6.0	22	4.4
	Stiffness	18	7.2	34	13.6	52	10.4
D	**Hearing**						
	Normal	226	90.4	228	91.2	454	90.8
	Hard of hearing	24	9.6	22	8.8	46	9.2
E	**Eyes**						
	Normal sight	188	75.2	181	72.4	369	73.8
	Poor sight	62	24.8	69	27.6	131	26.2
F	**Legs**						
	Normal	228	91.2	222	88.8	450	90.0
	Slightly bent	12	4.8	24	9.6	36	7.2
	Varicose veins	10	4.0	4	1.6	14	2.8
G	**Speech**						
	Normal	214	85.6	190	76.0	404	80.8
	Slurred	31	12.4	58	23.2	89	17.8
	Stammering	5	2.0	2	0.8	7	1.4

Among the 500 elderly studied, the posture of 471(94.20%) was normal, but twenty (4.00 %) were bent at waist. Nine (1.80 %) had

hunch back. Majority (93.80%) had normal gait while walking. Nine limped and twenty two elderly (4.40%) had a shuffling movement due to stiffness or pain at the joints.

Tremor and stiffness were observed in the hands of 4.40 per cent and 10.40 per cent of the elderly respectively. The remaining (85.20%) had no such symptoms. Tremor and stiffness may be due to general weakness and rheumatoid arthritis.

Hearing was normal in 90.80 per cent of the elderly studied. Hearing loss was found in 9.20 per cent of them. Only 73.80 per cent of the elderly studied had proper vision whereas 26.20 per cent of them complained of poor sight of varying extent. The reduction in vision may be due to cataract, age related macular degeneration or diabetic retinopathy.

The legs of 450 (90.00%) elderly were normal. Thirty six (7.20%) of them had slightly bent legs which may be due to ageing process. Varicose veins was observed in 2.80 per cent of the elderly. The speech was normal in 404 (80.80%) elderly while 89 (17.80 %) had slightly slurred speech. Seven (1.40 %) of the elderly had stammering also.

The clinical profile of the elderly is given in Table XX.

TABLE XX

CLINICAL PROFILE OF THE ELDERLY

	Clinical symptoms		Men (N:250)		Women (N:250)		Total (N:500)	
			Number	Per cent	Number	Per cent	Number	Per cent
a.	Temperature	Normal	235	94.0	236	94.4	471	94.2
		Elevated	14	5.6	12	4.8	26	5.2
		Hypothermia	1	0.4	2	0.8	3	0.6
b.	Sweating	Normal	231	92.4	234	93.6	465	93.0
		Profuse	19	7.6	16	6.4	35	7.0
c.	Nails	Normal	219	87.6	203	81.2	422	84.4
		Brittle	8	3.2	14	5.6	22	4.4
		Spoon shaped	1	0.4	2	0.8	3	0.6
		Discoloured	22	8.8	31	12.4	53	10.6
d.	Edema	No edema	233	93.2	227	90.8	460	92.0
		Localised	17	6.8	23	9.2	40	8.0
e.	Skin	Normal	202	80.8	194	77.6	396	79.2
		Dry skin	38	15.2	41	16.4	79	15.8
		Depigmentation	10	4.0	15	6.0	25	5.0
f.	Teeth*	Pearl white	28	11.2	35	14.0	63	12.6
		Caries/discoloured	110	44.0	123	49.2	233	46.6
		Plaque deposition	135	54.0	158	63.2	293	58.6
		Broken	48	19.2	51	20.4	99	19.8
g.	Gums	Normal	156	62.4	146	58.4	302	60.4
		Receded	80	32.0	88	35.2	168	33.6
		Inflammed	14	5.6	16	6.4	30	6.0
h.	Lips	Normal	224	89.6	219	87.6	443	88.6
		Cracked /dry	22	8.8	25	10.0	47	9.4
		Angular Stomatitis	4	1.6	6	2.4	10	2.0
i.	Digestive funcitons	Normal	232	92.8	227	90.8	459	91.8
		Distended	18	7.2	23	9.2	41	8.2
j.	Respiratory symptoms	Normal	226	90.4	227	90.8	453	90.6
		Asthmatic	10	4.0	14	5.6	24	4.8
		Dyspnic	8	3.2	4	1.6	12	2.4
		Persistant cough	6	2.4	5	2.0	11	2.2

* Mulitple responses

Out of the 500 elderly, 471 (94.20%) had normal body temperature and 26 (5.20%) had slightly elevated body temperature. Mild hypothermia was observed in three elderly (0.60%) only. Anon (1999) states that severe hypothermia causes irregular heartbeat leading to heart failure and death. Thirty five (7.00%) of the elderly were found to perspire profusely. It may be due to some health problems like fever or pain in the joints.

Normal nails was found in 422 (84.40%) elderly, while 22 (4.40%) of them had brittle nails and 53 (10.60%) had discoloured nails. The spoon shaped nails in three elderly may be due to severe iron deficiency anaemia. There was no edema in 460 (92.00%) of the elderly, but 40 (8.00%) of them had slight swelling at the ankles and feet. While 396 (79.20%) had normal skin, 79 (15.80%) of them had dry skin and 25 (5.00%) had depigmentation. This may be due to a decrease in the function of sebaceous gland and enzymatically active melanocytes.

Pearl white teeth was observed only in 63 (12.60%) elderly. There was plaque deposition on teeth in 293 (58.60%) elderly, caries/ discoloured teeth in 233 (46.60%) of them and 99 (19.80%) had broken teeth. Dental problems in elderly may be due to change in diet, decrease in oral hygiene, self-care and decreased salivary flow.

The gums were normal for 302 (60.40%) elderly, while 168 (33.60%) had receded gums and 30 (6.00%) of them had inflammed gums. The lips of the majority (88.60%) of the elderly studied were normal.

But 9.40 per cent of them had cracked/dry lips. Angular stomatitis was found in ten (2.00%) of them. This may be due to decreased intake of vitamin B rich foods or prolonged low dietary intake.

Mild distension of stomach was observed in 41 (8.20%) of the elderly, while 459 (91.80%) had normal digestive functions. While no respiratory symptoms were observed in 453 (90.60%) of the elderly, 24 (4.80%) were found to be asthmatic, 12 (2.40%) were dyspnic and eleven (2.20%) suffered from persistent cough.

The general health status of the elderly is given in Table XXI.

TABLE XXI

GENERAL HEALTH STATUS OF THE ELDERLY (N: 500)

General examination	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Normal	151	60.4	166	66.4	317	63.4
Undernourished	60	24.0	38	15.2	98	19.6
Obese	39	15.6	46	18.4	85	17.0
Total	**250**	**100.00**	**250**	**100**	**500**	**100.00**
Health status						
Able to move freely	218	87.2	221	88.4	439	87.8
Partially mobile	32	12.8	29	11.6	61	12.2
Total	**250**	**100.00**	**250**	**100.00**	**500**	**100.00**

It was determined that 60.4 per cent of elderly men and 66.4 per cent of elderly women were generally normal. Only 24.0 per cent of elderly men and 15.2 per cent of elderly women were undernourished and 15.6 per cent of elderly men and 18.4 per cent of elderly women were obese.

Regarding the health status of the elderly, majority of the elderly men and women (87.2% and 88.4 % respectively) were able to move freely. Thirty two men (12.8%) and 29 women (11.6 %) were partially mobile. They were able to walk only with the help of a stick, or with the assistance of their caretakers.

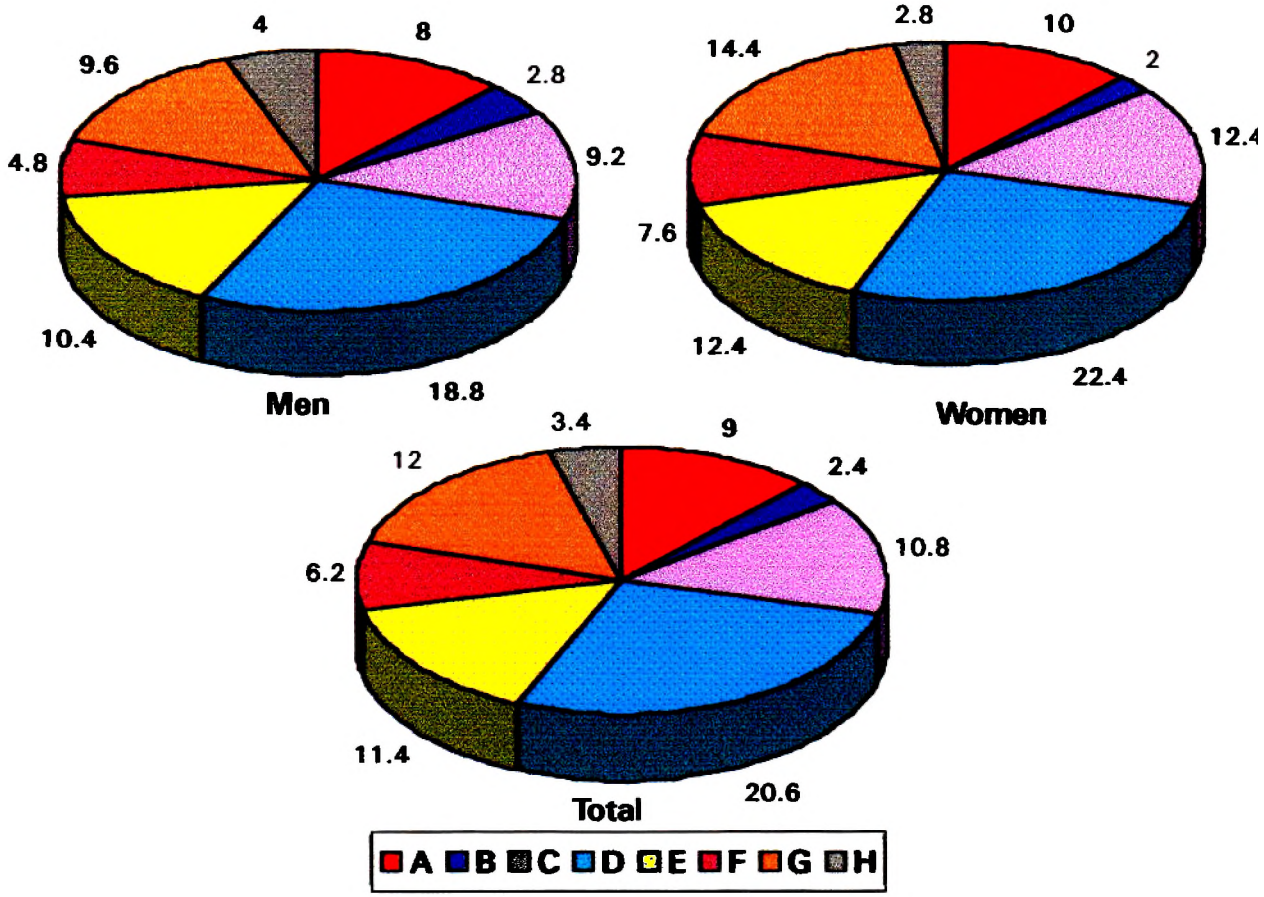
Some of the general health problems expressed by the elderly are given in Table XXII and Figure 8.

TABLE XXII

GENERAL HEALTH PROBLEMS AMONG THE ELDERLY

Health problems	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Constipation	20	8.0	25	10.0	45	9.0
Diarrhoea	7	2.8	5	2.0	12	2.4
Indigestion	23	9.2	31	12.4	54	10.8
Fatigue	47	18.8	56	22.4	103	20.6
Insomnia	26	10.4	31	12.4	57	11.4
Giddiness	12	4.8	19	7.6	31	6.2
Joint pain	24	9.6	36	14.4	60	12
Frequent cold	10	4.0	7	2.8	17	3.4

Eight per cent of the elderly men and 10 per cent of the elderly women had the problem of constipation. This might be due to certain factors like ageing, inadequate fibre and fluid in their diet and lack of exercise. Diarrhoea was present in 2.8 per cent of elderly men and 2.0 per cent of elderly women, followed by indigestion in 9.2 per cent and 12.4 per cent of the elderly men and women respectively.



A - Constipation
B - Diarrhoea
C - Indigestion
D - Fatigue
E - Insomnia
F - Giddiness
G - Joint pain
H - Frequent cold

FIGURE 8

GENERAL HEALTH PROBLEMS AMONG THE ELDERLY

A general feeling of tiredness or fatigue was experienced in 18.8 per cent and 22.4 percent of the elderly men of women respectively. Twenty-six elderly men (10.4%) and 31 elderly women (12.4%) had the problem of insomnia. Giddiness was experienced by 4.8 per cent of elderly men and 7.6 per cent of elderly women. Totally, 12 per cent of the elderly had the problem of joint pain, which is a common problem in elderly. Frequent cold was also observed in elderly men (4%) and women (2.8%).

The incidence of certain degenerative diseases among the elderly was elicited which is given in Table XXIII.

TABLE XXIII

DIFFERENT AILMENTS SUFFERED BY THE ELDERLY

Disease Condition	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Cardiovascular Disease	2	0.8	–	–	2	0.4
Hypertension	15	6.0	21	8.4	36	7.2
Respiratory Disease	12	4.8	16	6.4	28	5.6
Arthritis	21	8.4	36	14.4	57	11.4
Diabetes Mellitus	21	8.4	12	4.8	33	6.6
Cataract	32	12.8	29	11.6	61	12.2

Only two elderly men (0.8%) were suffering from cardiovascular disease. Six per cent of the elderly men and 8.4 per cent of the elderly women had hypertension. Respiratory disorders was observed in 4.8 per cent and 6.4 per cent of the elderly men and women respectively. Twenty-one men (8.4 per cent) and 36 women (14.4 per cent) were suffering from arthritis. Among the elderly men, 8.4 per cent and 4.8 per cent of elderly women had diabetes mellitus. Cataract was noticed in 12.8 per cent and 11.6 per cent of elderly men and women respectively. The elderly studied reported the common ailments associated with ageing as normally seen among elderly population. Among the common ailments, cataract was dominant among men and arthritis among women. Arthritis among elderly women may be associated with their poor intake of calcium rich foods and due to hormonal changes after menopause.

Physical exercise is an important aspect in elderly. The first and immediate benefit is that it establishes a sense of purpose – maintaining good health. Added to this is a sense of achievement as the person realizes that he/she has more control over the body than previously thought. Hence, information related to exercise pattern of the elderly in the present study were gathered. The details are given in Table XXIV.

TABLE XXIV

EXERCISE PATTERN OF THE ELDERLY (N:500)

Exercise	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
Walking	12	4.8	7	2.8	19	3.8
Jogging	–	–	–	–	–	–
Yoga	–	–	–	–	–	–
Others	–	–	–	–	–	–
Nil exercise	238	95.2	243	97.2	481	96.2
Reasons						
Poor health	38	15.97	49	20.17	87	18.09
Lack of Interest	46	19.33	27	11.11	73	15.18
Lack of time	32	13.44	36	14.81	68	14.14
Ignorance	122	51.26	131	53.91	253	52.59

It was found that only 4.8 per cent of the elderly men and 2.8 per cent of the elderly women practiced walking regularly. This was combined with other daily routine work such as going to their farms, to obtain milk and to buy vegetables. Natarajan (1998) stated that regular exercise can help, prevent high blood pressure, control diabetes, prevent constipation, reduce blood cholesterol, decrease the possibility of a heart attack and minimize the risk of osteoporosis. In this study, majority of the elderly (95.2% men and

97.2% women) did not follow any type of exercise. The reasons stated for the lack of exercise were poor health (18.09%), lack of interest (15.18 %) and lack of time (14.14 %). But most of the elderly were ignorant (51.26% men and 53.91% women) about the physical exercise and its importance in their day to day life. Natarajan (2003) points out that one should choose the exercise according to his physical capacity. Brisk walking, cycling and swimming are good exercises. Indoor games and floor exercises can also be done. Those with problems like arthritis can do upper body exercises sitting at home. The author also opines that the only tonic in old age is exercise.

c. Blood haemoglobin

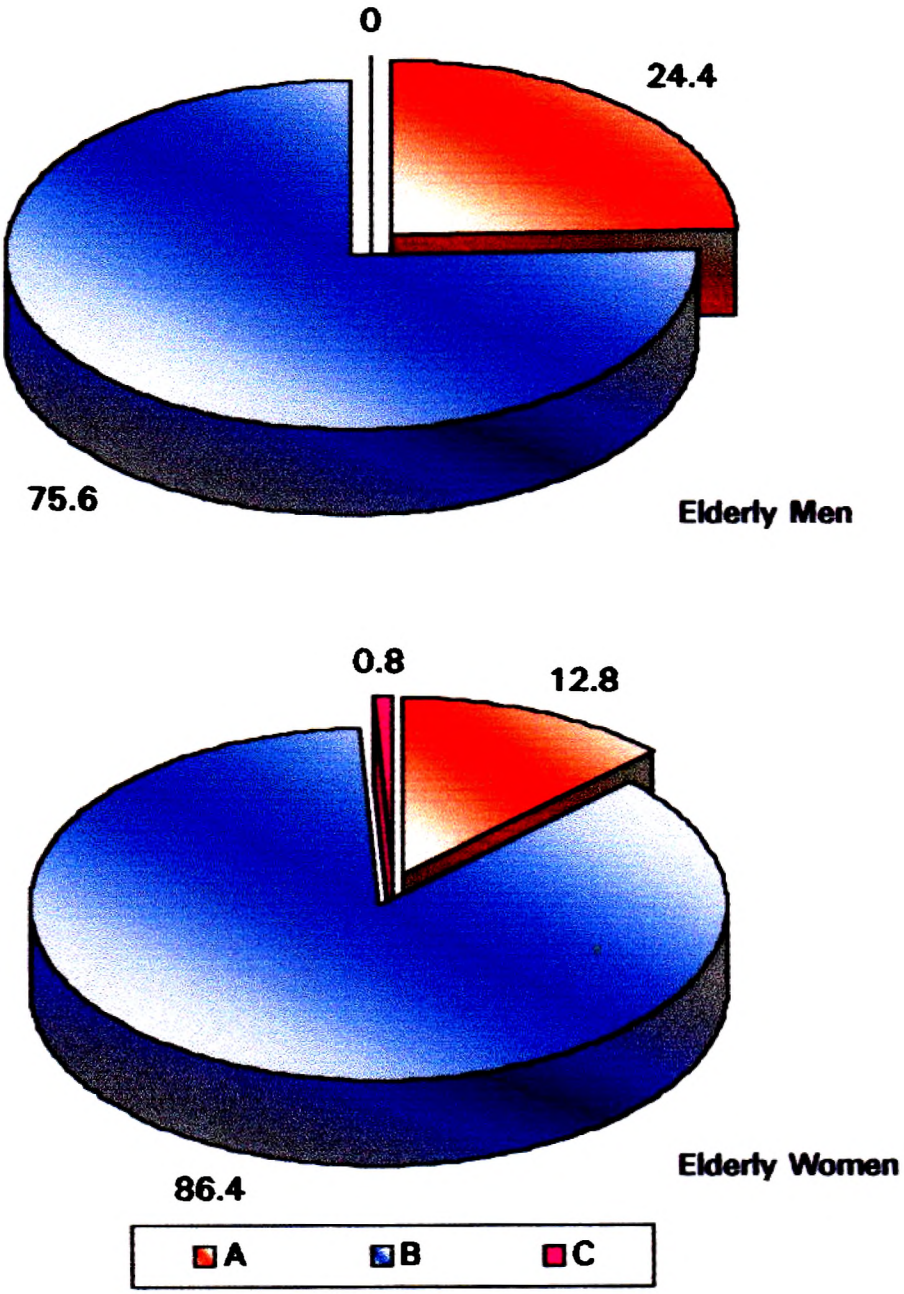
The mean haemoglobin levels of the elderly men and women were 10.81 g/dl and 10.46 g/dl of blood respectively. The elderly were classified based on their haemoglobin levels which is furnished in Table XXV and Figure 9.

TABLE XXV

CLASSIFICATION OF ELDERLY BASED ON HAEMOGLOBIN CONCENTRATION (N: 500)

*Blood Haemoglobin (g/dl)	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
12 and above (normal)	61	24.4	32	12.8	93	18.6
7-11 (mild anaemia)	189	75.6	216	86.4	405	81.0
7 and below (severe anaemia)	–	–	2	0.8	2	0.4
Total	**250**	**100**	**250**	**100**	**500**	**100**

* WHO (1986) Classification of anaemia



A - 12 and above (normal)

B - 7 - 11 (mild anaemia)

C - 7 and below (severe anaemia)

FIGURE 9

CLASSIFICATION OF ELDERLY BASED ON HAEMOGLOBIN CONCENTRATION

Among the 500 elderly studied 75.6 per cent of men and 86.4 per cent of women had mild anaemia, which is a common problem in elderly. In a study conducted by Natarajan, (1996) 76.09 per cent of men and 79.63 per cent of women were found to be anaemic. It was also observed that totally, 18.6 per cent of the elderly had normal blood haemoglobin concentration. Only two elderly women were suffering from severe anaemia. The low dietary intake of iron may be one of the reasons for the haemoglobin levels observed in the elderly. This can be attributed to poor intake of green leafy vegetables in their diet.

d. Food and nutrient intake of selected elderly

Proper nutrition is very essential to preserve sound health in all ages, more so in old age (Natarajan, 1995). Hence, a three-day weighment survey was done to study the food and nutrient intake of the selected elderly, 20 each of elderly men and women. The mean food and nutrient intake of the elderly in the age group of 60-67 years is shown in Tables XXVI and XXVII respectively.

i) Food intake pattern of selected elderly

Table XXVI and Figure 10 indicates the mean food intake of the selected elderly.

