REVIEW OF LITERATURE

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The present study was designed with a central objective to assess the mental and physical health profile of adult and older women with reference to depression. The study was distributed in three phases. The related objectives included screening adult and older women above the age group of 40 years for depression from the free living population & collection of information regarding their socio-demographic profile, dietary intake, psycho-social profile, activity pattern, lifestyle factors, disease profile and nutritional status. The objectives also included introduction of folic acid supplementation and brahmi to a group of older depressed women aged 60 years and above and evaluate their dietary intake, nutritional status, mental and physical health status after the period of supplementation. The relevant review of literature has been presented under the following heads.

1. Ageing	• Factors affecting ageing • Role of nutrition in ageing process • Malnutrition and Elderly
2. Mental Health	• Definition of mental health and its parameters • Magnitude of mental illnesses • Role of nutrition in mental health
3. Depression in Older Women	• Definition of Depression • Magnitude • Depression in Women • Role of nutrition in depression
4. Non-Pharmaceutical Management of Depression	• Brahmi- A Potential herbal remedy • Interventional studies with other herbs • Alternative therapy

1. AGEING

Aging can be defined as a progressive functional decline, or a gradual deterioration of physiological function with age, including a decrease in productiveness (Partridge and Mangel, 1999), or the intrinsic, inevitable, and irreversible age-related process of loss of viability and increase in vulnerability (Comfort, 1964). Clearly, human aging is associated with a wide range of physiological changes that leads to a decreased ability of the organism to respond to a wide range of stresses and adapt to adverse situations. Consequently, the organism is subjected to an increased risk of various old age diseases and disabilities (Thakur, 2002a; Singh et al., 1996, Kirkwood, 1995;) which in turn results in rise of vulnerability and reduction in vitality and ultimately the death of the individual.

Nonetheless, a brief look at the most important changes that occur in body and mind with age and the pathological consequences of these changes in the latter half of the life span are popularly referred to as ageing.

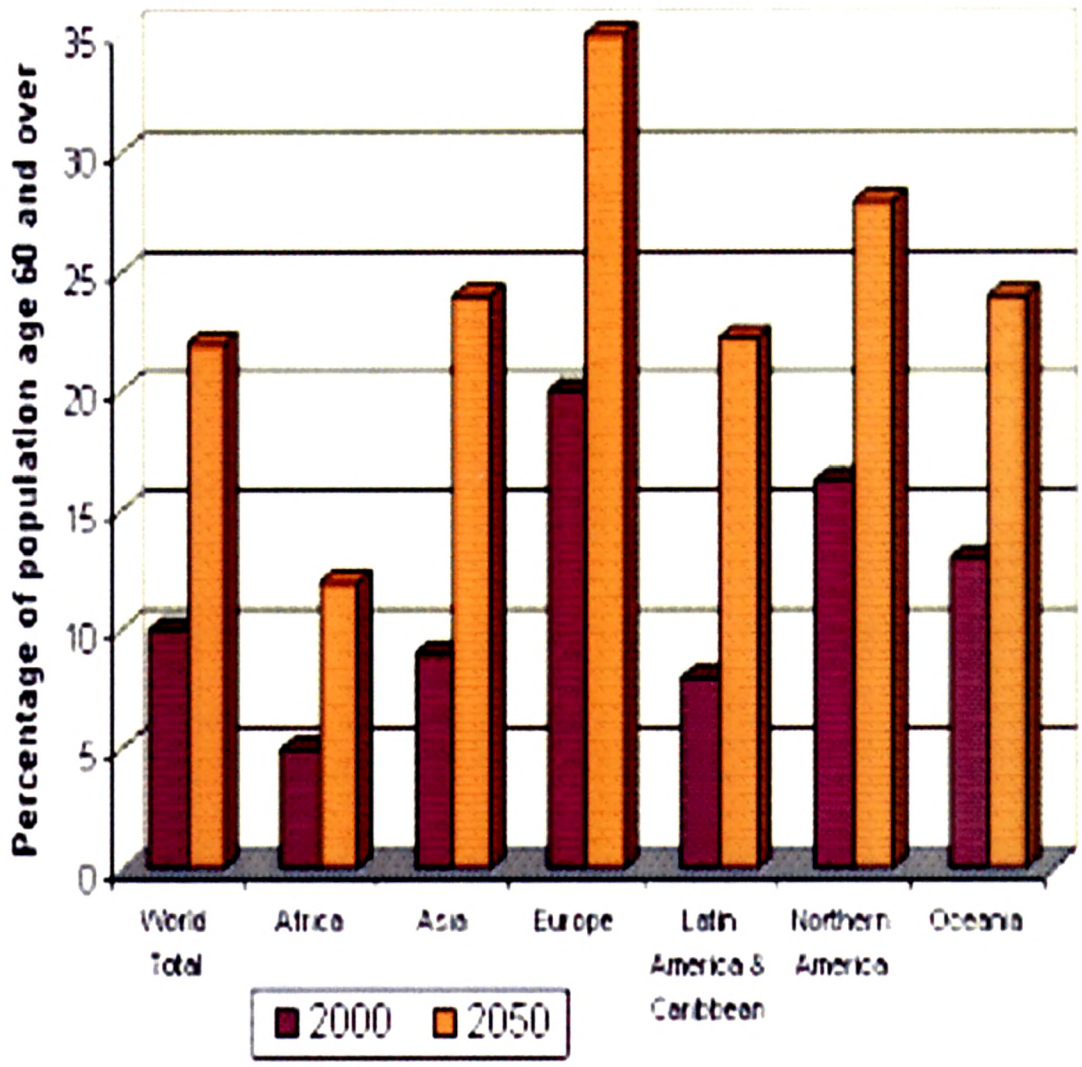
A difference between "normal" and "successful" aging is that the latter a combination of three components: a) absence or avoidance of disease and risk factors for disease, b) appropriate physical and cognitive functioning, and c) active engagement with life (including autonomy and social support). Although this is the most widely used approach in aging research - it fails to address the implications of the fact that a disease-free older age is unrealistic Lacruz et al (2010).