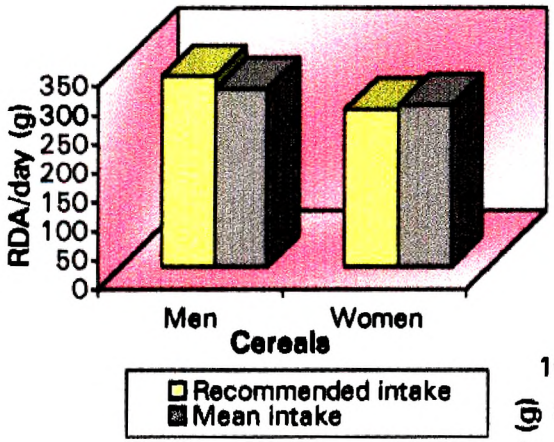
TABLE XXVI

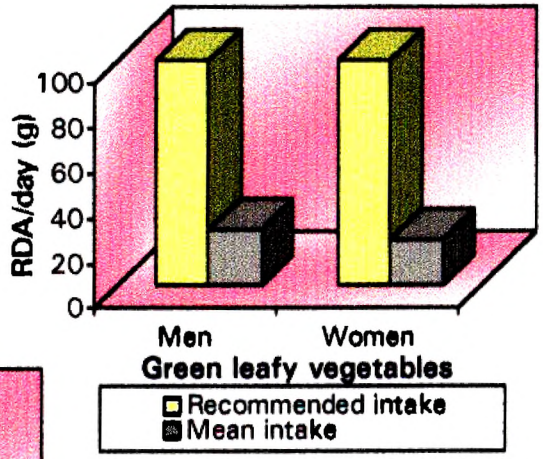
MEAN FOOD INTAKE OF THE SELECTED ELDERLY

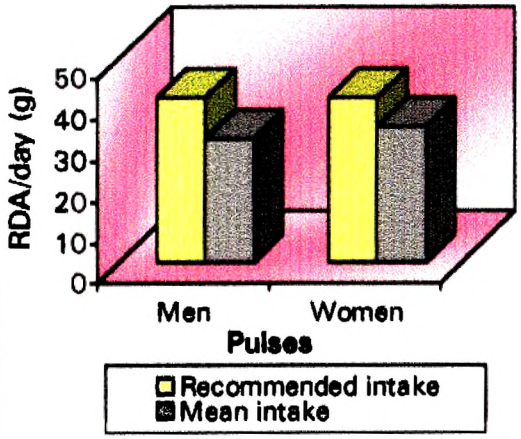
Foods g/day	Recommended Intake* g/day		Elderly Men (N:20)		Elderly Women (N:20)	
	Male	Female	Mean intake	Per cent Less or Excess	Mean intake	Per cent Less or Excess
Cereals	325	270	305	–6.15	276	+2.22
Pulses	40	40	30	–25	33	–17.5
Green leafy vegetables	100	100	25	–75	20	–80
Other vegetables	75	75	20	–73.33	18	–76
Roots and tubers	50	50	12	–76	15	–70
Fruits	30	30	14	–53.33	12	–60
Milk and Milk products	200	200	60	–70.00	45	–77.5
Meat, Fish, Egg	30	30	32	+6.66	26	–13.33
Sugar and jaggery	20	20	10	–50	10	–50
Fats and Oils	20	20	10	–50	10	–50

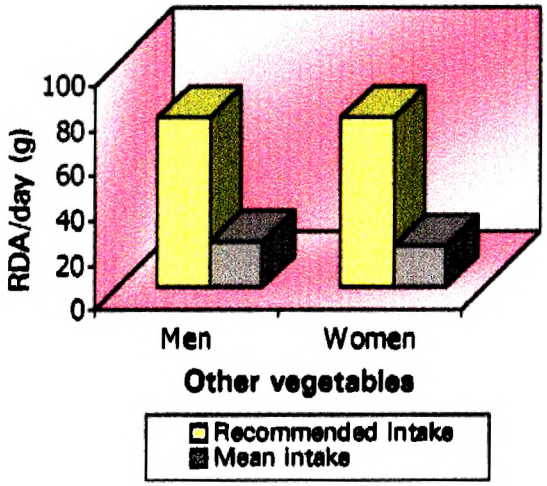
* - Pasricha and Thimmayamma (1997)

As far as cereal consumption, a less intake of 6.15 per cent was observed among elderly men, however an excess of 2.22 per cent was seen in the case of elderly women. The consumption of green leafy vegetables was found to be less by 75 per cent in men and 80 percent in women. Other vegetables and roots and tubers were also consumed below the recommended levels by elderly men and women. Milk and milk products consumed were found to be less by 70 per cent for men and 77.5 per cent for women. The fats and oils consumed were also found to be less by 50 per cent in both men and women.









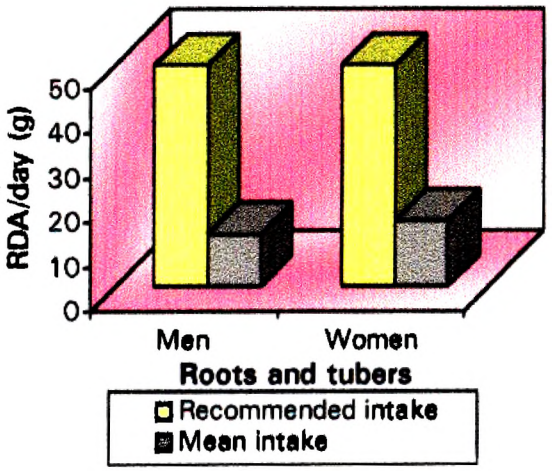


FIGURE 10 (a)

MEAN FOOD INTAKE OF THE SELECTED ELDERLY

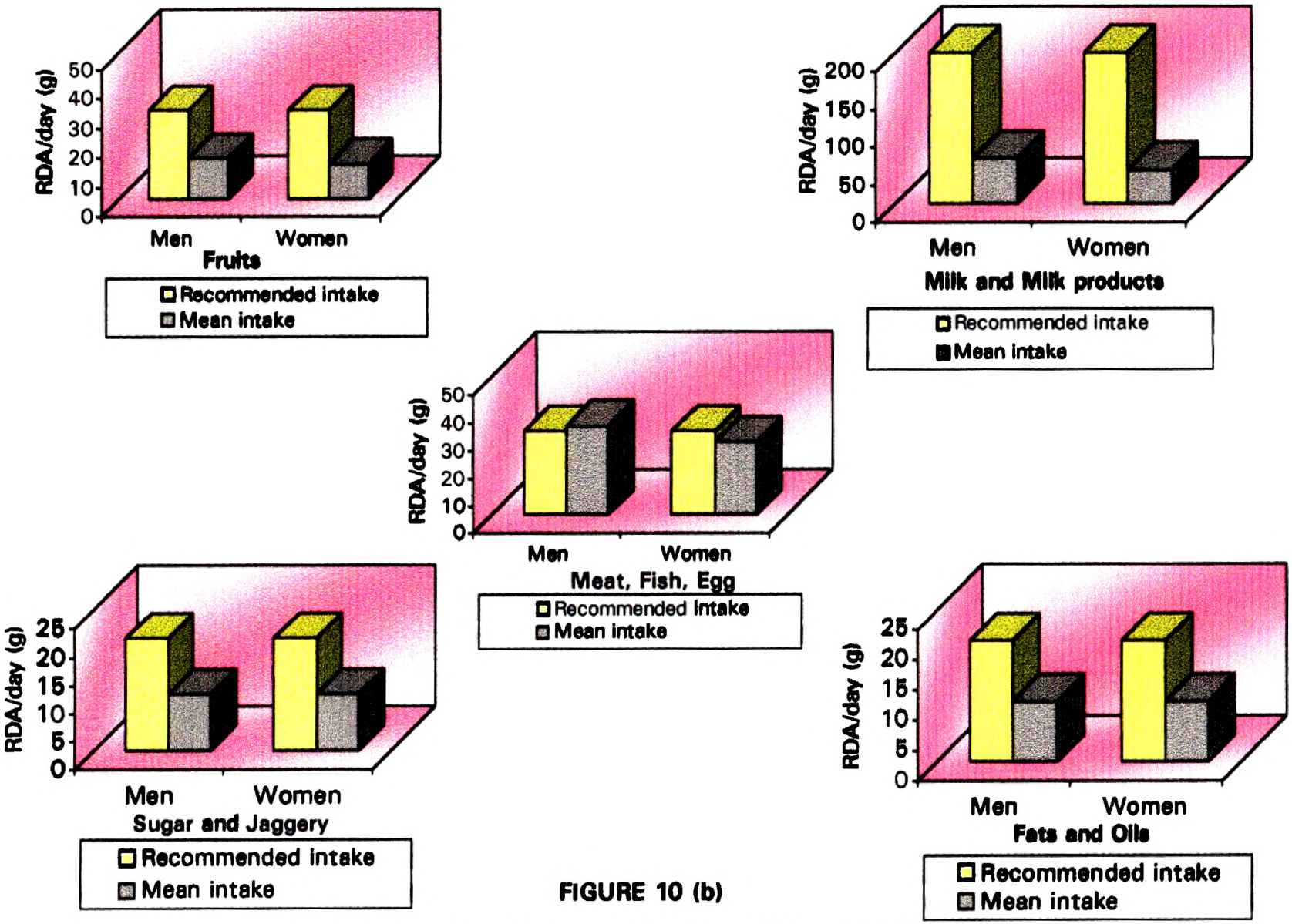


FIGURE 10 (b)

MEAN FOOD INTAKE OF THE SELECTED ELDERLY

ii) Nutrient intake pattern of selected elderly

Ideally, there are no specific nutrient requirements worked out for the elderly in India. However, one assumes some differences in the requirements of the elderly compared to those of young adults, because calorie intake is proportional to energy expenditure. Energy requirement is reduced by 11 per cent and 10 per cent in elderly men and women respectively. In the case of minerals and vitamins, there is practically no difference.

The mean nutrient intake of the selected elderly is given in Table XXVII and Figure 11.

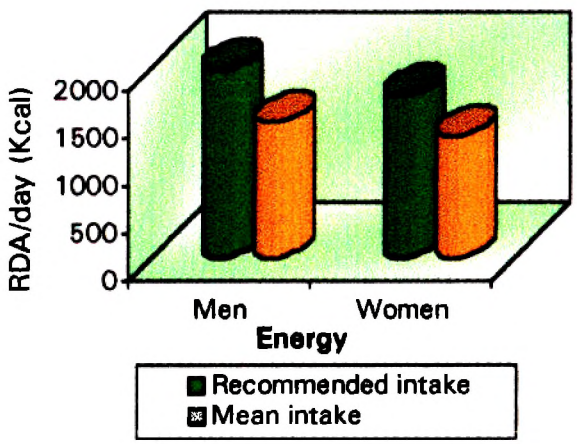
TABLE XXVII

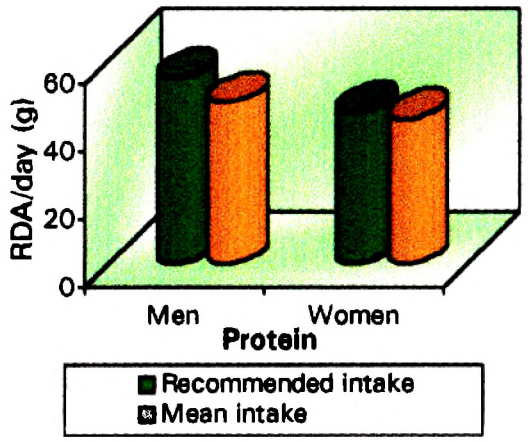
MEAN NUTRIENT INTAKE OF THE SELECTED ELDERLY

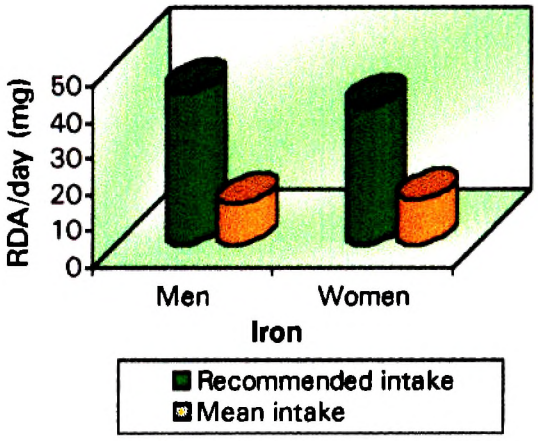
Nutrients	Recommended Intake* /day		Elderly Men (N:20)		Elderly Women (N:20)	
	Male	Female	Mean intake	Per cent Less or Excess	Mean intake	Per cent Less or Excess
Energy (Kcal)	1973	1704	1419	−28.08	1274	−25.23
Protein (g)	55	45	48	−12.73	43	−4.44
Iron (mg)	42	38	11	−73.81	12	−68.42
Calcium (mg)	886	865	304	−65.69	282	−67.40
Vitamin C (mg)	40	40	28	−30.00	21	−47.5
Thiamine (mg)	1.2	1.2	1.1	−8.33	0.87	−27.5
Riboflavin (mg)	1.1	1.1	1.0	−9.09	0.76	−30.91
Niacin (mg)	16	12	14.43	−9.81	8.64	−28.00
Vitamin A (µg)	2400	2400	1398	−41.75	1242	−48.25

* Pasricha and Thimmayamma (1997)

All the nutrients were Less in the case of elderly men when compared to that recommended by Pasricha and Thimayamma (1997).







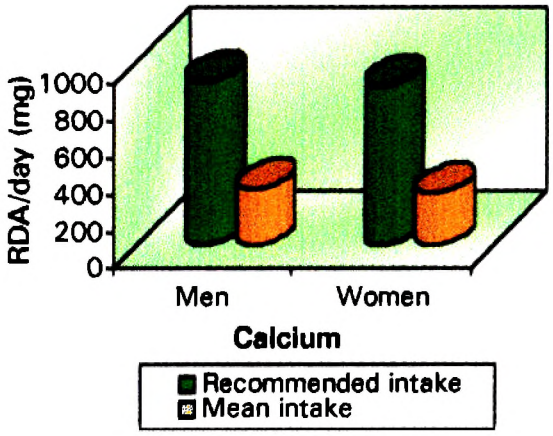


FIGURE 11 (a)

MEAN NUTRIENT INTAKE OF THE SELECTED ELDERLY

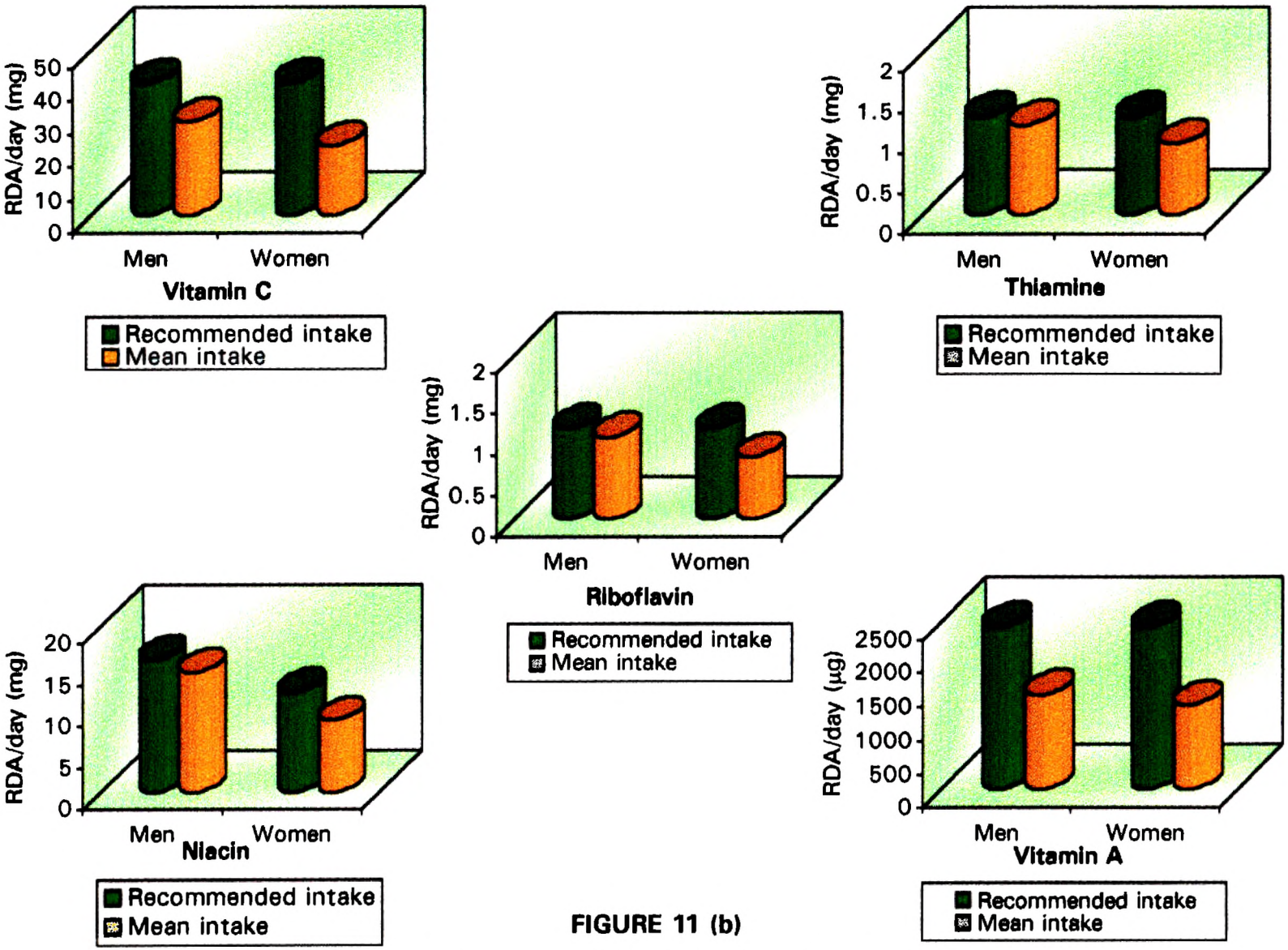


FIGURE 11 (b)

MEAN NUTRIENT INTAKE OF THE SELECTED ELDERLY

The same trend was also observed in elderly women. Though there was an excess intake of cereals (2.22 per cent) in elderly women, the energy intake was less by 25.23 per cent. This might be due to the low intake of other foods, which provide energy such as pulses, roots and tubers, sugar and jaggery and fats and oils.

Studies conducted by Chandrasekhar and Bhooma (1999), Pushpamma et al., (1999) and Devi and Khader, (1999) also showed that the nutrient intake in elderly was low compared to RDA for adults.

4. Psychological Well Being

Apart from gathering the informations related to socioeconomic background, dietary pattern, and nutritional profile, an attempt was also made to study the psychological well being of the elderly.

Table XXVIII depicts the feelings of the selected elderly related to their current status in the family.

TABLE XXVIII

CURRENT STATUS OF THE ELDERLY IN THEIR FAMILIES

Status	Men (N:250)		Women (N:250)		Total (N:500)*	
	Number	Per cent	Number	Per cent	Number	Per cent
No due respect by the family members	32	12.8	68	27.2	100	20
No involvement in decision making	67	26.8	81	32.4	148	29.6
No discussion in family matters	84	33.6	96	38.4	180	36.0
Feeling isolated	49	19.6	58	23.2	107	21.4
No financial freedom	67	26.8	92	36.8	159	31.8
No social movement	55	22.0	62	24.8	117	23.4

* Multiple Responses

Twenty per cent of the elderly expressed that there was no due respect given to them by the family members. The elderly (26.8% men and 32.4% women) also felt that they were not involved in any decision making by the other family members. Thirty six per cent of elderly expressed that the family members were not discussing with them on family matters. Since many of the elderly were living with their sons, only 19.6 per cent of elderly men and 23.2 per cent of elderly women had the feeling of isolation. Among the elderly men, 26.8 per cent and 36.8 per cent of elderly women felt that they did not had any financial freedom. Totally, 23.4 per cent of elderly expressed that their participation in social function including their visits to the relatives houses had decreased as they age. The elderly were asked to restrain from social functions/celebration by their children due to various reasons. Hence, the elderly of the present study felt that their movement in the society had been prevented.

During the personal interview with the elderly, observations were made to study the mental state of the selected elderly. Table XXIX shows the mental state of the elderly studied.

TABLE XXIX

MENTAL STATE OF THE SELECTED ELDERLY

Mental state	Men (N:250)		Women (N:250)		Total (N:500)*	
	Number	Per cent	Number	Per cent	Number	Per cent
Friendly	104	41.6	89	35.6	193	38.6
Hostile	22	8.8	53	21.2	75	15.0
Confused	67	26.8	112	44.8	179	35.8
Excited	54	21.6	69	27.6	123	24.6
Depressed	29	11.6	34	13.6	63	12.6

* Multiple Responses

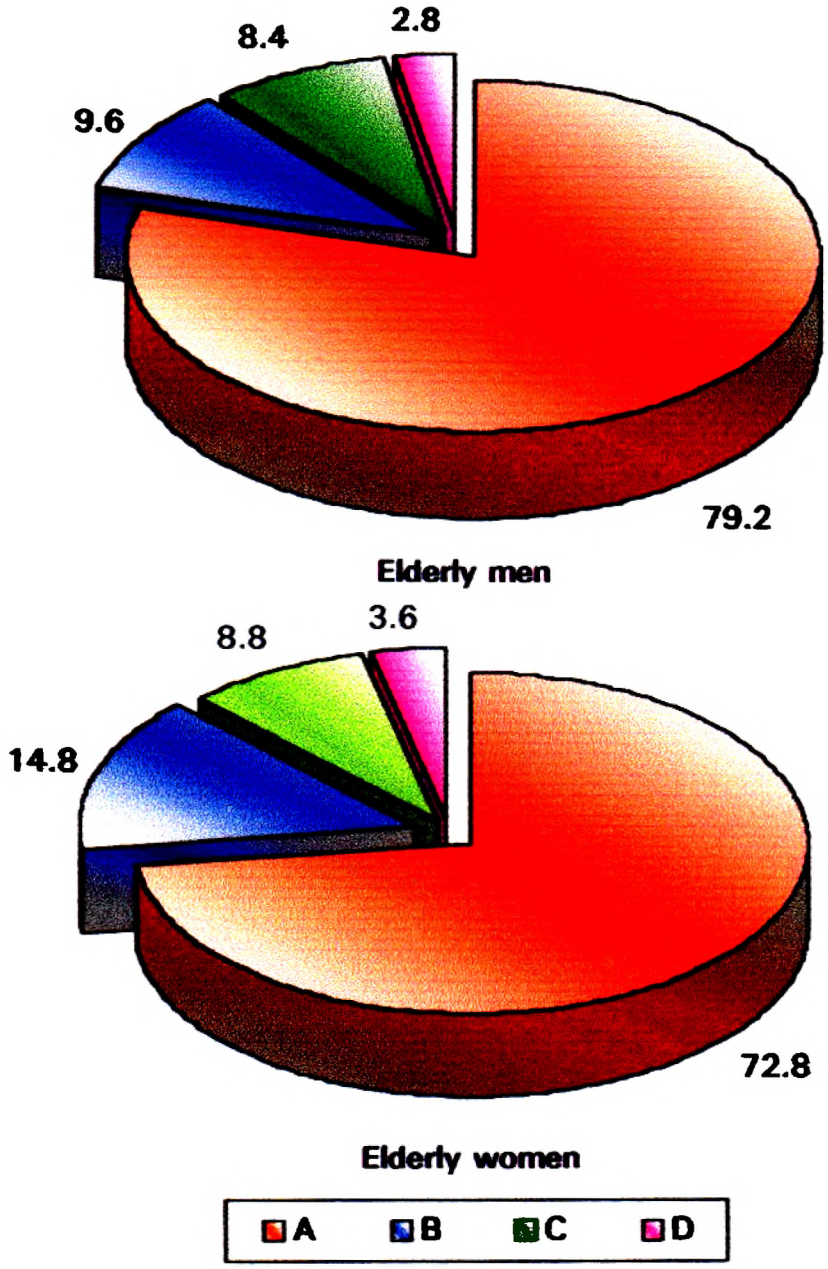
It was observed that 41.6 per cent of elderly men and 35.6 per cent of elderly women were friendly. Hostile attitude was more in elderly women (21.2%) when compared to elderly men (8.8%). A state of confusion was noted in 26.8 per cent of elderly men and 44.8 per cent of elderly women. Elderly men were less excited (21.6%) than women (27.6%). It was also observed that 11.6 per cent of elderly men and 13.6 per cent of elderly women were depressed. As regards mental health, Natarajan (2003) points out that it is very necessary that elders are paid enough attention to this aspect of their health. They should keep themselves mentally cheerful and occupied. Pursuing hobbies like bajans, meditation, spiritual discourses and so on gives peace of mind.

A geriatric depression scale developed by Verma et al., (1993) for Indian population was used for assessing depression in the selected elderly. The extent of depression in the elderly is given in the geriatric depression assessment Table XXX and Figure 12.

TABLE XXX

GERIATRIC DEPRESSION ASSESSMENT (N: 500)

Extent of depression	Men		Women		Total	
	Number	Per cent	Number	Per cent	Number	Per cent
No depression	198	79.2	182	72.8	380	76.0
Mild	24	9.6	37	14.8	61	12.2
Moderate	21	8.4	22	8.8	43	8.6
Severe	7	2.8	9	3.6	16	3.2
Total	**250**	**100.00**	**250**	**100.00**	**500**	**100.00**



A - No depression B - Mild

C - Moderate D - Severe

FIGURE 12

GERIATRIC DEPRESSION ASSESSMENT

On the whole, 76.0 per cent of the elderly were not depressed. It was found that 12.2 per cent of the elderly were mildly depressed and 8.6 per cent moderately depressed. Severe depression was observed only in 2.8 per cent of elderly men and 3.6 per cent of elderly women.

B. Nutritional Profile of the Selected Elderly involved in the Supplementation Study

Hundred elderly (50 men and 50 women) were selected for the supplementation study. The nutritional profile of these elderly is discussed below.

Table XXXI gives the mean height, weight and BMI of the selected elderly involved in the supplementation study.

TABLE XXXI

MEAN HEIGHT, WEIGHT AND BMI OF THE SELECTED ELDERLY

Parameters	Men (N:50)	Women (N:50)
Height (cm)	155.52	144.34
Weight (kg)	49.44	42.54
BMI	20.47	20.41

The mean height of the elderly men was 155.52cm and that of the elderly women was 144.34cm. The mean weight of the elderly men was 49.44kg and that of the elderly women was 42.54kg. Even though the calorie intakes of all the elderly men and women were lower than the ICMR allowances, they had a BMI within the normal range.

The BMI of the elderly selected for the study can be distributed as given in Table XXXII.

TABLE XXXII

DISTRIBUTION OF THE ELDERLY ACCORDING TO THEIR BMI (N:100)

BMI	Number	Per cent
16–16.9 (CED–Grade II)	8	8
17–18.4 (CED–Grade I)	12	12
18.5–19.9 (Low weight normal)	24	24
20–24.9 (Normal)	52	52
25–29.9 (Overweight)	4	4

It was observed that there were eight per cent and 12 per cent of the elderly in CED-grade II (BMI 16-16.9) and CED-grade I (BMI 17-18.4) categories respectively. Twenty four percent of the elderly belonged to low weight normal category (BMI 18.5-19.9). Fifty two per cent of the elderly were in the normal BMI category (20-24.9) and 4 per cent in the overweight category. As far as elderly men and women are considered, the weight gain in early adult life, sedentary life style with less physical activity would have contributed to over weight. Apart from these reasons, as far as elderly women are concerned, it may be precipitated by a number of events including pregnancy, intake of oral contraceptives and menopause.

The results of the blood profile of the 100 elderly men and women at the beginning of the study are given in Table XXXIII.

TABLE XXXIII

BIOCHEMICAL PROFILE OF THE SELECTED ELDERLY

Blood / Serum levels	Men (N:50) $\bar{x} \pm SD$	Women (N:50) $\bar{x} \pm SD$	Normal values *
Hemoglobin (g/dl)	10.26	10.21	12–14[1]
Vitamin A (μmol/l)	1.20±0.49	1.10±0.43	1.16–4.83[4]
Vitamin C (μmol/l)	29.0±2.81	26.5 ±1.61	30–110[3]
Vitamin E (μmol/l)	13.52±0.76	15.28±1.03	18–29[3]
Iron (μg/dl)	93.22±8.10	90.52±9.68	80–120[2]
Zinc (μg/dl)	88.00±5.98	85.12±4.01	80–110[2]
Copper (μg/dl)	78.64±4.53	79.78±6.50	75–160[1]
Lipid peroxide (n mol/ml)	3.71±1.35	3.29±0.95	

* [1]-Varley (1988) [3]-Meydani (1994)
[2]-WHO (1996) [4]-Chandra (1992)

The mean haemoglobin level was found to be 10.26g/dl and 10.21g/dl of blood for elderly men and women respectively. The low haemoglobin levels observed in the elderly may be due to their low daily dietary intake of iron, which was found to be less than the Recommended Dietary Allowance.

The mean serum vitamin A levels in elderly men and women were 1.20± 0.49 and 1.10± 0.43 μmol/l respectively. These values were found nearer to the lower limits of the normal range of 1.16 to 4.83 μ mol/l.

The mean vitamin C values for the elderly men and women were 29.0±2.81 and 26.5±1.61μmol/l respectively. These values were slightly below the normal range of 30-110 μmol/l.

The mean vitamin E level of the elderly men and women were 13.52±0.76 and 15.28±1.03 μmol/l respectively. These values were found to be below the normal range of 18-29 μmol/l.

The mean serum iron levels in both elderly men and women were 93.22 ±8.10 and 90.52 ±9.68 μg/dl respectively which was within the normal range of 80-120 μg/dl. The mean serum zinc and copper levels were also within the normal range in both elderly men and women.

The mean serum lipid peroxide levels of the elderly men and women were 3.71 ± 1.35 and 3.29±0.95 n mol/ml respectively. This is similar to the findings of Reddy et al., (1993).

The elderly selected for the supplementation study did not suffer from any chronic disease conditions and majority had acceptable BMI but

their biochemical profile were in the lower range. These factors would assist to study the impact of food supplementation on the selected elderly.

C. Quality Parameters of the Food Supplement

The food supplement was prepared by mixing malted wheat, ragi, green gram, pressure cooked carrots, blanched tomato and amaranthus. All the ingredients were dried, powdered and then mixed together thoroughly. The physical and nutritional qualities, recipe formulation and its acceptability and the results of the storage studies of the food supplement are discussed under the following headings:

1. Physical and Nutritional Quality
2. Recipe Formulation and its Acceptability
3. Storage Study
4. Cost Benefit Analysis

1. Physical and Nutritional Quality

The physical characteristics of the food supplement are given in Table XXXIV.

TABLE XXXIV

PHYSICAL CHARACTERISTICS OF THE FOOD SUPPLEMENT

Parameters	Food Supplement
Colour	Light Yellowish green
Flavour	Pleasant Sensation
Taste	Highly acceptable
Viscosity	15.27 centistokes

The food supplement had a light yellowish green colour and a pleasant flavour. The taste was highly acceptable due to the presence of

malted and slightly roasted flours and the vegetables and fruit. The viscosity of the food supplement was found to be 15.27 centistokes.

Table XXXV depicts the nutrients present in 100g of the food supplement.

TABLE XXXV

NUTRIENT COMPOSITION OF 100g FOOD SUPPLEMENT

Nutrients	Food Supplement - 100 gram
Energy (Kcal)	560
Protein (g)	7.00
Iron (mg)	6.40
Calcium (mg)	132.30
Phosphorus (mg)	208.60
β-Carotene (μg)	2855.40
Vitamin C (mg)	64.90
Vitamin E (mg)	5.60
*Zinc (mg)	1.25
* Copper (mg)	0.32
* Total Carotene (μg)	4395.50

* Calculated Value

The energy content of 100g of food supplement was 560Kcal. The protein content of the supplement was 7g. The iron, calcium and phosphorus in the food supplement were found to be 6.4, 132.3 and 208.6mg per 100g respectively. It was observed that 2855.4μg of β-carotene was present in 100g of the food supplement. The vitamin C and vitamin E content of 100g of food supplement was 64.9 and 5.6mg respectively. The trace minerals namely zinc and copper and the total carotene was

calculated using the Nutritive Value of Indian Foods (2000). The zinc and copper content was 1.25 and 0.32mg respectively in 100g of food supplement while total carotene was found to be 4395.5μg.

Gupta et al., (2002) studied the changes in ascorbic acid content during germination of pulses. The germination treatment was found to be effective in producing vitamin C in the pulses. Studies conducted by Sharma et al., (2002) reveals that total sugar content increases substantially during germination due to the reason that polysaccharides are broken into their lower sugars causing an increase in the total sugar content. Similarly, total reducing sugar content was found to increase on soaking and further markedly by germination due to an increase in the activity of enzyme amylase. Ascorbic acid content was elevated on soaking and germination had brought about a tremendous increase in the ascorbic acid content. To minimise losses of ascorbic acid it is preferable to cook for a shorter period. During frying, the losses were least and dry heat processing had resulted in better retention of nutrients than moist heat processing.

The food supplement developed in the present study contained all the essential macro and micro nutrients in considerable amounts which can be used as an ideal food supplement for the elderly.

2. Recipe Formulation and its Acceptability

Simple and easy to prepare recipes namely porridge (sweet and salt) and sweet balls were formulated using the food supplement developed in this study. The acceptability of porridge and balls was evaluated by a group of panel members in terms of quality attributes namely appearance, colour,

flavour, texture and taste organoleptically using a five point scale. The details of these are given in Table XXXVI.

TABLE XXXVI

ACCEPTABILITY OF PORRIDGE AND BALLS PREPARED FROM THE FOOD SUPPLEMENT

Recipes	Quality parameters					
	Appearance (5)	Colour (5)	Flavour (5)	Texture (5)	Taste (5)	Overall acceptability (25)
Porridge (sweet)	5.0	4.9	5.0	5.0	4.9	24.8
Porridge (salt)	4.7	4.9	4.9	5.0	4.8	24.3
Sweet balls	4.9	5.0	5.0	4.9	5.0	24.8

The above table gives the mean scores given by the panelists for the quality attributes of the three recipes prepared with the food supplement. The three recipes porridge (sweet and salt) and sweet balls prepared from the food supplement were found to have an overall acceptability of 24.8, 24.3 and 24.8 respectively out of 25.0 (Maximum score).

The mean scores obtained by sweet porridge for appearance, colour, flavour, texture and taste were 5.0, 4.9, 5.0,5.0 and 4.9 respectively with an overall acceptability of 24.8. The mean scores obtained by salted porridge for appearance, colour, flavour, texture and taste were 4.7, 4.9, 4.9, 5.0 and 4.8 respectively. Similarly the sweet balls also scored a maximum for its colour, flavour and taste and the overall acceptability was 24.8.

These recipes took only a minimum time to prepare and easy to cook and ready for their consumption by the elderly themselves.

3. Storage Study

The storage study of the food supplement conducted to find out the keeping quality revealed that it had a shelf life of more than two months and there was no insect infestation or other weevils upto three months which was observed by direct examination. The changes in moisture content, alcoholic acidity, peroxide value and the bacteriological examination during the storage periods are given in Table XXXVII.

TABLE XXXVII

STORAGE TRIALS FOR THE FOOD SUPPLEMENT

Storage period (Days)	Parameters				
	Moisture (%)	Alcoholic acidity (%)	Peroxide value (m moles/kg fat)	Bacteriological examination (cfu/g)	
1	7.25	0.041	0.05	0.05×10^4	500
15	7.42	0.048	0.07	0.07×10^4	700
30	7.65	0.053	0.13	0.09×10^4	900
45	8.05	0.061	1.20	1.02×10^4	10,200
60	8.58	0.063	1.29	1.60×10^4	16,000
PFA values	**14.00**	**0.120**	**10.0**		**50,000**

The initial mean moisture content of the food supplement was 7.25 per cent, which increased to 8.58 at the end of the storage period of 60 days at room temperature. These values were lower than that (14% moisture) laid down by Prevention of Food Adulteration Act (PFA), 1979 (Gopaldas, et al., 1992). The initial mean alcoholic acidity of the food supplement was 0.041 per cent which increased to 0.063 per cent at the end of storage period. The peroxide value was 1.29 millimoles/kg fat at the end of storage period. It was observed that all the parameters tested during the storage trials were within PFA standard values.

These results indicate that the supplement had a shelf life of 60 days without any quality deterioration.

4. Cost Benefit Analysis

The cost of the food supplement with the major nutrients namely energy and protein and the vital vitamins and minerals present in 100g of the food supplement was compared to a commercially available supplementary food that is commonly consumed or affordable by those elderly. The cost of the food supplement and the commercial supplementary food were calculated based on the existing prices in Erode in September 2003. Table XXXVIII gives the cost benefit analysis of the food supplement.

TABLE XXXVIII

COST BENEFIT ANALYSIS OF THE FOOD SUPPLEMENT

Nutrients	Food Supplement per 100g	Commercial Supplementary Food	
		Per 100g	Per 30g
Energy (kcal)	560	444	128.7
Protein (g)	7	20	6.0
Vitamin C (mg)	64.9	30	9.0
Vitamin E (mg)	5.6	3.0	0.9
β-Carotene (μg)	2855.4	7066.8	2120
Iron (mg)	6.4	13.5	4.05
Calcium (mg)	132.3	800	240
Phosphorus (mg)	208.6	780	234
Cost (in Rs/100g)	3.00	34.00	10.20

It was observed that the cost of the food supplement developed in the present study was only Rs 3.00 per 100g whereas the commercial supplementary food cost Rs 34.00 per 100g . The low price of the food

supplement may be due to the fact that wheat, ragi and green gram are low cost locally available cereals and pulse. The commonly adopted processing techniques were only used to prepare the food supplement, which were simple and does not require any large or modern machinery. Similarly, carrot, tomato and amaranthus, which were available at a cheaper rate, were added in the food supplement. All these factors may contribute to the low price of the food supplement.

The nutrients available from the food supplement in one meal (100g) was compared with the commercial supplementary food in which 30g of the food is dissolved in warm milk or water for consumption in one sitting. About 560 Kcal and seven grams of protein was present in the food supplement whereas 128.7 Kcal and six grams of protein was provided by the commercial supplementary food.

Similarly the antioxidant nutrients namely vitamins C, E and β-carotene that were present in the food supplement was 64.9mg, 5.6mg and 2855.4µg respectively compared to 9.0mg, 0.9mg and 2120µg in the commercial supplementary food. Iron contribution was 6.4mg in food supplement and only 4.05mg in the commercial supplementary food. But there was a difference in the case of calcium and phosphorus only, which were slightly more in the commercial supplementary food compared to the food supplement which may be attributed to the addition of synthetic salts of calcium and phosphorus. However, the nutrient contribution per sitting by the food supplement was better than that of the commercial supplementary food and the cost was about ten times more for this commercial supplementary food.

Thus, the developed food supplement had satisfactory quality attributes, good shelf life, nutrient content to meet the energy, protein and other antioxidant vitamins and the minerals adequate and above all was cost effective and innovative which can be introduced in the diets of the elderly people.

D. Impact of Food Supplementation on Selected Elderly

The impact of food supplementation was studied in 100 elderly of whom 50 (25 men and 25 women) formed the supplemented group and 50 (25 men and 25 women) the control group. The above impact was evaluated through anthropometric and biochemical parameters before and after supplementation.

1. Base Line Comparability

In the beginning of the study the demographic variables namely age and sex, body weight and BMI and biochemical variables of the supplemented group and control group were tested for comparability. Table XXXIX presents the comparability on demographics between the supplemented and control groups at baseline.

TABLE XXXIX

COMPARABILITY ON DEMOGRAPHICS BETWEEN SUPPLEMENTED AND CONTROL GROUPS AT BASE LINE

Demographic Variables	Group				Total	
	Supplemented		Control			
	Number	Per cent	Number	Per cent	Number	Per cent
Age Group						
60-67	50	50	50	50	100	100
Gender						
Men	25	50	25	50	50	50
Women	25	50	25	50	50	50

The supplemented and control groups were comparable at baseline on demographic characteristics namely age and gender.

Table XL gives the comparability on anthropometric and biochemical variables between the groups chosen for supplementation and control group at baseline.

TABLE XL

COMPARABILITY OF BODY WEIGHT, BODY MASS INDEX AND BIOCHEMICAL VARIABLES BETWEEN SUPPLEMENTED AND CONTROL GROUPS AT BASELINE

Variables	Men (N:50)			Women (N:50)		
	Supplemented group $\bar{x} \pm SD$	Control group $\bar{x} \pm SD$	't' value	Supplemented group $\bar{x} \pm SD$	Control group $\bar{x} \pm SD$	't' value
Weight (kg)	48.60 ±5.69	50.28 ±6.90	0.9389^{NS}	41.92 ±6.48	43.16 ±6.40	0.6668^{NS}
Body Mass Index	20.21 ±2.17	20.72 ±2.67	0.7388^{NS}	20.27 ±2.36	20.54 ±2.87	0.3554^{NS}
Haemoglobin (g/dl)	10.12 ±0.99	10.40 ±0.89	1.05^{NS}	10.08 ±0.89	10.33 ±0.90	0.9585^{NS}
Vitami A (µmol/l)	0.94 ±0.36	1.46 ±0.46	4.4193**	1.23 ±0.52	0.97 ±0.27	2.2115*
Vitami C (µmol/l)	29.0 ±2.16	29.0 ±3.38	0.000^{NS}	26.0 ±1.63	27.0 ±1.44	2.2942*
Vitami E (µmol/l)	13.30 ±0.68	13.74 ±0.77	2.1310*	15.31 ±0.98	15.25 ±1.09	0.2181^{NS}
Iron (µg/dl)	93.32 ±8.74	93.12 ±7.58	0.0864^{NS}	90.88 ±9.83	90.16 ±9.72	0.2604^{NS}
Zinc (µg/dl)	88.84 ±6.39	87.16 ±5.54	0.9926^{NS}	84.60 ±4.17	85.64 ±3.85	0.9158^{NS}
Copper (µg/dl)	78.44 ±3.91	78.84 ±5.15	0.3093^{NS}	79.92 ±6.00	79.64 ±7.09	0.1508^{NS}
Lipid peroxide (nmol/ml)	3.89 ±1.34	3.61 ±1.37	0.2776^{NS}	3.30 ±0.89	3.29 ±1.02	0.0546^{NS}

** - Significant at 1% level * - Significant at 5% level NS - Non significant

Both the group to be supplemented and control group were comparable at base line with respect to body weight, Body Mass Index and other biochemical parameters except serum vitamin A, vitamin C and

vitamin E levels. With regard to vitamin A, it was slightly more (0.52μmol/l) for the elderly men in the control group. Being control group, this slight difference may not interfere with the impact of supplementation. Serum vitamin A levels of the elderly women selected for the supplementation was slightly more (0.26μmol/l) than the control group. The difference between supplemented and control group for elderly men were significant at one per cent level and significant at five per cent level for elderly women which could be attributed to the individual absorption capacity of vitamin A, especially during ageing process.

As far as serum vitamin C levels were concerned slight increase (1.0μmol/l) was observed among the elderly women belonging to control group. This difference between supplemented and control group was significant at five per cent level, again which could be attributed to individual absorption capacity. Moreover being control group, this difference in serum vitamin C level may not interfere with the supplementation. With regard to vitamin E, it was slightly more (0.44 μmol/l) for the elderly men in the control group. Being control group this slight difference may not interfere with the impact of supplementation. Thus the over all comparability between the two groups was quite obvious in beginning of the study.

2. Nutrient Intake Pattern due to Supplementation

The total intake of nutrients in the supplemented group when the food supplement was given was calculated. The details are given in Table XLI.

TABLE XLI

TOTAL NUTRIENT INTAKE OF THE ELDERLY MEN AND WOMEN

DURING THE INTERVENTION PERIOD

Nutrients	RDA		Actual Intake		Supplement (100g)	Total Intake	
	Men	Women	Men	Women		Men	Women
Energy (kcal)	1973	1704	1419	1274	560	1979	1834
Protein (g)	55	45	48	43	7	55	50
Iron (mg)	42	38	11	12	6.4	17.4	18.4
Calcium (mg)	886	865	304	282	132.3	436.3	414.3
Vitamin C (mg)	40	40	28	21	64.9	92.9	85.9
β-Carotene (μg)	2400	2400	1398	1242	2855.4	4253.4	4097.4

It was observed that through supplementation the energy, protein, vitamin C and β-carotene requirements were met. The iron and calcium intake improved but did not meet the requirement. The bio availability of the nutrients especially the minerals iron and calcium are increased after malting (Giri et al., 1981). Therefore, the absorption of nutrients from the food supplement must have been enhanced. Thus, there was an overall improvement in the nutrient intake especially energy, protein and the antioxidant nutrients namely vitamin C and β-carotene.

3. Impact of Supplementation on the Nutritional Profile of the Elderly

a. Changes in weight and BMI

The impact of food supplementation on the weight and Body Mass Index of the supplemented group as against the control is given in Table XLII and Figure 13.