According to the latest census of India of 2001, there were 76.6 million persons of age 60 years and above. Although percentage wise Indian population may not appear to be highly aged but the absolute number 76.6 million is huge number for the elderly population. The share of the elderly population in India in the total elderly population of the world was 13 percent around 2000(United Nations, 2004).

The older population is growing at a considerably faster rate than that of the world's total population. In absolute terms, the number of older persons has tripled over the last 50 years and will more than triple again over the next 50 years.In relative terms, the percentage of older persons is projected to be more than double worldwide over the next half century. However, notable differences exist between regions in the numbers and proportions at higher ages. Although the highest proportions of older persons are found in the more developed regions, this age group is growing considerably more rapidly in the less developed regions. As a consequence, the older population will be increasingly concentrated in the less developed regions.

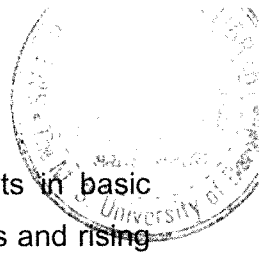
The twenty first century is often called the age of ageing. One of the world's greatest challenges of the present century is the enormous increase in the absolute numbers and proportions of older persons in the world. According to United Nations projections, by the year 2050, the number of older persons is expected to increase more than threefold, from 600 million to almost 2 billion. The relative weight of the older population is projected to double from 10 to 21 percent. The increase will be greatest and most rapid in various countries in Asia and Latin America. Presently, one of every ten persons in the world is aged 60 and over. It is projected that by the year 2050, this figure will increase to one of five and by 2150 it will be one out of three.

Figure 2.1: Demography of World ageing population



Source: World Population Ageing 1950-2050

Not only are more people surviving to oldage, but once there, they tend to live longer. Overthe next 50 years global life expectancy at age 60is expected to increase from 18.8 years in 2000-2005 to 22.2 years in 2045-2050 (an 18 per centgain), from 15.3 to 18.2 years (19 per cent) at age65 and from 7.2 to 8.8 years (22 per cent) at age 80. In fact, theolder the age group, the more remarkable are theexpected relative gains in life expectancy. In themore developed regions, average life expectancyat age 80 is projected to increase by 27 per centover the next half century as compared with 19per cent at age 60 and 9 per cent at birth (UN data, 2003).



Population ageing is a global phenomenon due to improvements in basic health care and living standards as well as declines in fertility rates and rising longevity. Both men and women face discrimination due to old age, but women experience ageing differently. In all ages over 65 years, there are more women than men in our society. Despite their lower mortality rates, older women have greater morbidity, including more limitation in self-care. One of the main social effects of extension of life in later years is the extended period of widowhood for women (Dhar, 2005). Women experience greater life expectancy than men as a result they compromise a lot among majority of older adults. Consequently, older women exhibit higher health service utilization rather than older men. Ageing implies a greater increment in the number of elderly women, 55 % of the world's elderly are women. The demographic shift toward elder women population, need to focus attention on their physical and psychosocial well-being. Though, the forecast for ageing population is that, more than ever before, aged adults will be physically, cognitively, psychologically and socially healthy (Madhu, 2009).