TABLE XLII

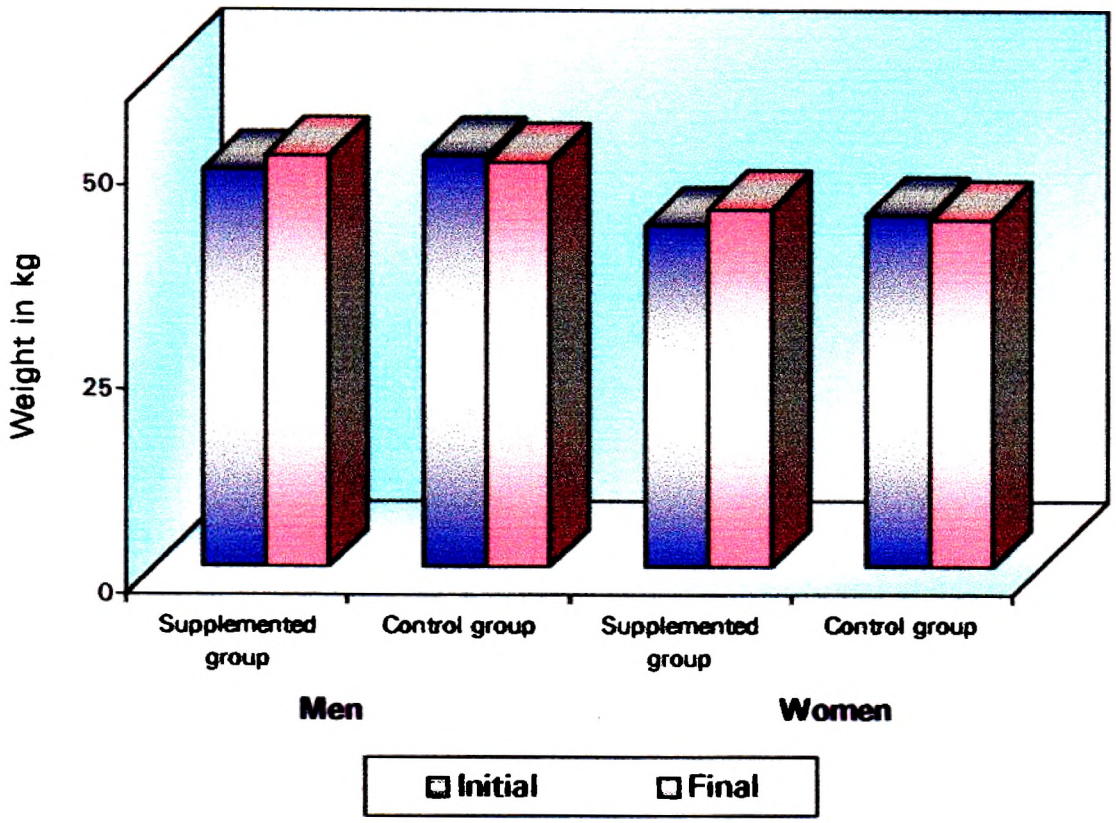
MEAN WEIGHT AND BODY MASS INDEX OF THE ELDERLY BEFORE AND AFTER SUPPLEMENTATION

Parameters	Supplemented group (N: 50)			Control group (N: 50)			't' value
	Initial	Final	Difference	Initial	Final	Difference	
Weight (kg)							
Men	48.60	50.40	1.80	50.28	49.64	-0.64	5.9395**
Women	41.92	43.96	2.04	43.16	42.56	-0.60	7.1430**
Body Mass Index							
Men	20.20	20.94	0.74	20.72	20.45	-0.27	6.1088**
Women	20.27	21.29	1.01	20.54	20.25	-0.28	6.9320**

** - Significant at 1% level

The initial mean weight of the elderly men and women in the supplemented group was 48.60kg and 41.92kg, which increased to 50.40kg and 43.96kg respectively at the end of the supplementation period. The mean increase in weight was 1.80kg and 2.04kg in the elderly men and women respectively. In the control group, a slight reduction of 0.64kg in elderly men and 0.60kg in elderly women was observed in weight at the end of the study period.

The Body Mass Index which was 20.20 in the elderly men at the beginning of the study increased to 20.94 at the end of supplementation period recording an increase of 0.74. A similar trend was observed in the BMI of elderly women showing an increase of 1.01. However, in the case of elderly men and women of the control group, a reduction of 0.27 and 0.28 in the BMI was observed respectively. These results indicate that the food supplement had a beneficial effect in maintaining the weight and BMI of the elderly study.



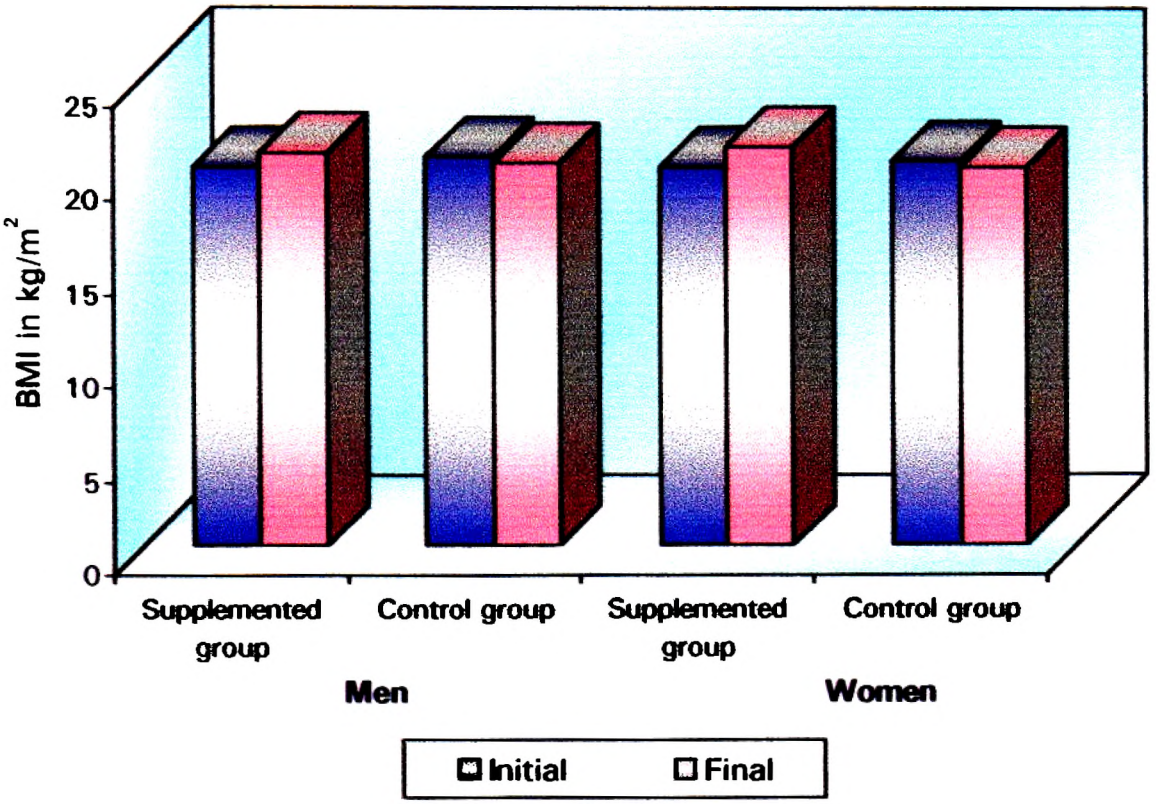


FIGURE 13

MEAN WEIGHT AND BODY MASS INDEX OF THE ELDERLY BEFORE AND AFTER SUPPLEMENTATION

The impact of supplementation in terms of improvement/reduction in BMI at the end of the intervention period is presented in Table XLIII and Figure 14.

TABLE XLIII

IMPROVEMENT/REDUCTION IN BMI DUE TO SUPPLEMENTATION

BMI	Supplemented group (N:50)				Control group (N:50)			
	Men		Women		Men		Women	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Improved	16	64	20	80	2	8	1	4
Maintained	7	28	4	16	11	44	10	40
Reduced	2	8	1	4	12	48	14	56
Total	**25**	**100**	**25**	**100**	**25**	**100**	**25**	**100**

It was observed that the BMI of 64 per cent of elderly men and 80 per cent of elderly women in the supplemented group had improved as against 8 per cent and 4 per cent of elderly men and women in the control group. Seven elderly men (28%) and 4 elderly women (16%) in the supplemented group had the same BMI whereas 11 elderly men (44%) and 10 elderly women (40%) in the control group had the same BMI. The BMI of 2 elderly men (8%) and one elderly woman (4%) in the supplemented group decreased whereas the reduction in BMI in 48 per cent of elderly men and 56 per cent of elderly women in the control group was observed.

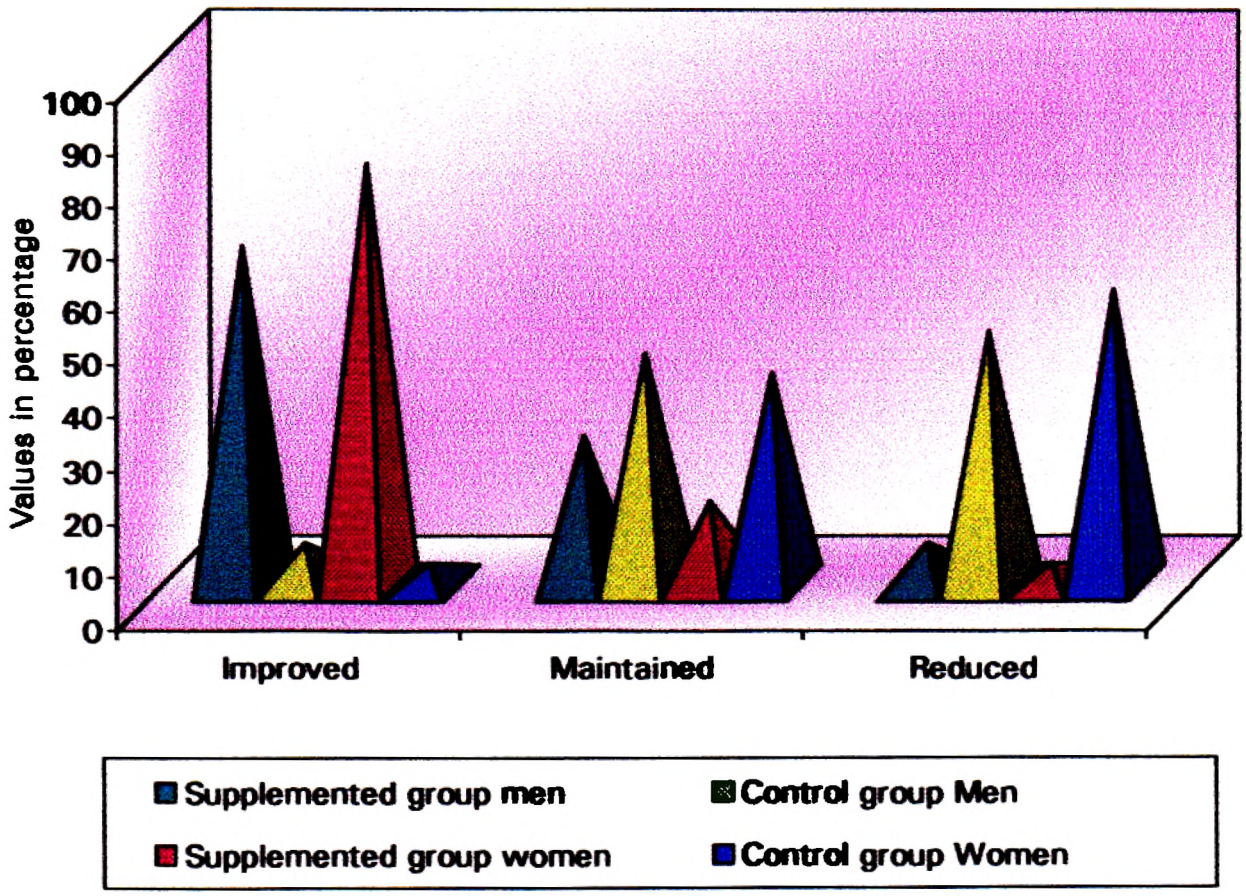


FIGURE 14

IMPROVEMENT/REDUCTION IN BMI DUE TO SUPPLEMENTATION

Table XLIV shows the shift in BMI category of the elderly after supplementation.

TABLE XLIV

SHIFT IN BMI CATEGORY OF THE ELDERLY AFTER SUPPLEMENTATION

BMI	Supplemented group (N:50)				Control group (N:50)			
	Before		After		Before		After	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
16–16.9	4	8	0	0	4	8	4	8
17–18.4	7	14	4	8	5	10	5	10
18.5–19.9	9	18	6	12	15	30	13	26
20–24.9	28	56	38	76	24	48	26	52
25–29.9	2	4	2	4	2	4	2	4
Total	**50**	**100**	**50**	**100**	**50**	**100**	**50**	**100**

After supplementation, no elderly belonged to the moderate CED (BMI 16-16.9) category. There was a reduction in the group of elderly in mild CED (BMI 17-18.4) and low weight normal (BMI 18.5-19.9) categories. In the supplemented group, the per cent of elderly in the normal BMI category (20-24.9) increased from 56 per cent to 76 per cent. The number of elderly in the overweight category (BMI 25-29.9) remained the same.

In the control group, the number of elderly in three BMI categories namely 16-16.9, 17-18.4 and 25-29.9 remained the same. There was a decrease in the low weight normal category (BMI 18.5- 19.9) from 30 per cent to 26 per cent, whereas an increase in the normal category (BMI 20-24.9) from 48 per cent to 52 per cent was observed.

b. Changes in biochemical parameters

The impact of food supplementation on selected biochemical parameters namely blood haemoglobin, serum antioxidants, serum minerals

and lipid peroxide levels of the supplemented and control groups of selected elderly are discussed as follows:

The mean blood haemoglobin profile of elderly before and after supplementation is given in Table XLV and Figure 15.

TABLE XLV

MEAN BLOOD HAEMOGLOBIN PROFILE OF THE ELDERLY

Haemoglobin (g/dl)	Supplemented group (N:50)			Control group (N:50)			't' value
	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	
Men (N:25)	10.12 ±0.97	11.59 ±0.69	1.47 ±0.69	10.40 ±0.88	9.88 ±0.88	-0.53 ±0.75	9.5876**
Women (N:25)	10.08 ±0.89	11.18 ±0.75	1.10 ±0.48	10.33 ±0.90	9.81 1.01	-0.52 ±0.62	10.0447**

** - Significant at 1% level

The initial mean haemoglobin level of the elderly men in the supplemented group was 10.12±0.97g/dl which increased to 11.59±0.69 g/dl at the end of the supplementation period. The initial mean haemoglobin level of elderly men in the control group was 10.4 ±0.88g/dl and at the end of study period a reduction of 0.53 ±0.75g/dl was observed. The initial mean haemoglobin level of the elderly women in the supplemented group was 10.08 ±0.89g/dl which increased to 11.18 ±0.75g/dl. At the end of study period, a reduction of 0.52±0.62g/dl in the haemoglobin value was observed in the control group. Improvements in the haemoglobin levels of the supplemented group were statistically significant in comparison to the control group and are an indicative of the positive impact of the food supplementation.

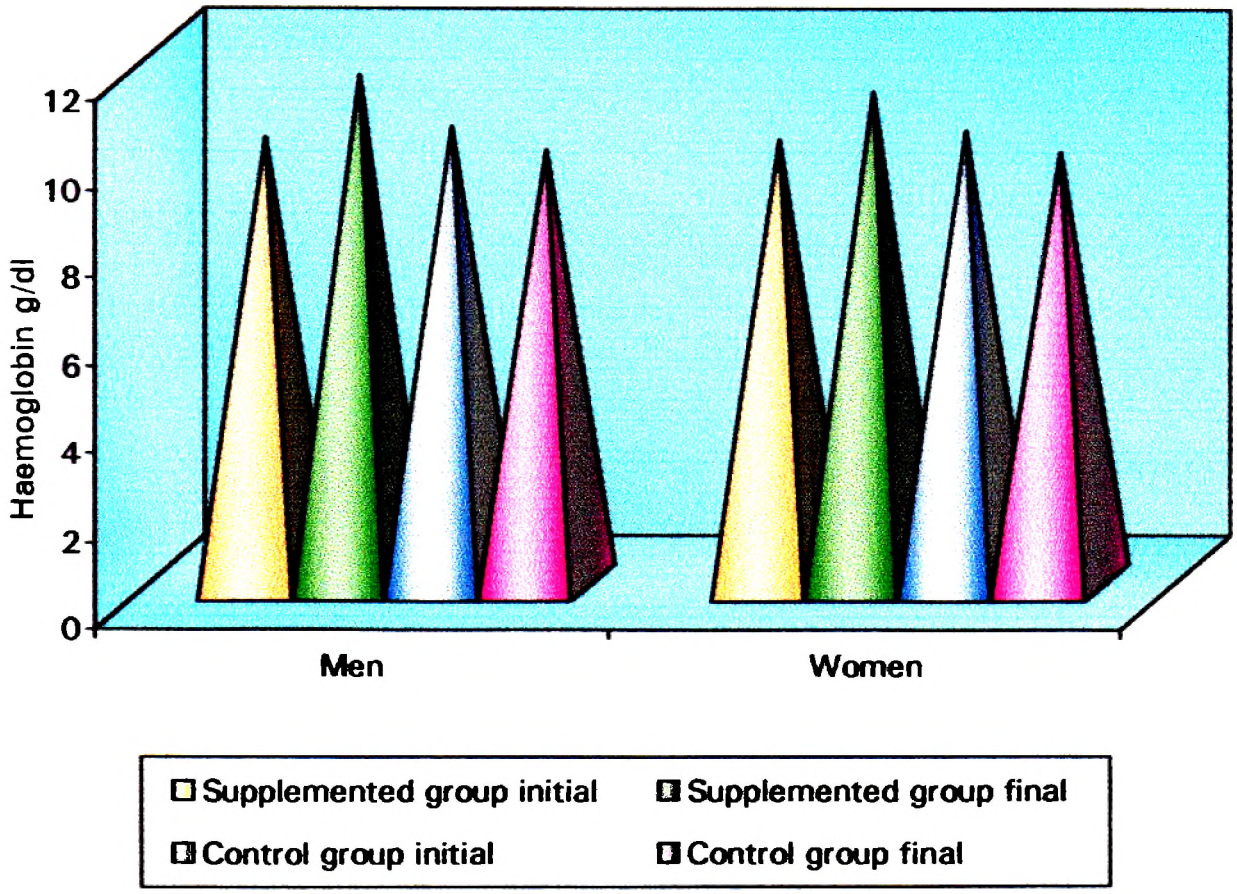


FIGURE 15

MEAN BLOOD HAEMOGLOBIN PROFILE OF THE ELDERLY

The mean serum antioxidant profile of the elderly before and after supplementation is given in Table XLVI and Figure 16.

TABLE XLVI

MEAN SERUM ANTIOXIDANT PROFILE OF THE ELDERLY

Serum Antioxidants	Supplemented group (N:50)			Control group (N:50)			't' value
	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	
Vitamin A (μmol/l) Men	0.94± 0.36	2.69± 0.70	1.75± 0.54	1.46± 0.45	1.15± 0.38	−0.31± 0.28	17.0266**
Women	1.23± 0.51	2.82 0.49	1.59± 0.43	0.97± 0.26	1.01± 0.27	0.04± 0.02	18.1094**
Vitamin C (μmol/l) Men	29± 2.12	41± 3.11	12± 2.45	29± 3.31	28± 2.48	−1± 1.41	22.8622**
Women	26± 1.6	37± 2.91	11± 3.21	27± 1.41	26± 1.2	−1± 1.38	17.1429**
Vitamin E (μmol/l) Men	13.30± 0.67	15.91± 0.70	2.61± 0.68	13.74± 0.76	13.82± 0.78	0.08± 0.26	17.2050**
Women	15.31± 0.96	17.26± 1.11	1.95± 0.59	15.24± 1.07	15.04± 1.06	−0.20± 0.28	16.6890**

** - Significant at 1% level

The initial mean serum vitamin A level of the elderly men and women in the supplemented group was 0.94±0.36 and 1.23±0.51 μmol/l respectively. At the end of study period, the mean serum vitamin A level of elderly men and women increased to 2.69 ± 0.70 and 2.82±0.49 μmol/l respectively. A reduction of 0.31 ± 0.28 μmol/l in elderly men and a slight increase of 0.04 ±0.02 μmol/l in elderly women was also observed in the

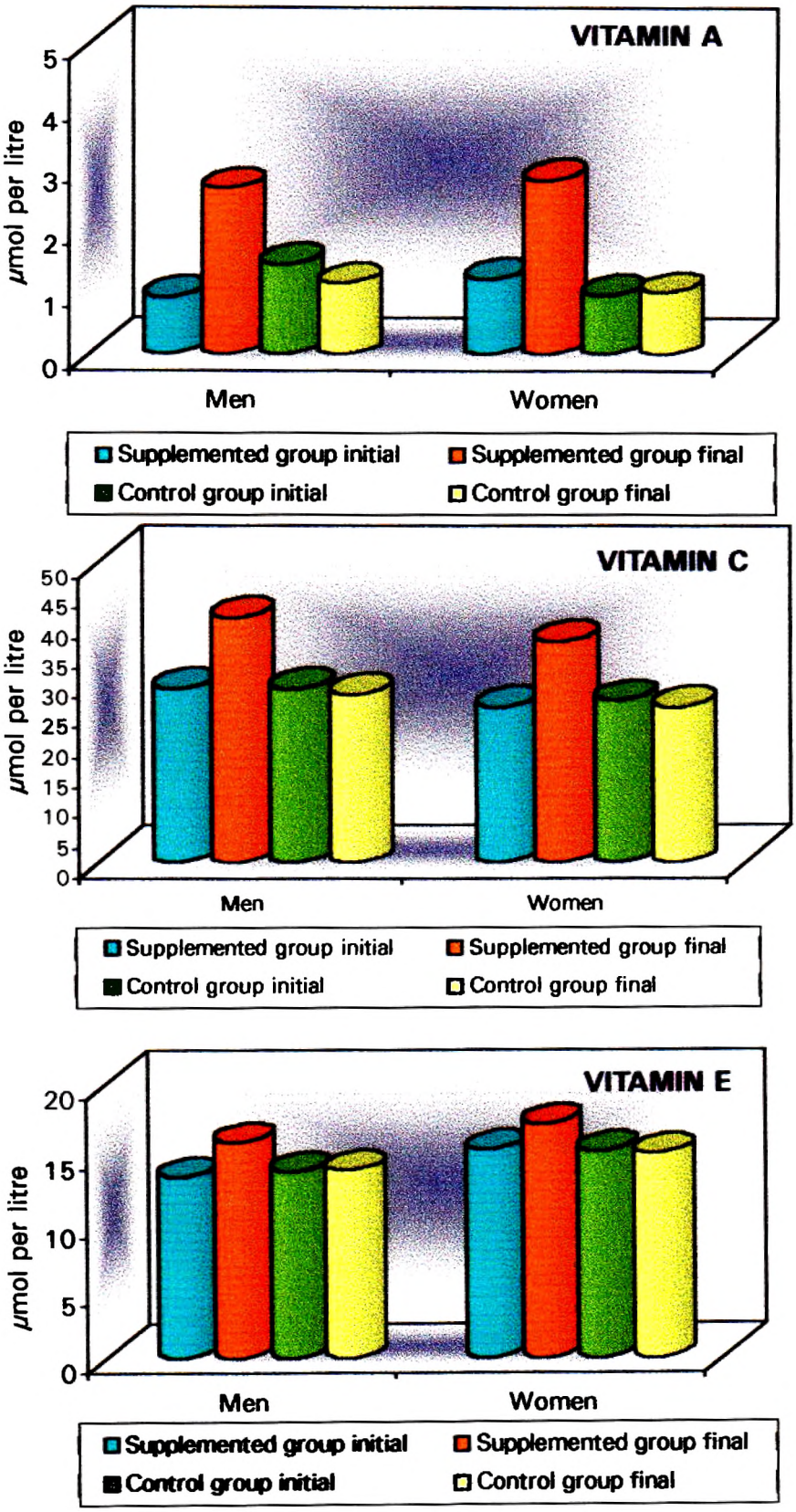


FIGURE 16

MEAN SERUM ANTIOXIDANT PROFILE OF THE ELDERLY

control group. These changes in serum vitamin A level were significant at one per cent level and could probably be attributed to the positive impact of the food supplementation.

The mean serum vitamin C increased by 12.0 ±2.45 and 11.0 ±3.21μmol/l in both elderly men and women of the supplemented group respectively, whereas it reduced by 1.0 ±1.41 and 1.0 ±1.38 μmol/l in the control group. Improvements in the serum vitamin C level of the supplemented group were statistically significant in comparison to the control group.

The mean serum vitamin E level increased from 13.3±0.67 to 15.91±0.70 μmol/l in elderly men and 15.31±0.96 to 17.26±1.11 μmol/l in elderly women of the supplemented group. There was a slight increase of 0.08±0.26 μmol/l in the elderly men and a reduction of 0.20± 0.28 μmol/l in the elderly women of the control group was observed. The changes in vitamin E levels were significant at one per cent level which is an indication of positive impact of the food supplementation.

The changes in serum mineral profile of the selected elderly before and after supplementation is given in Table XLVII and Figure 17.

TABLE XLVII

MEAN SERUM MINERAL PROFILE OF THE ELDERLY

Serum minerals	Supplemented group (N:50)			Control group (N:50)			't' value
	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	
Iron (μg/dl)							
Men	93.32± 8.56	99.40± 8.56	6.08± 1.38	93.12± 7.43	93.0± 7.78	−0.12± 1.20	16.9287**
Women	90.88± 9.63	96.04± 9.11	5.16± 1.02	90.16± 9.52	89.64± 9.37	−0.52± 1.05	19.3686**
Zinc (μg/dl)							
Men	88.84± 6.27	93.92± 6.01	5.08± 1.08	87.16± 5.43	85.96± 5.25	−1.2± 0.91	22.2403**
Women	84.60± 4.09	89.36± 3.66	4.76± 1.23	85.64± 3.77	84.12± 4.06	−1.52± 1.12	18.8212**
Copper (μg/dl)							
Men	78.44± 3.83	82.48± 3.77	4.04± 0.93	78.84± 5.05	77.92± 5.17	−0.92± 0.91	19.0207**
Women	79.92± 5.88	83.52± 5.76	3.6± 1.26	79.64± 6.94	79.76± 6.66	0.12± 0.97	2.0917*

** - Significant at 1% level * - Significant at 5% level

The mean serum iron level increased from 93.32 ± 8.56 to 99.40 ± 8.56μg/dl in elderly men and from 90.88 ± 9.63 to 96.04 ± 9.11μg/dl in elderly women at the end of supplementation period, whereas there was a slight reduction of 0.12 ± 1.20 and 0.52 ± 1.05μg/dl in the elderly men and women of the control group respectively. The mean serum zinc levels showed a difference of 5.08 ± 1.08 and 4.76 ± 1.23μg/dl in the elderly men and women after the intervention period respectively. A decrease of 1.2 ± 0.91 and 1.52 ± 1.12μg/dl in the serum zinc levels of the elderly men and women in the control group was observed. The changes in the zinc level were significant at one per cent level, which may be attributed to the positive impact of food supplementation.

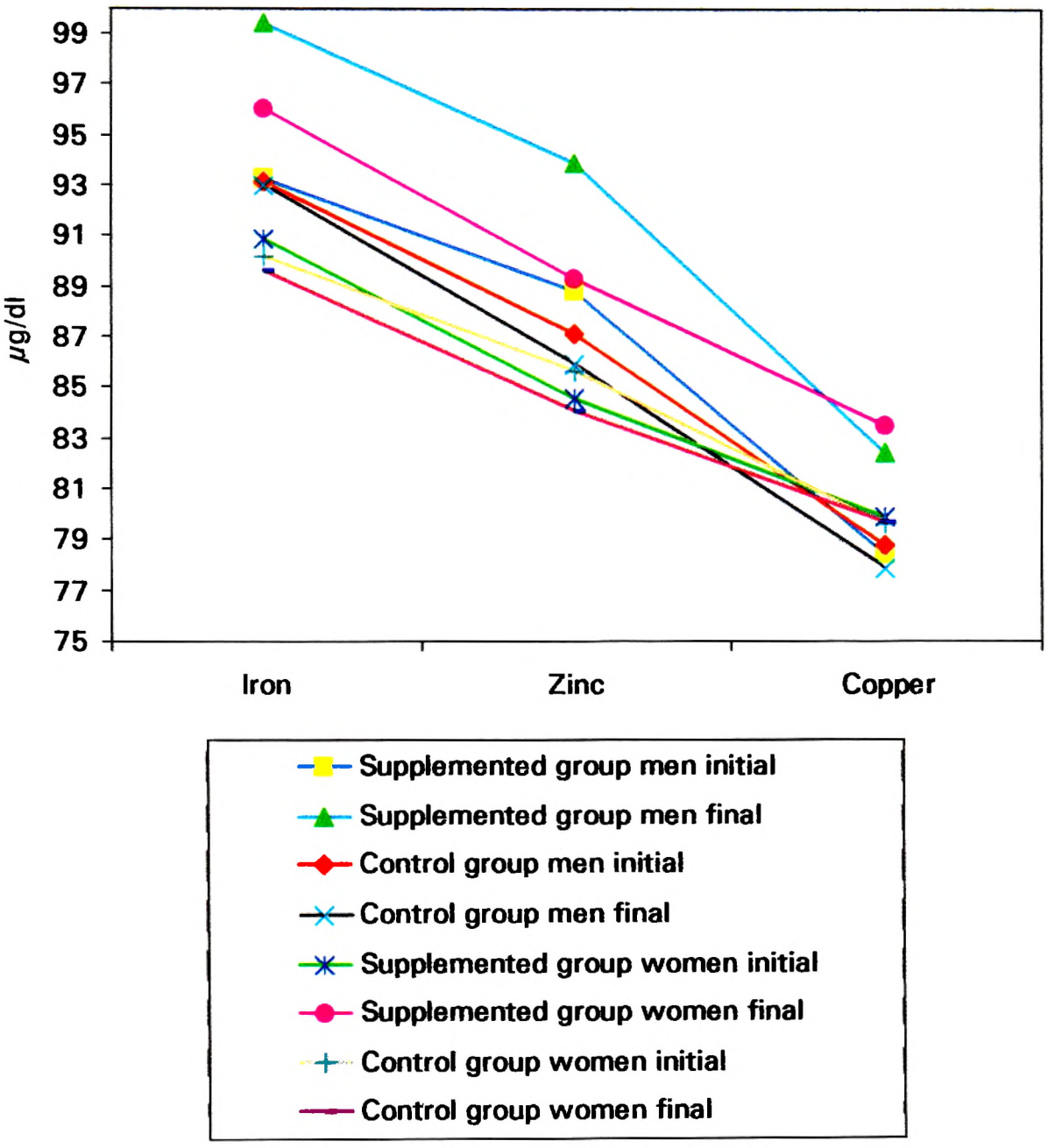


FIGURE 17

MEAN SERUM MINERAL PROFILE OF THE ELDERLY

The mean serum copper level increased from 78.44±3.83 to 82.48±3.77μg/dl in elderly men and 79.92±5.88 to 83.52±5.76μg/dl in elderly women of the supplemented group after the intervention period. There was a slight increase of 0.12±0.97μg/dl in elderly women and a decrease of 0.92±0.91μg/dl in the elderly men of control group. Improvements in the copper level of the supplemented group was statistically significant in comparison to the control group and is indicative of the positive impact of food supplementation.

The positive impact of food supplementation statistically revealed a significant improvement in the supplemented group compared to the control group. It is encouraging to note that the serum mineral profile of the supplemented group showed increased improvement. This positive trend calls for longer period of supplementation to help elderly to maintain their normal serum mineral profile.

Since the food supplement developed in the present study has considerable amounts of antioxidants namely vitamins C and E and β-carotene it was also tested for its impact on the serum lipid peroxide levels of the selected elderly during the supplementation study. Many literature shows that antioxidants would reduce the serum lipid peroxide levels, which is on par with the present study and the results are depicted in Table XLVIII and Figure 18.

TABLE XLVIII

MEAN SERUM LIPID PEROXIDE LEVELS OF THE ELDERLY

Serum lipid peroxide (n mol/ml)	Supplemented group (N:50)			Control group (N:50)			't' value
	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	
Men (N:25)	3.89 ±1.32	2.63 ±1.24	1.26 ±0.57	3.53 ±1.34	3.57 ±1.31	0.04 ±1.44	9.9146**
Women (N:25)	3.30 ±0.88	2.14 ±0.84	1.16 ±0.69	3.28 ±1.0	3.21 ±0.95	0.07 ±0.18	7.5800**

** - Significant at 1% level

The mean initial serum lipid peroxide level of the elderly men was 3.89 ± 1.32 nmol/ml which decreased to 2.63 ± 1.24 nmol/ml at the end of the study period. A similar trend was also observed in elderly women which decreased from 3.30 ± 0.88 to 2.14 ± 0.84nmol/ml at the end of the study. Only a negligible difference of 0.04 ± 1.44 and 0.07 ± 0.18nmol/ml was observed in the elderly men and women of the control group respectively. These results indicate that the food supplement had beneficial effects, reducing the serum lipid peroxide levels of the elderly studied.

Table XLIX and Figure 19 reveals the comparison of the impact of food supplementation between elderly men and women.

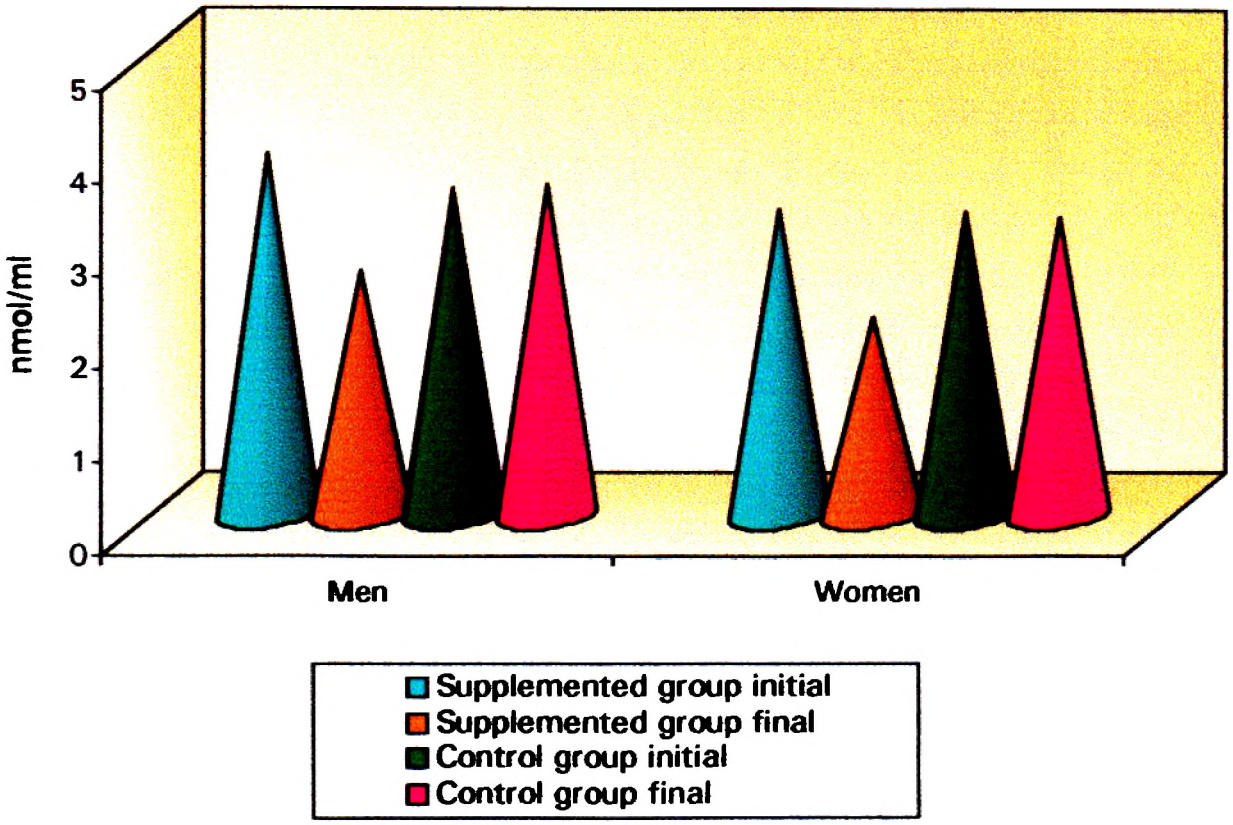


FIGURE 18

MEAN SERUM LIPID PEROXIDE LEVELS OF THE ELDERLY

TABLE XLIX

COMPARISON OF THE IMPACT OF FOOD SUPPLEMENTATION BETWEEN ELDERLY MEN AND WOMEN

Parameters	Difference value (Supplemented group)		't' value
	Elderly men $\bar{x} \pm SD$ (N:25)	Elderly women $\bar{x} \pm SD$ (N:25)	
Vitamin A	1.7504 ±0.5363	1.5936 ±0.4277	1.1429^{NS}
Vitamin C	12.0 ±2.4495	11.0 ±3.2146	1.2372^{NS}
Vitamin E	2.6120±0.6852	1.9520 ±0.5860	3.6601**
Iron	6.08 ±1.3820	5.16 ±1.0279	2.6707*
Zinc	5.08 ±1.0770	4.76 ±1.2342	0.9768^{NS}
Copper	4.04 ±0.9345	3.6 ±1.2583	1.4036^{NS}
Lipid Peroxide	1.2622 ±0.5832	1.1592 ±0.6922	0.5692^{NS}

** - Significant at 1% level * - Significant at 5% level NS - Non significant

It was observed that there was no difference in vitamins A and C levels between elderly men and women due to supplementation which was statistically revealed as non significant. With regard to vitamin E, elderly men had a better impact than elderly women and this was statistically significant at one per cent level. The same trend was observed in iron level also showing a significant difference at five per cent level. The elderly men and women revealed a non significant difference in the zinc and copper levels. This shows that both of them had the same impact due to food supplementation. The difference in the reduction of lipid peroxide levels in elderly men was 1.2622±0.5832 and 1.1592±0.5832 in elderly women. This was statistically revealed as non significant.

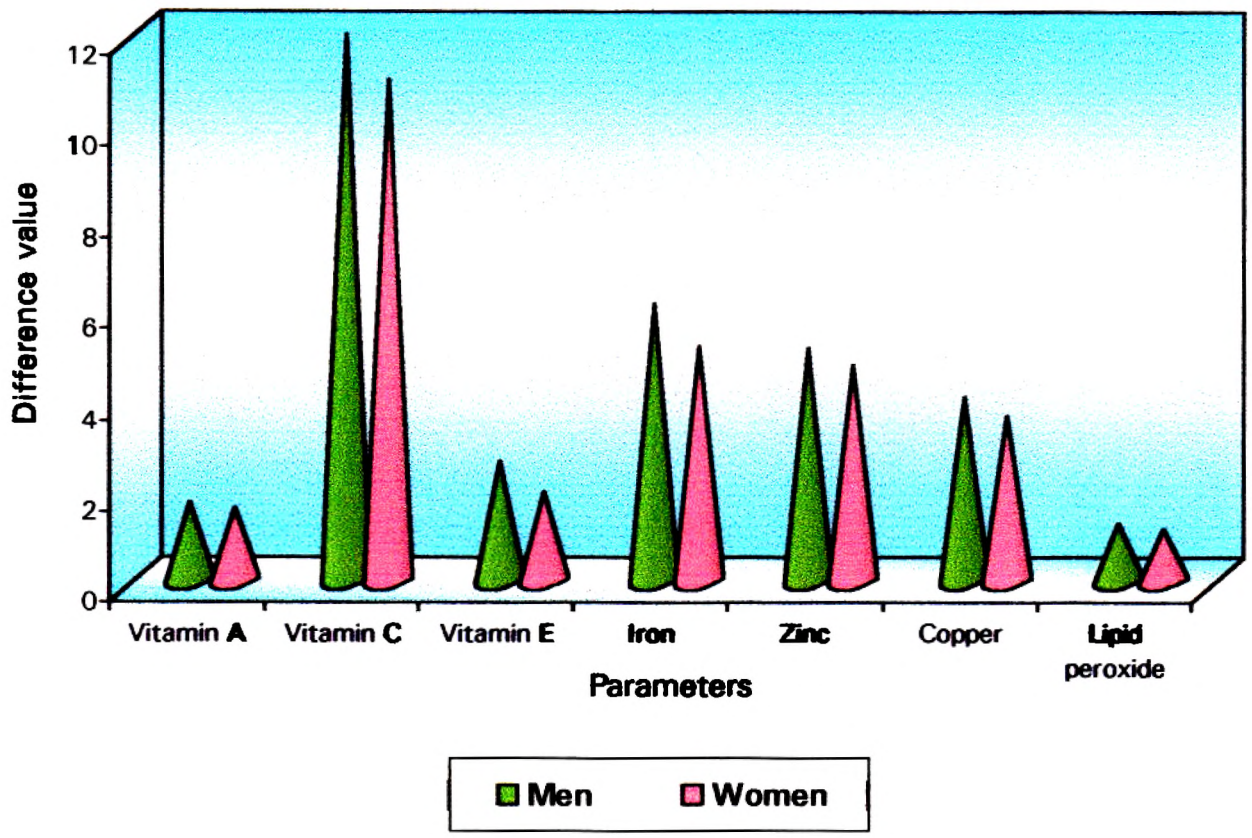


FIGURE 19

COMPARISON OF THE IMPACT OF FOOD SUPPLEMENTATION BETWEEN ELDERLY MEN AND WOMEN

From the above results it was observed that the food supplement developed in the present study had a better impact with regard to serum vitamin E and iron levels in elderly men compared to elderly women.

E. Characteristics of Ageing observed on Selected Adults and Impact of Food Supplementation

As a part of main study an effort was made to study the efficacy of feeding the same food supplement provided to the elderly to a selected group of adults between the age group of 50 and 55 years. The thought behind this effort was whether the food supplement would help to delay certain characteristics related to ageing process. A group of 86 adults (46 men and 40 women) who were apparently healthy were selected and they were related to the 500 elderly already studied in the main study. The results are presented under the following headings :

1. Socioeconomic Background
2. Lifestyle and Dietary Pattern of the Selected Adults
3. Changes Observed Related to Ageing
4. Impact of Food Supplementation on the Selected Adults
5. Comparison of Blood Parameters between Elderly and Adults

1. Socioeconomic Background

Fifty six adults (30 men and 26 women) between the age of 50 and 55 years were selected for this aspect of the supplementation study. Thirty adults (16 men and 14 women) in the same age group (50 to 55 years) were selected as the comparable control group. The socioeconomic background of these adults are given in Table L.

TABLE L

SOCIOECONOMIC BACKGROUND OF THE SELECTED ADULTS (N:86)

Socioeconomic background	Men (N:46)		Women (N:40)	
	Number	Per cent	Number	Per cent
a.Age in years				
50 – 55	46	100.00	40	100.00
b.Educational status				
Primary	12	26.09	16	40.00
Middle school	4	8.70	5	12.5
High school	4	8.70	2	5.0
Higher Sec. school	3	6.52	–	–
Graduate	2	4.35	–	–
Illiterate	21	45.65	17	42.5
c. Marital status				
Married	46	100.00	40	100.00
Single	–	–	–	–
Widow	–	–	–	–
Widower	–	–	–	–
Divorce	–	–	–	–
d. Type of family				
Joint	6	13.04	4	10.00
Nuclear	40	86.96	36	90.00
e. Occupation				
Education	2	4.35	–	–
Agriculture	29	63.04	21	52.5
Industries	15	32.61	12	30.00
Nil	–	–	7	17.5
f. Income				
Rs. 1000 - 1500	22	47.83	23	57.5
Rs. 1500 - 2000	17	36.96	9	22.5
Rs. 2000 and above	7	15.22	1	2.5
Nil	–	–	7	17.5

It was observed that twelve out of 46 adult men (26.09%) and sixteen out of 40 adult women (40.00%) had their primary education. There were only two graduates among the adult men. Illiteracy was found in twenty one adult men (45.65%) and seventeen adult women (42.5%).