Gender relations structure the entire life cycle, from birth to old age, influencing access to resources and opportunities and shaping life choices at every stage. Good health, economic security and adequate housing are essential requirements of ageing with dignity, but older women in both developed and developing countries face difficulties in accessing these on a basis of equality with men.

A.FACTORS AFFECTING AGEING

i. Morbidity Profile of Elderly

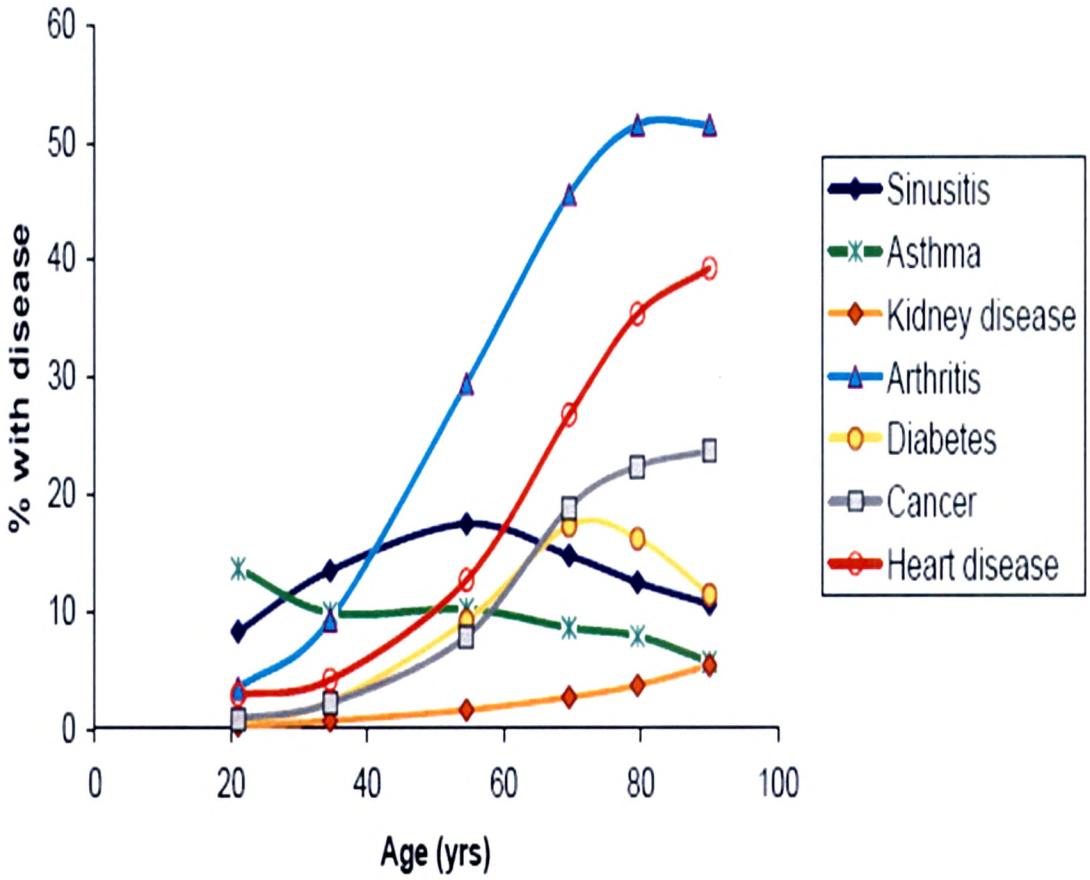
Increasing age is associated with increasing morbidities and disabilities for majority of elderly. Indian data in this regard is similar to global experience (NSSO 2000 and KAS, 2005). A good health and socio-economic status are two more important pillars of successful ageing. Health in elderly subject is verdict of inter play of genetic factors, life style and morbidities.

Evaluation ofthe morbidityprofile among elderly people, andthe impact of chronic conditions and co-morbidity on functionaldisability and psychological well-being is required for betterunderstanding of the relation between perceived health and chronicand disabling conditions. It will have implications for providinghealth care for the elderly population and its costs.