All the selected adults were married. Six adult men (13.04%) and four adult women (10.00%) were living in joint families. The remaining were dwelling as nuclear families.

Twenty nine adult men (63.04%) and twenty one adult women (52.5%) were involved in agriculture as their occupation. Fifteen men (32.61%) and twelve women (30.00 %) were occupied as labourers, supervisors, weavers and masons. Only seven adult women (17.5%) were without any occupation.

Regarding the income of the adults, 22 men (47.83%) and 23 women (57.5%) had their income from Rs.1000 - 1500. Seventeen men (36.96%) and nine women (22.5%) were under the income range Rs.1500 - 2000. Seven men (15.22%) and one woman (2.5%) had income between Rs.2000 and above. Seven women (17.5%) did not receive any income because they were not employed in any type of occupation.

2. Lifestyle and Dietary Pattern of the Selected Adults

a. Lifestyle pattern

The lifestyle pattern of the selected adults is presented in the following Table LI.

TABLE LI

LIFESTYLE PATTERN OF THE SELECTED ADULTS (N:86)

Lifestyle pattern	Men (N:46)		Women (N:40)	
	Number	Per cent	Number	Per cent
a. Personal Habits*				
Smoking	12	26.09	–	–
Alcohol consumption	4	8.70	–	–
Chewing tobacco	7	15.22	4	10
Chewing betel leaves	22	47.83	24	60
Using snuff	2	4.35	–	–
Nil habits	21	45.65	16	40
b. Exercise Practiced				
Walking	5	10.87	2	5
Jogging	–	–	–	–
Yoga	–	–	–	–
Nil	41	89.13	38	95
Nil-reasons				
Poor health	2	4.35	4	10
Lack of interest	31	67.39	28	70
Lack of time	8	17.39	6	15
c. Leisure Time Activities *				
Watching TV, Listening to radio	42	91.30	31	77.5
Cinema	39	84.78	27	67.5
Reading News paper, books, etc	26	56.52	10	25.0
Any other	12	26.09	14	35.0

*Multiple Responses

Table LI reveals that smoking and alcohol consumption was seen in 12.00 (26.09%) and 4.00 (8.70%) adult men respectively. Chewing of tobacco and betel leaves was observed in 15.22 per cent and 47.83 per cent of adult men and 10 per cent and 60 per cent of adult women respectively.

Forty one adult men (89.13%) and 38 (95.0%) adult women did not practice any type of exercise. As a part of leisure time activity, watching television and listening to radio was noticed in 91.30 per cent of adult men and 77.5 per cent of adult women. Reading newspaper and books was observed in 26 adult men (56.52%) and 10 adult women (25.0%).

(b) Dietary pattern

Among the selected adults, 5 men (10.87 %) and 9 women (22.5%) were vegetarians and 41 men (89.13%) and 31 women (77.5%) were non-vegetarians. All the adults followed three-meal pattern. The different foods taken during their meals are given in Table LII.

TABLE LII

MEAL PATTERN OF THE SELECTED ADULTS

Meals	Foods Taken
Early morning	Tea / coffee
Break fast	Idli /dosai / chutney / tomato subji / semia upma
Mid-morning	Tea / coffee
Lunch	Rice / sambar / poriyal
Tea	Sundal / vadai / puffed rice / tapioca
Dinner	Dosai / chapathi / upma / meals
Bed time	Milk (a few only)

Regarding the foods included and avoided, majority of the adults included all types of foods in their diet; only a few food were avoided, like flesh foods, egg, roots and tubers. Personal likes and dislikes, allergy and gas producing nature of foods, were the reasons given by the adults for avoiding the above foods.

3. Changes Observed Related to Ageing

The characteristic changes related to ageing process were observed on the selected adults. The details are given in Table LIII.

TABLE LIII

CHARACTERISTIC CHANGES RELATED TO AGEING

Parameters	Men (N:46)		Women (N:40)	
	Number	Per cent	Number	Per cent
a. Grey Hair				
Absent	–	–	–	–
Present				
Few	26	56.52	28	70
Many	19	41.31	12	30
Fully	1	2.17	–	–
b. Dentition				
Number present	29	63.04	27	67.5
Number fallen	17	36.96	13	32.5
Dental caries	6	13.04	5	12.5
c. Vision				
Long sight	6	13.04	5	12.5
Short sight	–	–	–	–
Cataract				
Nil	38	82.61	37	92.5
One eye	7	15.22	3	7.5
Both eyes	1	2.17	–	–
No problems	32	69.57	33	82.5
d. Hearing				
Able to hear	46	100.00	39	97.5
Unable to hear	–	–	1	2.5
e. Menopause	–	–	38	95.0
f. Osteoporosis	–	–	1	2.5
g. Memory power				
Marks (Scores)				
i) 20 (Excellent)	–	–	–	–
ii) 15-19 (Good)	–	–	–	–
iii) 10-14 (Fair)	16	34.78	10	25.0
iv) 5 - 9 (Poor)	21	45.65	17	42.5
v) Below 5 (Very Poor)	9	19.57	13	32.5

From Table LIII it was observed that there were no adults in the present study without any grey hairs. Twenty six adult men (56.52%) and 28 adult women (70.0%) had only a few grey hairs. However in 19 adult men (41.30%) and 12 adult women (30.00%) the presence of many grey hairs was noticed. Only one adult man (2.17%) had grey hairs fully.

Regarding the dentition, 63.04 per cent of adult men 67.5 per cent of adult women had complete dentition whereas, in 36.96 per cent and 32.5 per cent, a few teeth had fallen. Dental caries was observed in 13.04 per cent of adult men and 12.5 per cent of adult women.

No problems in vision were noticed in 32 adult men (69.57%) and 33 adult women (82.5%). Cataract had developed in seven men (15.22%) in only one eye whereas only one man (2.17%) had in both the eyes. Three women (7.5%) had cataract in only one eye.

All the adult men selected for the study were able to hear properly. In the case of women, only one (2.5%) was unable to hear which was not an inborn impairment.

Out of forty adult women, 38 (95.0%) have reached their menopause stage. Osteoporosis was not noticed in adult men whereas only one adult woman (2.5%) of the present study was suffering from it.

The memory power of the selected adults were tested by placing 20 objects on a table and they were asked to observe these objects for a certain period of time. Then they were asked to repeat the names of the things orally in the case of illiterates and by writing them in a paper in the case of literates. A score of one was given for each correct answer. Through this method, it was studied that the memory power of the selected adult men

and women was not excellent or good. Sixteen men (34.78%) and 10 women (25.0%) scored a range of 10-14 marks, which indicates that their memory power was fair. A poor performance in memory was observed in 21 adult men (45.65%) and 17 adult women (42.5%). A score of below five was noticed in 9 adult men (19.57%) and 13 adult women (32.5%). Thus it shows that, as age advances, memory power would decrease.

Thus, the foregoing results reveals that ageing is individual and many of the characteristic changes related to it was observed on the selected adult men and women of the present study.

4. Impact of Food Supplementation on the Selected Adults

The food supplement developed in the present study was supplemented to a group of adults and its impact was studied. The results of this aspect are depicted in the following Tables.

Table LIV depicts the mean weight and BMI of the adults.

TABLE LIV

MEAN WEIGHT AND BMI OF THE ADULTS

Particulars	Supplemented group (N:56)			Control group (N:30)		
	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$
Men						
Weight (kg)	53.08±8.97	55.38±7.76	2.30±1.68	53.72±5.75	52.06±6.69	−1.66±1.88
BMI	20.45±2.68	21.36±2.19	0.91±0.64	20.50±2.04	20.01±2.18	−0.49±0.59
Women						
Weight (kg)	46.56±6.61	49.25±5.02	2.69±2.49	46.89±6.03	45.71±5.77	−1.18±1.54
BMI	20.37±2.68	21.45±1.74	1.08±1.39	20.59±2.53	20.14±2.35	−0.45±0.68

It was observed that the mean weight of adult men increased from 53.08kg to 55.38 kg and in the case of adult women, it increased form 46.56kg to 49.25kg after supplementation. In the control group, the weight of adult men and women decreased by 1.66kg and 1.18kg respectively.

The body mass index increased by 0.91 in adult men and 1.08 in adult women at the end of the study. In the control group, the BMI decreased by 0.49 in adult men and 0.45 in adult women.

The mean haemoglobin level of adult men in the supplemented group was 11.61 g/dl which increased to 13.23 g/dl at the end of supplementation study. Whereas, the haemoglobin level of adult men in the control group decreased from 11.37 g/dl to 11.23 g/dl. The mean haemoglobin level of adult women in the supplemented group increased from 11.25 g/dl to 12.32 g/dl at the end of study. Whereas the adult women in the control group showed a decrease by 0.17 g/dl in the haemoglobin level at the end of study.

Table LV presents the mean serum antioxidant profile of the adults.

TABLE LV

MEAN SERUM ANTIOXIDANT PROFILE OF THE ADULTS

Serum Antioxidants	Supplemented group (N:56)			Control group (N:30)			't' value
	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	
Vitamin A (µmol/l)							
Men	1.31±0.22	3.79±0.25	2.48±0.26	1.63±0.30	1.25±0.21	-0.38±0.24	35.0333**
Women	1.63±0.40	2.94±0.51	1.31±0.42	1.13±0.16	1.15±0.16	0.025±0.02	14.8373**
Vitamin C (µmol/l)							
Men	42±3.91	56±4.21	14±2.39	40±4.21	41±3.91	1±1.06	23.8612**
Women	40±1.73	52±3.04	12±2.26	41±2.69	40±2.06	-1±1.06	17.7493**
Vitamin E (µmol/l)							
Men	22.1±1.29	27.1±1.38	5±1.72	21.2±0.67	21.05±0.66	-0.15±0.22	18.2188**
Women	23.04±1.04	26.04±1.34	3.0±1.28	22.33±0.68	21.93±0.59	-0.4±0.19	12.5750**

** - Significant at 1% level

The initial mean serum Vitamin A level of adult men was 1.31 ± 0.22 which increased to 3.79 ± 0.25 after the supplementation study. In the adult men of control group, a reduction of 0.38 ± 0.24 in the serum vitamin A value was observed. The mean serum vitamin A value of the adult women in the supplemented group had increased by 1.31 ± 0.42 and that of the control showed a slight increase of 0.025 ± 0.02.

There was a significant increase in the serum vitamin C level of both the adult men and women in the supplemented group in comparison to the control group. The initial mean serum vitamin E value was 22.1 ± 1.29 and 23.04 ± 1.04 for the adult men and women in the supplemented group which increased to 27.1 ± 1.38 and 26.04 ± 1.34 at the end of the supplementation period respectively. These was a reduction of 0.15 ± 0.22 in adult men and 0.4 ± 0.19 in adult women of the control group. These changes in the serum antioxidant levels between the two groups for vitamin A, vitamin C and vitamin E were statistically significant at one per cent level.

Table LVI gives the changes in serum mineral profile of the adults before and after supplementation.

TABLE LVI

MEAN SERUM MINERAL PROFILE OF THE ADULTS

Serum minerals	Supplemented group (N:56)			Control gorup (N:30)			't' value
	$\bar{x} \pm SD$ Initial	$\bar{x} \pm SD$ Final	$\bar{x} \pm SD$ Difference	$\bar{x} \pm SD$ Initial	$\bar{x} \pm SD$ Final	$\bar{x} \pm SD$ Difference	
Iron (µg/dl)							
Men	94.53±6.47	101.97±6.10	7.43±1.17	94.88±4.23	94.75±4.07	-0.125±1.54	18.2079**
Women	91.35±6.05	98.04±5.14	6.69±1.77	90.93±5.86	89.57±5.15	-1.36±1.84	13.1917**
Zinc (µg/dl)							
Men	88.67±5.90	94.73±5.82	6.07±2.05	88.75±6.15	88.5±5.92	-0.25±1.56	10.5412**
Women	83.27±3.89	91.73±4.30	5.31±1.35	89.07±3.88	85.79±4.13	-0.29±1.39	12.0591**
Copper (µg/dl)							
Men	80.3±5.63	85.5±5.55	5.2±0.75	81.06±5.40	81.06±5.01	0±1.12	18.3674**
Women	80.58±5.58	84.96±5.37	4.38±0.92	80.43±5.56	78±4.31	-2.43±1.78	5.9358**

** - Significant at 1% level

The mean serum iron level of men increased from 94.53 ± 6.47 to 101.97 ± 6.10μg/dl at the end of the supplementation period. The same trend was observed in the case of women also. At the end of study period, a slight reduction of 0.125 ± 1.54 and 1.36 ± 1.84μg/dl in the serum iron value was observed in the control group. The mean zinc levels of the supplemented group showed an increase by 6.07 ± 2.05 and 5.31 ± 1.35 μg/dl in adult men and women respectively. But there was a reduction of 0.25 ± 1.56 and 0.29 ± 1.39μg/dl in the control group.

The mean copper levels of the supplemented group increased by 5.2 ± 0.75 and 4.38 ± 0.92μg/dl in adult men and women respectively. In the control group no difference was noticed in adult men 90 ± 1.12μg/dl) whereas, a decrease of 2.43 ± 5.56μg/dl) was observed in adult women. The changes in the serum iron, zinc and copper levels were significant at one per cent level and could probably be attributed to the positive impact of food supplementation.

The impact of food supplementation on the serum lipid peroxide level of selected adults is given in Table LVII.

TABLE LVII

MEAN SERUM LIPID PEROXIDE LEVELS OF THE ADULTS

Serum lipid peroxide (nmol/ml)	Supplemented Group (N:56)			Control Group (N:30)			't' value
	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	
Men	4.12±0.93	2.42±0.80	1.70±0.41	3.99±0.96	3.86±0.81	0.13±0.27	6.4897**
Women	3.91±1.26	2.17±0.96	1.74±0.63	3.01±0.95	3.26±0.80	-0.25±0.27	15.1586**

** Significant at 1% level

The initial mean serum lipid peroxide levels of the adult men and women were 4.12 ± 0.93 and 3.91 ± 1.26 which decreased to 2.42 ± 0.80

and 2.17±0.96 respectively. A decrease of 0.13±0.27 in adult men and an increase of 0.25±0.27 in adult women were observed in the serum lipid peroxide values of the control group. The reduction in serum lipid peroxide levels of the supplemented group was statistically significant in comparison to the control group.

5. Comparision of Blood Parameters between Elderly and Adults

In order to study the impact of food supplementation both on elderly and adults, serum antioxidant levels, serum mineral profile and serum lipid per oxide levels were assessed. Food supplementation had been proved beneficial for both the groups. It was thought of interest to compare the various serum levels of antioxidants, minerals and lipid peroxide levels of elderly with adults.

Table LVIII and Figure 20 provides a comparative picture of serum antioxidant levels for both the groups (elderly and adults).

TABLE LVIII

COMPARISON OF MEAN SERUM ANTIOXIDANT PROFILE OF SELECTED ELDERLY AND ADULTS (SUPPLEMENTED GROUP)

Groups	Serum antioixidant levels (μmol/l)								
	Vitamin A			Vitamin C			Vitamin E		
	Initial $\bar{x}\pm SD$	Final $\bar{x}\pm SD$	Difference $\bar{x}\pm SD$	Initial $\bar{x}\pm SD$	Final $\bar{x}\pm SD$	Difference $\bar{x}\pm SD$	Initial $\bar{x}\pm SD$	Final $\bar{x}\pm SD$	Difference $\bar{x}\pm SD$
Elderly									
Men (N:25)	0.94± 0.36	2.69± 0.70	1.75± 0.54	29± 2.12	41± 3.11	12± 2.45	13.3± 0.67	15.91± 0.70	2.61± 0.68
Women (N:25)	1.23± 0.51	2.82± 0.49	1.59± 0.43	26± 1.60	37± 2.91	11± 3.21	15.31± 0.96	17.26± 1.11	1.95± 0.59
Adults									
Men (N:30)	1.31± 0.22	3.79± 0.25	2.48± 0.26	42± 3.91	56± 4.21	14± 2.39	22.1± 1.29	27.1± 1.38	5± 1.72
Women (N:26)	1.63± 0.40	2.94± 0.51	1.31± 0.42	40± 1.73	52± 3.04	12± 2.26	23.04- ±1.04	26.04± 1.34	3± 1.28

As far as serum vitamin A levels are concerned, to start with, elderly men had the initial level by 0.94μmol/l and final levels was 2.69μmol/l, the difference was 1.75μmol/l whereas in the case of adult men the initial serum vitamin A level was 1.31μ mol/l and final level was 3.79μmol/l, the difference was 2.48μmol/l. The difference was found to be more among the adults indicating the beneficial impact of food supplementation through increased level of vitamin A absorption. In the case of elderly women Vs adult women, the increase of serum vitamin A level was more among the elderly women when compared to adult women, which could be attributed to some of the hormonal factors during the post menopausal period interfering with absorption of nutrients like vitamin A.

Regarding the vitamin C levels, the elderly men had an initial level of 29.0μmol/l and final level was 41.0$\pm$3.11μ mol/l, showing difference of 12.0$\pm$2.45μmol/l.

The initial and final levels of serum vitamin C in adult men was 42$\pm$3.91 and 56$\pm$4.21μmol/l respectively, making a difference of 14$\pm$2.39μ mol/l, which is higher than the elderly men. The elderly women revealed a difference of 11.0$\pm$3.21μmol/l in serum vitamin C levels as against 12$\pm$2.26μ mol/l in adult women.

The elderly men had an initial level of 13.3$\pm$0.67μmol/l, vitamin E level and final level was 15.91$\pm$0.70, showing a difference of 2.61$\pm$0.68μmol/l whereas the initial and final serum vitamin E levels in adult men was 22.1$\pm$1.29μmol/l and 27.1$\pm$1.30μmol/l respectively. The difference was 5.0$\pm$1.72μmol/l, which was also higher than that of

elderly men. The same trend was observed in the case of elderly women and adult women. The initial and final vitamin E serum levels in elderly women was 15.31 ± 0.96μmol/l and 17.26 ± 1.11μmol/l, which a difference of 1.95 ± 0.59μmol/l. The adult women had an initial level of 23.04 ± 1.04 μmol/l and final level of 26.04 ± 1.34μmol/l, making a difference of 3.0 ± 1.28 μmol/l in serum vitamin E levels after food supplementation.

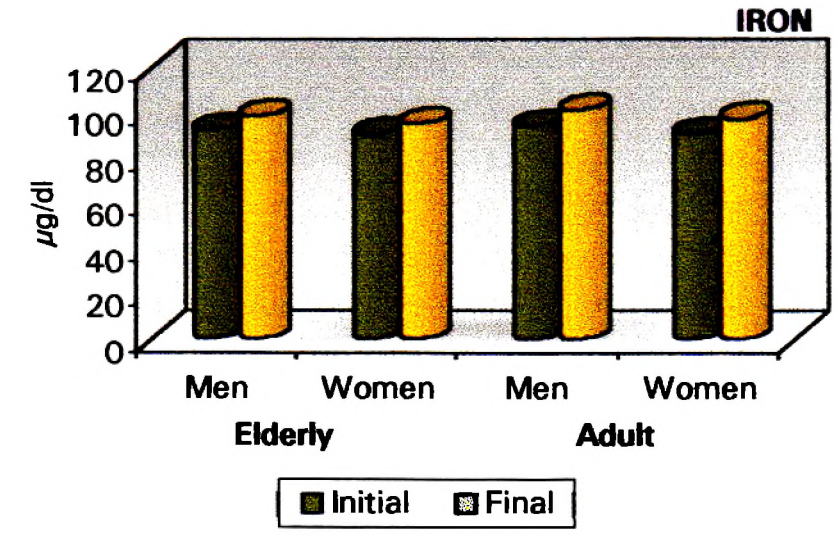
Table LIX and Figure 21 presents the comparison of mean serum mineral profile of selected elderly and adults (supplemented group).

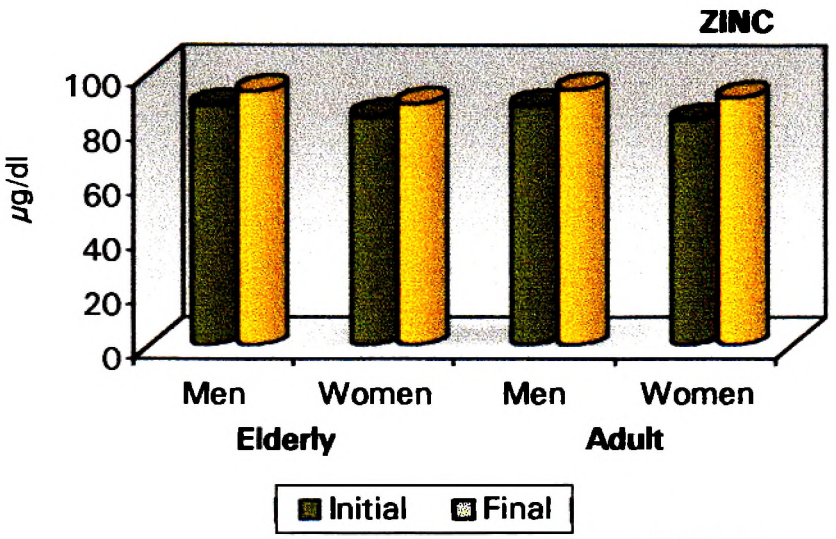
TABLE LIX

COMPARISON OF MEAN SERUM MINERAL PROFILE OF SELECTED ELDERLY AND ADULTS (SUPPLEMENTED GROUP)

Groups	Serum mineral levels (μmol/l)								
	Iron			Zinc			Copper		
	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$	Initial $\bar{x} \pm SD$	Final $\bar{x} \pm SD$	Difference $\bar{x} \pm SD$
Elderly Men (N:25)	93.32± 8.56	99.40± 8.56	6.08± 1.38	88.84± 6.27	93.92± 6.01	5.08± 1.08	78.44± 3.83	82.48± 3.77	4.04± 0.93
Women (N:25)	90.88± 9.63	96.04± 9.11	5.16± 1.02	84.60± 4.09	89.36± 3.66	4.76± 1.23	79.92± 5.88	83.52± 5.76	3.6± 1.26
Adults Men (N:30)	94.53± 6.47	101.97± 6.10	7.43± 1.17	88.67± 5.90	94.73± 5.82	6.07± 2.05	80.30± 5.63	85.5± 5.55	5.2± 0.75
Women (N:26)	91.35± 6.05	98.04± 5.14	6.69± 1.77	83.27± 3.89	91.73± 4.30	5.31± 1.35	80.58± 5.58	84.96± 5.37	4.38± 0.92

It was observed that the initial and final serum iron levels in elderly men was 93.32 ± 8.56 and 99.40 ± 8.56 μg/dl respectively. The difference was 6.08 ± 1.38 μg/dl. As far as the adult men are considered,





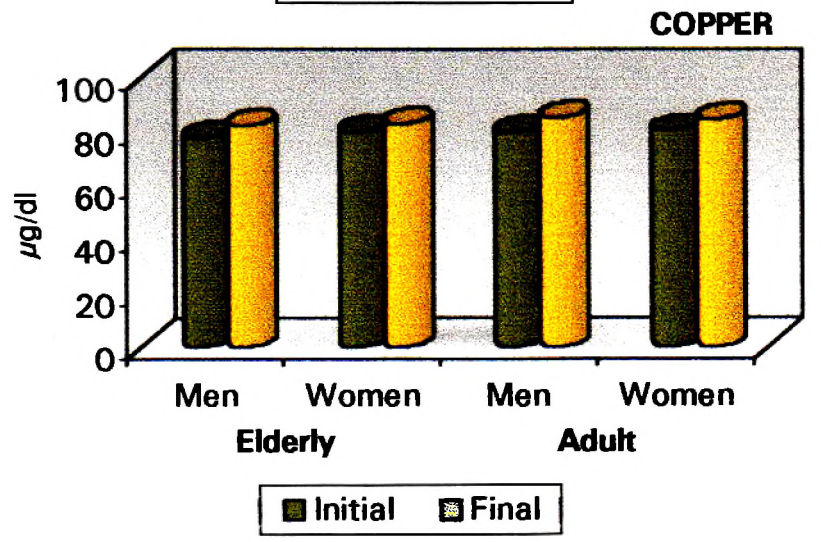


FIGURE 21

COMPARISON OF MEAN SERUM MINERAL PROFILE OF SELECTED ELDERLY AND ADULTS (SUPPLEMENTED GROUP)

their initial and final serum iron levels was 94.53±6.47 and 101.97±6.10μg/dl respectively, with a difference of 7.43±1.17μg/dl. The difference in serum iron levels in elderly and adult women was 5.16±1.02 and 6.69±1.77μg/dl respectively at the end of supplementation period.

The initial serum zinc level of elderly men was 88.84±6.27μg/dl. The difference was 5.08±1.08μg/dl in elderly men and 6.07±2.05μg/dl in adult men. The elderly women had an initial level of 84.60±4.09μg/dl and final level of 89.36±3.66μg/dl. The difference was 4.76±1.23μg/dl. The adult women had an initial level of 83.27±3.89μg/dl and final level of 91.73±4.30μg/dl, with a difference of 5.31±1.35μg/dl.

The initial and final serum copper levels of elderly men was 78.44±3.83μg/dl and 82.48±3.77μg/dl respectively, with a difference of 4.40±0.93μg/dl. Whereas the initial and final serum copper levels of adult men was 80.3±5.63μg/dl and 85.5±5.55μg/dl, with a difference of 5.2±0.75μg/dl, which is higher than the elderly men. The elderly women had 79.92±5.88μg/dl and 83.52±5.76μg/dl as their initial and final serum copper levels. The difference was 3.6±1.26μg/dl. The adult women had an initial serum copper level of 80.58±5.58μg/dl and final level of 84.96±5.37μg/dl, with a difference of 4.38±0.92μg/dl.

From the above results, it was observed that the rate of increase in the serum antioxidant and mineral profile was much higher in adults compared to the elderly, which reveals the positive and better impact of food supplementation in the adult stage of life. The early intake of foods consisting of antioxidants and trace minerals might help the adults to age gracefully during the remaining part of their life.

These observations brings home the fact that antioxidant rich food supplements would definitely help to increase the serum antioxidant and mineral levels of elderly and adults. In the present study, adult men and women provided with the same food supplement given to the elderly revealed that, if such a food supplement could be provided during the middle age, the serum antioxidant and serum mineral levels could be maintained, helping them to age gracefully, free from degenerative diseases.

The mean serum lipid peroxide levels of the selected elderly and adults of the supplemented group is compared which is shown in Table LX and Figure 22.

TABLE LX

COMPARISON OF MEAN SERUM LIPID PEROXIDE LEVELS OF THE SELECTED ELDERLY AND ADULTS (SUPPLEMENTED GROUP)

Groups	Serum Lipis Peroxide (nmol/ml)		
	$\bar{x} \pm SD$ Initial	$\bar{x} \pm SD$ Final	$\bar{x} \pm SD$ Difference
Elderly			
Men (N:25)	3.89±1.32	2.63±1.24	1.26±0.57
Women (N:25)	3.30±0.88	2.14±0.84	1.16±0.69
Adults			
Men (N:30)	4.12±0.93	2.42±0.80	1.70±0.41
Women (N:26)	3.91±1.26	2.17±0.96	1.74±0.63

From the above table it is inferred that the initial and final serum lipid peroxide levels in elderly men was 3.89±1.32 and 2.63±1.24 nmol/ml respectively and the difference was 1.26±0.57 nmol/ml. When the adult men are considered, though their initial level of serum lipid peroxide was 4.12±0.93 nmol/ml (higher than the elderly men), the final level was decreased

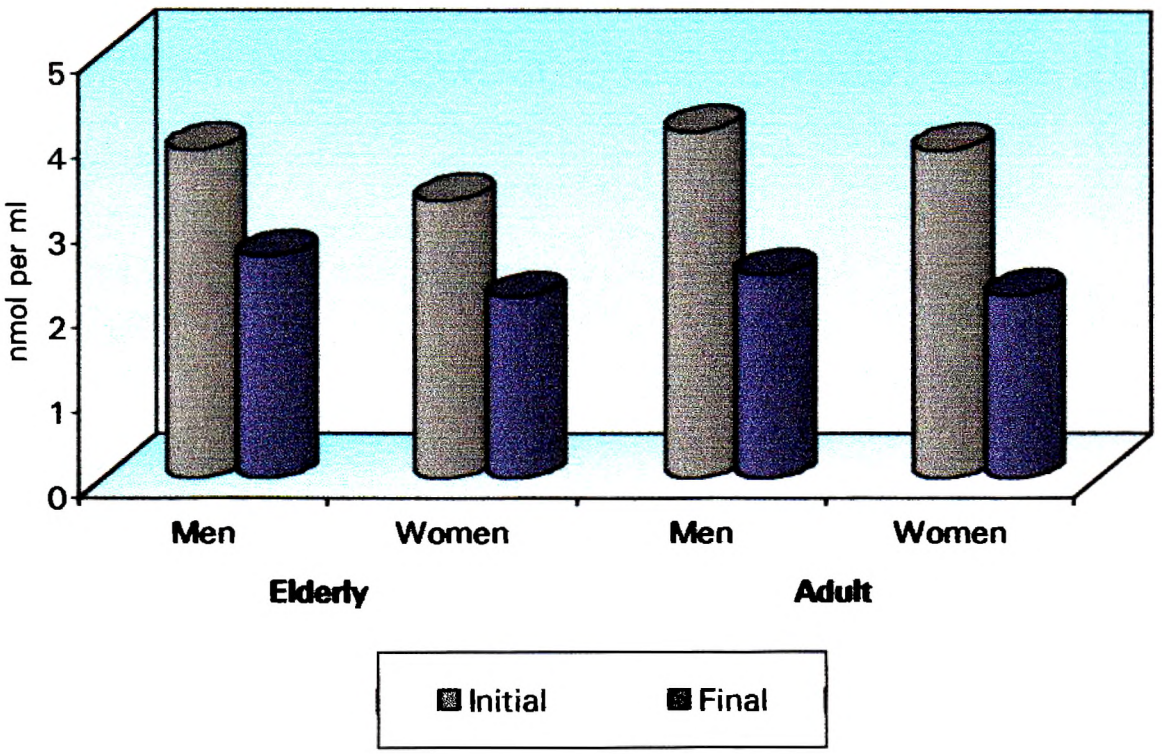


FIGURE 22

COMPARISON OF MEAN SERUM LIPID PEROXIDE LEVELS OF SELECTED ELDERLY AND ADULTS (SUPPLEMENTED GROUP)

to 2.42±0.80 nmol/ml, making a difference of 1.70±0.41nmol/ml. Similarly the elderly women had an initial level of 3.30±0.88 nmol/ml and final level of 2.14±0.84 nmol/ml, with a difference of 1.16±0.69 nmol/ml; whereas the adult women showed a marked decrease of 1.74±0.63 nmol/ml in the serum lipid peroxide levels at the end of supplementation study.

Reduction in lipid peroxide levels normally indicate the degree of ageing process. In the present study, the reduction of peroxide levels was higher among the adults (both men and women) compared to elderly men and women. This fact again highlights the beneficial impact of food supplementation. The food supplementation would have reduced much the free radicals in the blood stream of adults, which could have been attributed to their reduced lipid peroxide levels after the supplementation.

F. Impact of Nutrition Education on Selected Elderly

Apart from developing and evaluating the food supplement on elderly, nutrition education was also planned. Accordingly, fifty elderly who were participating in the supplementation study (25 men + 25 women) were selected and nutrition messages were imparted using the conventional audio-visual aids. Another group of 25 elderly men were selected and they were given nutrition education with the help of computers. Nutrition messages were common for both the groups, only the method of imparting nutrition message was varied. The results are given in the following tables.

1. Nutrition Education through Audio-Visual Aids

The mean scores obtained by the selected elderly before and after nutrition education through audio-visual aids is given in Table LXI.

TABLE LXI

MEAN SCORES OBTAINED BY THE ELDERLY

(NUTRITION EDUCATION THROUGH AUDIO-VISUAL AIDS) (30 POINT SCALE)

Parameters	Men (N:25)		Women (N:25)		't' value
	Score $\bar{x} \pm SD$	Per cent	Score $\bar{x} \pm SD$	Per cent	
Initial	7.92±3.06	26.40	6.24±2.47	20.80	
Final	20.00±2.84	66.67	18.24±3.06	60.80	33.0106
Difference	12.08±2.90	40.27	12.00±2.15	40.00	

It was observed that the nutrition knowledge of the elderly has improved after the education through audio-visual aids. Based on a 30 point scale, the initial and final scores obtained by elderly men was 7.92 (26.40 per cent) and 20.00 (66.67 per cent) respectively. In the case of women, the initial and final scores obtained were 6.24(20.80%) and 18.24 (60.80%) respectively. The percentage improvement in nutrition knowledge after education was given through the audio-visual aids in elderly men and women were 40.27 and 40.00 respectively. The knowledge gained after nutrition education was highly significant in the selected elderly and a positive correlation was found between the initial and final scores of elderly men ($r = 0.51993$) and elderly women ($r = 0.71661$).

2. Nutrition Education through Computers

The mean scores obtained by the selected elderly before and after nutrition education through computers is given in Table LXII.

TABLE LXII

MEAN SCORES OBTAINED BY THE ELDERLY

(NUTRITION EDUCATION THROUGH COMPUTERS) (30 POINT SCALE)

Parametes	Elderly (N:25)		't' value
	$\bar{x}$ Score $\pm$ SD	Per cent	
Initial	12.52±3.69	41.73	
Final	28.64± 1.49	95.47	25.88
Difference	16.12±3.05	53.73	

From Table LXII it was observed that the initial and final scores obtained for nutrition knowledge (given through computers) by the elderly men were 12.52(41.73%) and 28.64(95.47%) respectively. The mean difference score was 16.12 and hence the percentage improvement in nutrition knowledge after the education was 53.73. The results reveal that it was highly significant when analysed statistically and showed a positive correlation ($r = 0.59301$).

From the above results regarding the impact of nutrition education through audio-visual aids and computers, it was observed that there was a positive impact, which shows that nutritional awareness could be created on nutrition and its importance even in the elderly age group. This could be achieved by giving nutrition education to the elderly community through social service organizations, school and college volunteers, hospitals and other public and private sectors.

From the results as analysed in the foregoing sections of this chapter, it is interesting to note that the developed food supplement comprising

of the macro and micronutrients especially antioxidants is an economically feasible, culturally and habitually acceptable food supplement to the diets of the elderly and adults. When the impact of food supplementation was studied, a positive trend was observed on the nutritional profile. An effort that was taken to study the impact of nutrition education on elderly revealed a positive and encouraging results. The foods that are rich in micronutrients namely antioxidant vitamins and minerals should be popularised among the rural elderly and adults so that they can age gracefully in the remaining years of their life.

SUMMARY AND CONCLUSION

V SUMMARY AND CONCLUSION

The aged or the elderly (more than 60 years of age) belong to post mature adult group of population. These people with all their wisdom and experience contribute their mite to total family income and welfare of society, and as such they should be considered as an asset to the community. Many consider that our ageing population is a soft issue which can be dealt with another day, or better yet, by another generation. Yet, an understanding of the various dimensions of ageing as well as the multi-disciplinary approaches to the study of ageing is necessary for all those who are concerned with the problem of evolving policies and strategies on how best to sustain the quality of life throughout old age.

Ageing has attracted the attention of health planners, economists and demographers, as there has been a steep rise in the world population of people aged 60 years and above in the last four decades and the demographers are predicting a steeper rise in the coming years.

The rural elderly population is older than that of the urban areas. For the majority living in the rural areas, inadequate income and poverty lead to dependency on breadwinning sons. Older people in rural areas thus report a poorer quality of life than those in the cities and towns. They are severely disadvantaged by economic hardships, unresolved chronic health problems, functional impairment and illiteracy. Hence, keeping these aspects in mind, an effort was taken in the present investigation entitled 'Nutritional Profile of the Rural Elderly and Impact of Food Supplementation and Nutrition Education'.

The broad objective of this study was to assess the lifestyle and nutritional profile of elderly living in rural areas of Tamilnadu and to study the impact of food supplementation and nutrition education.

Accordingly, the rural areas of Appakudual and Jambai panchayat of Bhavani block in Erode district of Tamilnadu were chosen as the study areas. A total of 500 elderly (250 men and 250 women) in the age group of 60 to 94 years were randomly selected. All the elderly were personally interviewed, using the interview schedule. The general profile of these elderly were studied by drawing informations like educational level, erstwhile occupation and income, number of children, leisure time activities, personal habits, and dietary practices. The psychological well being was assessed using a Geriatric Depression Scale. For all the 500 elderly, body weight and height were assessed and BMI computed. The functional and clinical assessments were carried out with the help of a trained physician. Blood haemoglobin levels of all the elderly was also estimated.

As a part of the study, a food supplement was formulated using wheat, ragi, green gram, carrot, tomato and amaranthus. Wheat, ragi and green gram were germinated and powdered. Carrot was pressure-cooked and tomato and amaranthus were blanched. These were then sun dried and powdered. All these six powders were mixed together thoroughly to form the ***food supplement***. It was organoleptically evaluated and subjected to routine nutrient analysis. The physicochemical characteristics was also assessed. The food supplement was packed in 200 gauge low density polyethylene bags and evaluated for its shelf life parameters. Porridge and balls were prepared from the food supplement in which form it was consumed by the selected elderly.

For feeding trial, a sub-sample of 50 elderly in the age group 60-67 years (25 men and 25 women) were selected from the total sample of 500 elderly and they formed the supplemented group. A comparable control group (50 elderly) was also maintained. Biochemical parameters namely haemoglobin, serum antioxidants (vitamins A, C and E), trace minerals (iron, zinc and copper) and lipid peroxide levels were estimated before and after the supplementation. A three day food weighment survey was conducted in a sub sample of 40 elderly (20 each from supplemented and control groups). The impact of food supplementation was assessed through the changes in body weight, BMI, biochemical evaluation in the supplemented group and compared with that of the control.

An attempt was taken in the present investigation to identify a group of adults (50 to 55 years) and trace out the characteristic changes related to ageing. Totally, 86 adults (46 men and 40 women) were selected to observe the specific characteristics namely appearance of grey hair, changes in dentition, impairment in vision and hearing, reduction in memory power, problems like osteoporosis and onset of menopause in women. For assessing the specific characteristics of ageing, a trained physician's help was obtained. The food supplement developed in the main study was also provided to these adults to study its impact through certain blood parameters. The supplemented group comprised of 30 men and 26 women (56 adults) and the control group had 16 men and 14 women (30 adults).

Nutrition education was planned and its impact on elderly was studied. Conventional audio-visual aids and a computer aided programme with PowerPoint presentation were used as the teaching aids. The nutrition

messages taught were common in both the methods. The fifty elderly who were involved in the supplementation study were given nutrition education using the common audio-visual aids. Another twenty five elderly men who were part of the main study, were taught the nutrition messages using the computers. The mother tongue of the elderly (Tamil) was used to learn these messages. In order to evaluate the impact of nutrition education, a questionnaire was administered before and after the education programme.

The salient findings of the present study are summarised as follows:

1. Among the 500 elderly selected for the study, 250 were men and 250 were women. The highest percentage of elderly men (40.8%) were between the age group of 60-64 years, followed by 29.6 per cent in the 65-69 age group. Among the elderly women, 37.2 per cent belonged to the age group of 65-69 years, followed by 25.2 per cent in the age group of 60-64 years. The least number of the elderly men and women fell into the age category of 90-94 years.

2. Out of the 250 elderly men, 72 (28.8%) were literates and 178 (71.2%) were illiterates. Of the 250 elderly women, 34 (13.6%) were literates and 216 (86.4%) were illiterates. Illiteracy was more common among the elderly women (86.4%) than men (71.2%). On the whole, 106 elderly (21.2%) were literates and 394 elderly (78.8%) were illiterates.

3. Regarding the occupational status, majority (34.4%) of the elderly men were agricultural labourers. They were also employed as mill workers (14.8%), street vendors (6%) and 3.2 per cent were petty shop holders. Fifty four elderly men (21.6%) were involved in farming in their own lands. Majority of

the elderly women (34.0%) were involved in household work followed by agricultural labourers (19.6%). A few elderly women (11.6%) were working in their own farms. Most of the elderly (51.4%) were involved in moderate work like labourers in textile industry, carpentry and mill workers. The sedentary (21.6%) and heavy workers (27.0%) formed 48.60 per cent of the elderly surveyed.

4. Out of 250 men, 14 (5.6%) were bachelors and among the 250 women, 6 (2.4%) were spinsters. Among the married men, 14.8 per cent were widowers and 28.8 percent of the women were widows. In the families of 14.41 per cent of elderly men and 11.88 per cent of elderly women, there were only one child. In each of the families of 28.81 per cent and 30.93 per cent elderly men, there were two and three children respectively. Likewise in the families of 30.33 per cent and 27.05 per cent elderly women, there were two and three children respectively. There were four children and more in 17.80 per cent and 27.87 per cent families of elderly men and women respectively.

5. Regarding the type of family that the elderly were dwelling, 43 elderly men (17.2%) and 41 elderly women (16.4%) were living with spouse. Majority of the elderly (64.8% men and 69.6% women) were living with their son. Only 10.4 per cent and 9.2 per cent of the elderly men and women were living with their daughters respectively. A few elderly (4.4% men and 2.0% women) were also living with their relatives and friends.

6. Majority of the elderly were watching television (60.8%) and listening to radio (39.0%) as their leisure time activities. The next common leisure time

activity was reading newspaper and local magazines. Compared to men (7.6%) more elderly women (35.6%) helped in the house hold work. Some of the elderly were engaged in other activities such as gardening, rearing cattle, cleaning and chatting.

7. The personal habits of the elderly revealed that 27.2 per cent and 14.4 per cent of elderly men had the habit of smoking and drinking alcohol respectively. Chewing betel leaves was found in 15.6 per cent of elderly men and 28.8 per cent of elderly women. Snuff was used by only 2.8 per cent of elderly men and 1.6 per cent of elderly women. However 34.4 per cent of elderly men and 62.4 per cent of elderly women did not have any of the above habits.

8. The dietary pattern of the elderly revealed that majority of the elderly men (91.6%) and elderly women (87.2%) were non-vegetarians and the rest of them were vegetarians. Of the elderly men, 17.2 per cent and 15.2 per cent of elderly women had two meals per day. Most of the elderly selected for the study (83.8%) had three meals a day. Regarding the meal pattern, majority of the elderly had breakfast in the form of dhal rice or tomato rice. Some of them had tiffin items like uppuma, idli or dosai. For lunch, along with rice they consumed some of the locally available vegetables like cabbage, brinjal and drumstick. It was observed that not much of fruits and vegetables were used in their meals .

9. Majority of the elderly preferred liquid, semisolid, soft and solid foods. Only a few liked crunchy foods. Most of the elderly preferred sweet, salt, hot and bland foods. A few did not prefer hot and spicy foods. Some elderly did

not prefer sweets. Regarding the foods included, most of the elderly included all the food items. Certain foods like brinjal, roots and tubers, organ meats, ghee, nuts and oil seeds were avoided by some elderly. The elderly avoided these foods because of reasons like indigestion, allergy, constipation and financial constraints.

10. The elderly expressed some of their food beliefs and taboos. About 82.6 per cent believed that papaya, jack fruit, horse gram and sesame are heat producing foods. The common belief among 77.2 per cent of elderly was that garlic and ginger are good for digestion. Majority of the elderly (96.2%) believed that banana stem is good for the health of men. The elderly (42.6%) also believed that after boiling the vegetables with water, it should be drained because it is not good for health.

11. It was observed that rice was the staple food consumed daily by all the elderly. Wheat was taken daily by only two percent and 0.8 per cent of elderly men and women respectively. Ragi was not taken daily by the elderly. The frequency of pulse consumption daily among the elderly men and women was 14.40 per cent and 9.20 per cent respectively. Green leafy vegetables was not taken neither daily nor on alternate days. It was taken weekly by 11.20 per cent of elderly men and 13.60 per cent of elderly women. Twenty per cent of elderly men and 30.40 per cent of elderly women consumed vegetables daily. Fruits was consumed daily by only 4.80 per cent and 5.60 per cent of elderly men and women respectively. Milk and its products were taken daily by 68 per cent of elderly men and 63.60 per cent of elderly women. All the elderly consumed oil daily in the form of unsaturated fat. Saturated fats were taken occasionally and majority of them never consumed it.

12. While 76.0 per cent of the elderly did not have any difficulty in consuming food, the others had problems in biting, chewing and swallowing.