Clearly, the incidence of a number of pathologies increases with age (Fig. 2). These include diabetes, heart disease, cancer, arthritis, and kidney disease. Also the incidence of some pathology, like sinusitis, remains relatively constant with age, while that of others, like asthma, even decline. Therefore, it is important to stress that aging is not merely a collection of diseases. With age they become more susceptible to certain diseases.

Gregg et al (2002) analyzed data from 8344 women aged 65 years and above to examine the relationship between diabetes and the incidence of functional disability and found that diabetes is associated with an increased incidence of functional disability which is likely to further erode health status and quality of life.

Figure 2.2: Prevalence of selected chronic conditions, expressed in percentages, as a function of age for the US population (2002-2003 dataset).



Source: National Center for Health Statistics, Data Warehouse on Trends in Health and Aging.

The table below shows the most important causes of death in the elderly. Not surprisingly, heart diseases ranks first in causing death in people aged 85 and older, followed by cancer, cerebrovascular diseases, Parkinson's and Alzheimer's diseases, pneumonia, and chronic lower respiratory diseases. While diseases like cancer, heart diseases, diabetes and osteoporosis are major causes of death at all ages and most commonly affected, other diseases, like Parkinson's and Alzheimer's, only become significant at old age. All diseases are related to deficiency of nutrients and reduction in diet. Increasingly in the diet/disease debate, the role that micronutrients play in

promoting health and preventing non-communicable disease is receiving considerable attention.

Table 1: Death by underlying or multiple cause, expressed in rates per 100,000 people or in percentage of the total deaths, for the 2001 US population in two age groups: 45-54 years and 85 years of age and older.

Cause of death	45-54 years		Over 85 years	
	Incidence	% of deaths	Incidence	% of deaths
Cardiovascular diseases	92.8	21.66%	5607.5	37.48%
Malignant neoplasm	126.3	29.48%	1747	11.68%
Cerebrovascular diseases	15.1	3.52%	1485.2	9.93%
Parkinson's disease	0.1	0.02%	1312.8	8.77%
Alzheimer's disease	0.2	0.05%	703.2	4.70%
Pneumonia	4.6	1.07%	676.5	4.52%
Chronic lower respiratory diseases	8.5	1.98%	638.2	4.27%
Diabetes mellitus	13.6	3.17%	318.6	2.13%
Certain infectious and parasitic diseases	22.9	5.35%	243.8	1.63%
Atherosclerosis	0.5	0.12%	177.3	1.19%
Others	143.8	33.57%	2050.9	13.71%

Source: National Center for Health Statistics, Data Warehouse on Trends in Health and Aging.

Mental disorders are also frequent in later life (affecting approximately 20% of old people) with dementia and depression being the most prevalent conditions in this age group (Rockville, 1999). Moreover, dementia and depression are the leading causes of years of life lost due to disability in world.

However, rates, trends, and specific types of these diseases differ between women and men. Perhaps more importantly, the scenario of gender in society – the complex pattern of roles, responsibilities, norms, values,freedoms, and limitations that define what is thought of as "masculine"

and "feminine" in a given time and place– has a great bearing on the health of the aged.

A Community Based Study of the Morbidity Profile among the Elderly conducted in Chandigarh by HM Swami (2002) on Three hundred and sixty two persons (aged 65 years and above) amongst which 313 from urban and 49 from rural area were registered in the study. The results revealed that 153 were males and 209 were females. A large number of the subjects (89%) were suffering from at least one medical problem. Morbidity among rural subjects was observed to be less when compared to urban subjects. Females had higher rate of morbidity. Common presenting symptoms were pain/ swelling of joints (36.5%), limitation of movements (20.2%), indigestion/ heartburn (17.7%), backache (17.4%) and excessive tiredness. Medical history and physical examination by the physician revealed that most common diseases in order of the magnitude were hypertension (58%), osteoarthritis (50.55%),cataract (18.51%), gastritis (17.67%), deafness (13.53%) and diabetes mellitus/ hyperglycemia (12.15%). Anaemia (estimated by Hemoglobin estimation below 12 gm%) was recorded in 68.2% of the subjects.

Findings of the study by Patel and Mehta (2003) on 20 institutionalized elderly reported that 95% of total subjects had oral cavity problems followed by problem of gastrointestinal tract (80%), central nervous system (65%) and cardiovascular problem (60%).