13. Mean height of the elderly men was 155.09cm and that of the women was 146.39cm. The mean weights of elderly men and women were 52.79kg and 46.04kg respectively. The mean BMI values for elderly men and women were 21.97 and 21.48 respectively.

14. Functional assessment of the elderly revealed that posture of 94.20 per cent of them was normal. Tremor and stiffness of the hands were observed in 4.40 and 10.40 per cent of the elderly respectively. Poor sight was observed in 26.20 per cent of the elderly. Varicose veins were seen in 2.80 per cent of the elderly. The clinical examination indicated that 94.20 per cent of the elderly had normal body temperature. Profuse sweating was observed in seven per cent, localised edema in eight per cent, receded gums in 33.60 per cent and angular stomatitis in two per cent of the elderly.

15. It was found that nine percent of the elderly suffered from constipation, 10.8 per cent from indigestion, 11.4 per cent from insomnia and 12.0 per cent from joint pain. Frequent cold was reported by 3.4 per cent of the elderly.

16. The incidence of hypertension, respiratory disease, arthritis, diabetes mellitus and cataract among the elderly were 7.2, 5.6, 11.4, 6.6 and 12.2 per cent respectively.

17. While tracing the exercise pattern of the elderly, majority of them (96.2%) were not having the habit of doing exercise. Only 3.8 per cent of the elderly

practiced walking regularly. This was combined with other daily routine work such as going to their farms to obtain milk and to buy vegetables. The reasons stated for the lack of exercise were poor health (18.09%), lack of interest (15.18%) and lack of time (14.14%). But most of the elderly (52.59%) were ignorant about the physical exercise and its importance in their day to day life.

18. The mean haemoglobin levels of the elderly men and women were 10.81g/dl and 10.46 g/dl of blood respectively. Among the 500 elderly studied, 75.6 per cent of men and 86.4 per cent of women had mild anemia, which is a common problem in elderly.

19. The food and nutrient intake of the elderly were found to be lower than the RDA, except for an excess of 2.22 per cent of cereal consumption in the case of elderly women.

20. Twenty per cent of the elderly expressed that they were not respected by the family members, 29.6 per cent felt that they were not allowed to involve in decision making and 36.0 per cent of the elderly felt that family matters were not discussed with them. About 21.4 per cent of the elderly felt that they were isolated and 23.4 per cent expressed that their social movement had decreased as they age.

21. While 38.6 per cent of the elderly were friendly, fifteen percent were hostile and 35.8 per cent were in a state of confusion. When the extent of depression was assessed using the Geriatric Depression Scale, it was found that 12.2 per cent were mildly depressed, 8.6 per cent were moderately depressed and 3.2 per cent were severely depressed.

22. The developed food supplement was light yellowish green in colour, with a pleasant and highly acceptable taste. The viscosity was 15.27 centistokes. The nutrient content of 100g of food supplement was: energy 560 kcal, protein 7g, iron 6.4mg, calcium 132.3mg, phosphorus 208.60mg, β-carotene 2855.40μg, vitamin C 64.90mg, vitamin E 5.60mg, zinc 1.25mg, copper 0.32mg and total carotene was found to be 4395.50μg.

23. Simple and easy to prepare recipes namely porridge (sweet and salt) and sweet balls were formulated in this study. The acceptability trials by the panelists of the three recipes indicated a mean score of 24.8, 24.3 and 24.8 respectively out of 25.0 (Maximum score). These recipes took only a minimum time to prepare and ready for their consumption by the elderly themselves.

24. The storage study indicated that the keeping quality of the food supplement packed in 200 gauge LDPE pouches and stored at ambient conditions was good for more than two months. This was confirmed by assessing the moisture content, alcoholic acidity, peroxide value and microbial count during the storage period.

25. The amount of food supplement that could be consumed by elderly in one sitting, in the form of porridge or balls was found to be 100g. The cost of the food supplement was compared with that of a commercially available supplementary food. It was found that the cost of 100g of commercially available supplementary food was Rs.34/- whereas the price of the same quantity of food supplement was Rs.3.00/- only.

26. The two groups namely the supplemented group (50 elderly) and control group (50 elderly) were found to be comparable at baseline on demographic characteristics namely age, gender, body weight, BMI and biochemical variables.

27. By the inclusion of the food supplement the energy, protein, vitamin C and β-carotene requirements were met. The iron and calcium intake improved but did not meet the RDA. The bioavailability of the nutrients especially the minerals iron and calcium are increased after malting. Therefore, the absorption of nutrients from the food supplement must have been enhanced.

28. The weight of the supplemented group was found to have increased while there was a reduction of the same in the control group. The BMI of 64 per cent of the elderly men and 80 per cent of the elderly women in the supplemented group improved, 28 per cent and 16 per cent of the elderly men and women maintained and 8 and 4 per cent of the elderly men and women reduced, at the end of the study period.

29. The biochemical parameters namely haemoglobin, serum antioxidants namely vitamins A, C and E increased significantly after supplementation, when compared to the control group.

30. The serum minerals namely iron, zinc, and copper also increased in the elderly of the supplemented group compared to the control group.

31. The mean initial serum lipid peroxide levels of the elderly men in supplemented group was 3.89±1.32nmol/ml which decreased to 2.63±1.24nmol/ml at the end of the study period. A similar trend was also observed in elderly women which decreased from the initial level of 3.30±0.88nmol/ml to 2.14±0.84nmol/ml at the end of the study period.

32. When the impact of food supplementation between elderly men and women was compared, there was no difference in the vitamins A and C, minerals, zinc and copper and the lipid peroxide levels. This shows that both of them had the same impact due to food supplementation. But in the case of vitamin E and iron status, the elderly men had a better impact than elderly women.

33. As a part of the main study an effort was made to study efficacy of feeding the same food supplement provided to the elderly to a selected group of adults between the age group of 50-55 years. Their socioeconomic background, lifestyle and dietary pattern and the characteristic changes related to ageing were assessed.

34. The mean serum vitamins A, C and E, minerals iron, zinc and copper and the lipid peroxide levels showed a positive impact in the selected adult group due to food supplementation when compared to the control group.

35. Food supplementation had been proved beneficial for both the elderly and adult groups. When these two groups were compared, the rate of increase in the serum antioxidant and mineral profile was much higher in adults compared to the elderly, which reveals a positive and better impact of food supplementation during middle age.

36. The reduction in lipid peroxide levels was higher among the adults (middle age) compared to elderly, the fact again highlights the beneficial impact of food supplementation.

37. Nutrition education was imparted to the elderly through conventional audio-visual aids and through computer aided programme, the PowerPoint

presentation. When the impact of nutrition education was assessed, it was observed that there was a positive impact which shows that nutrition awareness could be created even in the elderly age group.

To conclude, the present study was a step taken up to view the lifestyle pattern and nutritional profile of elderly living in rural areas and to assess the impact of food supplementation and nutrition education. It emerged from the results that among the 500 elderly selected for the study, majority of the elderly were between the age range of 60-69 years. Literacy level among elderly men were more. Majority of the elderly were agricultural labourers and the elderly women were involved in household work (as cooks and caretakers). The percentage of widows were greater than widowers. Most of the elderly were living with their son. Majority of the elderly were non-vegetarians. The elderly also had their own food beliefs and taboos. Rice was consumed as their staple food. Not much of fruits and vegetables were included in their diet.

The mean body weight and BMI of the elderly were found to be lesser than that of literature values. Few of the health problems among the elderly were constipation, indigestion, insomnia, joint pain and frequent cold. Some of them also suffered from hypertension, respiratory disease, arthritis, diabetes and cataract. Majority of the elderly had mild anaemia.

The formulated food supplement had satisfactory quality attributes, good shelf life, sufficient nutrient content with enough antioxidants and was cost effective. The food supplement was utilized in the preparation of porridge and balls which was easier and ready to eat by the elderly themselves.

Supplementation of elderly with the food supplement was found to have a positive impact on weight, BMI, haemoglobin, serum antioxidants and mineral profile. The food supplement reduced serum lipid peroxide levels which normally indicate the degree of ageing process. The early intake of foods consisting of antioxidants and trace minerals might also help the middle agers to age gracefully during the remaining part of their life. Since the rural elderly consume insufficient quantities of fruits and vegetables, they can be educated and an awareness can be created to include such a type of food supplement, with considerable quantities of macro and micro nutrients.

The present data on various aspects of the rural elderly could guide the government, welfare organisations and other health care personnels in making policy decision and intervention programmes for the elderly. It is recommended that due to projected rise in elderly population in the forthcoming years, nutrition intervention programmes and strategies should be implemented by the government. This is an urgent need of the hour which would promote better nutritional status among the rural elderly.

Hence, if ageing is to be a positive experience, longer life must be accompanied by optimizing opportunities for health, participation and security in order to enhance quality of life as people age and thereby we can achieve the vision–'Active Ageing'.

Recommendations for Future Research

1. Assessment of nutritional profile of rural elderly in other districts of Tamilnadu and other states in India.

2. Formulation of region specific low cost food supplements rich in micro nutrients/antioxidants.

3. Feasibility of producing supplementary foods for elderly as ready to eat through appropriate food technology.

4. Long term studies on the benefits of food supplementation and nutrition education.

5. Follow-up studies on the effect of food supplementation with regard to characteristic changes related to ageing.

6. Longitudinal studies beginning at the age of 40+ with food based antioxidants and trace minerals and calcium supplements on the nutritional and health status and on bone nutrition at 60+ and above.

7. Role of nutritionists in creating nutrition awareness among the elderly using different modern and scientific techniques.

8. Comparative study on the nutritional profile of rural and urban elderly.

9. Popularisation of antioxidant rich foods and their utilisation in the formulation of a geriatric food supplement.

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APPENDIX

APPENDIX I

QUESTIONNAIRE TO ELICIT INFORMATION ON SOCIOECONOMIC BACKGROUND, HEALTH AND NUTRITIONAL PROFILE OF ELDERLY

1. S.No. :

2. Name of the subject :

3. Age in years

   (a) 60-70 ☐ (b) 71-80 ☐ (c) 81-90 ☐ (d) 91 and above ☐

4. Sex :

   Male ☐ Female ☐ Height:____ cm Weight: ____ kg

5. Address:

   Door No :

   Name of the Village :

   Block :

6. Educational Status : (a) Primary School ☐
   (b) Middle School ☐
   (c) High School ☐
   (d) Graduate ☐
   (e) Illiterate ☐

7. (i) Marital Status : (a) Married ☐
   (b) Single ☐
   (c) Widow ☐
   (d) Widower ☐
   (e) Divorce ☐

   (ii) Number of Children : (a) No child ☐
   (b) One child ☐
   (c) Two children ☐
   (d) Three children ☐
   (e) Four children and more ☐

8. Type of family : (a) Joint / Nuclear ☐

(b) Elderly living with spouse ☐

(c) Elderly living alone ☐

(d) Elderly living with son ☐

(e) Elderly living with daughter ☐

(f) Elderly living with relatives / friends ☐

9. Occupation : (a) Inservice ☐

(b) Retired ☐

(i) Pensioner ☐

(ii) Without Pension ☐

(c) Agriculture ☐

(d) Others ☐

(e) Nil ☐

10. Do you have any of the following habits?

(a) Smoking : Yes / No

(b) Alcohol drinking : Yes / No

(c) Chewing tobacco : Yes / No

(d) Chewing betal leaves : Yes / No

(e) Snuff : Yes / No

11. Do you have regular exercise: Yes / No

If Yes, the type of exercise

(a) Walking ☐ (b)Jogging ☐

(c) Yoga ☐ (d) Others (specify) ☐

If No, reasons

(a)Poor health ☐ (b) Lack of interest ☐

(c)Lack of time ☐ (d) others(specify) _____

12. **Leisure time activities :**

- (a) Reading ☐
- (b) Listening to radio ☐
- (c) Watching TV ☐
- (d) Gardening ☐
- (e) Any other (specify) _____

13. **Mental state :**

- (a) Friendly ☐
- (b) Hostile ☐
- (c) Confused ☐
- (d) Excited ☐
- (e) Depressed ☐

APPENDIX II

DIETARY SURVEY SCHEDULE

1. Vegetarian /Non -vegetarian:

2. Number of meals per day :One/Two/Three/More than three

3. Meal pattern

Meals	Foods taken
Early Morning	
Break fast	
Mid-Morning	
Lunch	
Tea	
Dinner	
Bed time	

4. Preference of food forms

a) Liquid ☐ b) Semisolid ☐ c) Soft ☐ d) Solid ☐ e) Crunchy ☐

5.Foods included and avoided in the diet

Foods Included	Reasons	Foods avoided	Reasons

6. Preference of food taste:

a) Sweet ☐ b) Salt ☐ c) Hot ☐ d) Spicy ☐ e) Bland ☐

7. Do you have any problem while biting /chewing/swallowing ? If yes, specify

8. Frequency of Consumption of food items :

Food items	Frequency of use						
	Daily	Alternate day	Weekly	Biomonthly	Monthly	Ocassionaly	Never
Cereals Rice Wheat Ragi **Pulses** **Roots and tubers** **Green leafy vegetables** **Other vegetables** **Flesh foods and egg** **Sea foods** **Fruits** **Milk and milk products** **Sugar products** **Fats and oils** **Nuts**							

APPENDIX III

GERIATRIC DEPRESSION SCALE (GDS-20)

Please write your answers as 'Yes' or 'No'		Yes	No
1.*	Are you basically satisfied with your life?	☐	☐
2.	Have you dropped many of your activities and interests?	☐	☐
3.	Do you feel that your life is empty?	☐	☐
4.	Do you often get bored?	☐	☐
5.	Are you bothered by thoughts that you just cannot get out of your head?	☐	☐
6.	Are you afraid that something bad is going to happen to you?	☐	☐
7.*	Do you feel happy most of the time?	☐	☐
8.	Do you often feel helpless?	☐	☐
9.	Do you often get restless and fidgety?	☐	☐
10.	Do you prefer to stay at home at night rather than go out and do new things?	☐	☐
11.	Do you frequently worry about the future?	☐	☐
12.	Do you feel that you have more problems than most?	☐	☐
13.*	Do you feel that it is wonderful to be alive now?	☐	☐
14.	Do you often feel down hearted and blue?	☐	☐
15.	Do you feel pretty worthless the way your are now?	☐	☐
16.	Do you worry a lot about the past?	☐	☐
17.*	Do you find life very exciting?	☐	☐
18.	Do you think that most people are better off than you are?	☐	☐
19.	Do you frequently get upset over little things?	☐	☐
20.*	Is your mind as clear as it used to be?	☐	☐

Note : *score 1 for each 'Yes " except starred item where each 'Yes' have to be scored negatively.*

APPENDIX IV (a)

FUNCTIONAL ASSESSMENT SCHEDULE

a.	Posture	:	Normal
			Bent at waist
			Hunch
b.	Gait	:	Normal
			Limping
			Shuffling
c.	Hands	:	Normal
			Tremor
			Stiffness
d.	Hearing	:	Normal
			Hard of hearing
e.	Eyes	:	Normal sight
			Poor sight
f.	Legs	:	Normal
			Slightly bent
			Varicose veins
g.	Speech	:	Normal
			Slurred
			Stammering

APPENDIX IV (b)

CLINICAL ASSESSMENT SCHEDULE

1. General examination :
   a) Normal
   b) Undernourished
   c) Obese
2. Health status of subject:
   a) Able to move freely
   b) Partially mobile
   c) Immobilized
3. Clinical symptoms

a.	Temperature	:	Normal
			Elevated
			Hypothermia
b.	Sweating	:	Normal
			Profuse
c.	Nails	:	Normal
			Brittle
			Spoon shaped
			Discoloured
d.	Edema	:	No edema
			Localised
e.	Skin	:	Normal
			Dry skin
			Depigmentation
f.	Teeth	:	Pearl white
			Caries / discoloured
			Plaque deposition
			Broken

g.	Gums	:	Normal
			Receded
			Inflammed
h.	Lips	:	Normal
			Cracked / dry
			Angular stomatitis
i.	Digestive Function	:	Normal
			Distended
j.	Respiratory symptoms	:	Normal
			Asthmatic
			Dyspnic
			Persistant Cough

4. General health problems:

i) Constipation
ii) Diarrhoea
iii) Indigestion
iv) Fatigue
v) Insomnia
vi) Giddiness
vii) Joint pain
viii) Frequent cold

5. Prevalence of Major disease conditions:

i) Cardiovascular disease
ii) Hypertension
iii) Respiratory disease
iv) Arthritis
v) Diabetes mellitus
vi) Cataract

APPENDIX V

QUESTIONNAIRE TO ELICIT INFORMATION ON SOCIOECONOMIC BACKGROUND, LIFESTYLE, NUTRITIONAL PROFILE AND CHARACTERISTICS OF AGEING ON SELECTED ADULTS

1. S.No. :
2. Name :
3. Address :
   Door No :
   Name of the Village :
   Block :
4. **Age in years** : 50 ☐ 51 ☐ 52 ☐
   53 ☐ 54 ☐ 55 ☐
5. Sex : Male / Female
6. i. Height ____cm ii. Weight: _____kg
7. Educational Status :
   (a) Primary School ☐
   (b) Middle School ☐
   (c) High School ☐
   (d) Higher Sec. School ☐
   (e) Graduate ☐
   (f) Illiterate ☐
8. Marital Status :
   (a) Married ☐
   (b) Single ☐
   (c) Widow ☐
   (d) Widower ☐
   (e) Divorce ☐

9. Type of family : Joint / Nuclear ☐

10. Occupation : (a) Education ☐

(b)Agriculture ☐

(c) Industries ☐

(d) Not been Employed ☐

11. Income : (a) Rs.1000-1500 ☐

(b) Rs.1500-2000 ☐

(c) Rs.2000 and above ☐

(d) Nil ☐

12. Do you have any of the following habits?

(a) Smoking : Yes / No

(b) Alcohol drinking : Yes / No

(c) Chewing tobacco : Yes / No

(d) Chewing betel leaves : Yes / No

(e) Snuff : Yes / No

13. Do you have regular exercise: Yes / No

If Yes, the type of exercise

(a) Walking ☐ (b)Jogging ☐

(c) Yoga ☐ (d) Others (specify)_____

If No, reasons

(a) Poor health ☐ (b) Lack of interest ☐

(c) Lack of time ☐ (d) Others(specify) _____

14. Leisure time activities : (a) Watching TV, Listening to Radio ☐

(b) Cinema ☐

(c) Reading News Paper, Books etc ☐

(d) Any Other ☐

15. Dietary Pattern :

(i) Vegetarian / Non-vegetarian

(ii) Number of meals/day

(iii) Meal pattern

Meals	Foods Taken
Early Morning	
Break Fast	
Mid-Morning	
Lunch	
Tea	
Dinner	
Bed Time	

iv.

Foods Included	Reasons	Foods avoided	Reasons

16. Characteristic changes related to ageing

1. Grey Hair : a) Absent

b) Present

i) Few

ii) Many

iii) Fully

2. Dentition : a) i) No. Present

ii) No. Fallen

b) Dental Caries

3. Vision :

a) Long sight

b) Short sight

c) Cataract

i) Nil

ii) One eye

iii) Both eyes

4. Hearing :

a) Able to hear

b) Unable to hear

5. Occurrence of menopause : Yes/No

If yes, at what age :

6. Osteoporosis : Yes/No

7.Memory power : a) Excellent

b) Good

c) Fair

d) Poor

e) Very Poor

APPENDIX VI

SCHEDULE TO TEST THE NUTRITION KNOWLEDGE OF THE ELDERLY

Name: Age in years:

a) Subject: Educational qualification:

b) Investigator: Occupation:

Tick (✓) any one answer for each question

1. The elderly or the aged belong to more than 60 years of age.

   Yes ☐ No ☐

2. In order to achieve good health, one must understand the process of ageing.

   Yes ☐ No ☐

3. Any ailment (illness) should be detected and treated early enough

   Yes ☐ No ☐

4. Fats and oils are concentrated source of energy

   True ☐ False ☐

5. Which one is high vitamin A. (β- Carotene)

   a) Pulses ☐ b) Carrots ☐

6. Fruits and vegetables increase the fibre content in our diet.

   Yes ☐ No ☐

7. Which food is rich in calcium?

   a) Egg ☐ c) Ragi ☐

   b) Mango ☐ d) Wheat ☐

8. Habits like smoking and drinking may lead to cardiac problems.

   Yes ☐ No ☐

9. Counselling is necessary for elderly to adopt corrective measures in his diet.

Yes ☐ No ☐

10. Calorie intake is proportional to energy expenditure

Yes ☐ No ☐

11. The energy requirement is same for elderly persons and young adults.

Yes ☐ No ☐

12. Elderly should not take plenty of fluids.

Yes ☐ No ☐

13. Carbohydrates does not yield energy.

Yes ☐ No ☐

14. Dietary fibre does not help to relieve constipation.

Yes ☐ No ☐

15. Blood cholesterol level especially among elderly people can be lowered by dietary fibre

Yes ☐ No ☐

16. For the formation and strength of bones, the following nutrient is essential.

a) Iron c) Vitamin C

b) Calcium d) Protein

17. About 200grams of fruits should be included in the diet.

Yes ☐ No ☐

18. Antioxidant vitamins can delay the ageing process.

True ☐ False ☐

19. Which vitamin is necessary to prevent bleeding gums.

a) Vitamin D ☐ c) Vitamin B ☐

b) Vitamin A ☐ d) Vitamin C ☐

20. Butter and ghee are rich sources of fat.

Yes ☐ No ☐

21. A balanced diet does not contain all the essential nutrients in the right amount.

Yes ☐ No ☐

22. More than quantity, quality in a diet is very important.

Yes ☐ No ☐

23. Twenty grams of fats and oils can be included in our diet.

Yes ☐ No ☐

24. Fried foods should not be avoided in the elderly's diet.

Yes ☐ No ☐

25. Diabetes is a common nutrition related problem in elderly.

Yes ☐ No ☐

26. Physical exercise is essential for maintaining good health.

True ☐ False ☐

27. Sprouted grams are rich in vitamin C.

Yes ☐ No ☐

28. Many diseases in old age can be managed by diet control.

Yes ☐ No ☐

29. The elderly should reduce salt intake.

Yes ☐ No ☐

30. The elderly must take frequent, but small meals.

True ☐ False ☐

APPENDIX VII

NUTRITION EDUCATION THROUGH COMPUTERS

(POWERPOINT PRESENTATION - COMPACT DISC)