A study conducted by Mehta and Sharma (2009) on 140 centenarians reported most prevalent minor Illnesses among age group of 65-74yrs and 75-84yrs were lethargy, body aches, lack of appetite and pain in joints. In case of 85-92yrs and 93-104yrs age groups highest prevalence was seen for lack of appetite being 80% and 83.3% respectively and lethargy followed by eye problems (60%) in 85-92yrs and trembling of limbs (66.6%) in 93 -104yrs age group.

In India, women bear a high burden of reproductive ill health which is an outcome of their poverty, powerlessness, low social status, malnutrition, infection, high fertility, and lack of access to health care. These factors play a role in women's health seeking behavior: that is, what women do when they have a health problem. Durrant in (2003) reported that the prevalence of urinary incontinency was 54.5%, this was highest in females and prevalence increases with age.

Similar study conducted at Delhi on 128 elderly subjects for general health profile check up in a clinic for the age group of 65-75 years out of which women constituted 56.25% and men 43.75% of a total of 128 study subjects. The finding revealed that 85% of the subjects complained of one or more health problems. Further 90.62% of them suffered from dental problems. A significantly higher ($p<0.05$) proportion of women (79.61%) suffered from problems of joints and locomotion as compared to men (60.71%). Genito-urinary problems were significantly higher in men ($p<0.05$) whereas anemia was significantly higher in women ($p<0.05$). Also 42.5% of the women and 30.76% of the men were obese. (A Khokhar, M Mehra, 2001).

Mehta and Ayyar (2000) conducted study on nutritional status, dietary habits and disease profile of elderly men and women aged 70years and above. The result showed highest occurrence of GIT problems in elderly women from both MIG and HIG income groups followed by locomotor, cardio vascular and respiratory disorder. Oral cavity disorder, genitourinary and muscular problem were very high among MIG women as compared to the HIG women.

Bone and joint disorders are common diseases in the elderly especially among post menopause women. The study conducted by Dipa P (1999) on nutritional status and dietary profile of elderly people in relation to osteoporotic fracture revealed that majority of subjects had a hip fracture (70%), followed by vertebral (25%) and wrist fractures(10%). Along with problems of bone, gastrointestinal track problems, cardio vascular problems there are other problems prevailing among elderly such as urinary problems including urinary track infection and urinary incontinency which further affect their health status.

Sarcopenia and increasing body fat are both hallmarks of theaging process (Evans, 1993). However, most of our knowledge regardingage-related patterns of change is derived from cross-sectionalstudies, few of which include elderly subjects. Lean mass peaksin the third to fourth decade of life, followed by a steadydecline with advancing age. This decline in muscle massis associated with weakness, disability, and morbidity (HughesVA, 2001).In contrast, body weight increases until 60 y of age; thereafter,60% of the population experiences a decrease in weight.Therefore, an accumulation of fat mass (FM) occurs during midlife.Obesity is a major public health problem in the general population,although weight loss in the elderly has a more detrimental effecton health or physical function than does an equivalent amountof weight gain (Harris TB, 1997).

Chauhan and Mehta (2006) conducted a study on 180 elderly women were selected from free living population. The results of morbidity profile revealed that The most frequent minor illness prevalent among women with different living arrangements were headache (23%), body ache (28%) and general weakness (37%). Younger group subjects showed the prevalence of dryness of skin (36%), dental problems (29%), bodyache (25.6%) and general weakness (23.3%), whereas additional illnesses among older group women were stomach distension (20%), trembling of limbs and slow reflexes.

ii. Nutritional Status in Ageing

The ageing process is associated with changes body composition and physiological changes which are not due to any specific diseases. The most striking feature of aging is the decline in the lean body mass and increase in adipose tissue. There is also reduction of body fat centrally and intra abdominally in old age, consistent with it, there is a decline in the body water.

Deterioration of the nutritional status affects and is affected by disease, especially among the elderly. Nutritional diagnosis and the identification of factors that contribute to this diagnosis are, therefore, essential but complex processes. This complexity is due to the occurrence of many changes, both

physiological and pathological, which may be taken as inherent to the aging or disease process. However, indirect indicators that likely guarantee proper and healthy eating, such as economic, social, lifestyle and quality of life aspects may represent important tools for assessing nutritional risk (Gariballa S, Forster S, 2007).

A cross sectional study was carried out by Maria RM (2009) in order to find out the interplay of nutritional status and functional capacity in 240 hospitalized elderly subjects aged (> 60 years of age), Among the 240 studied elderly, only 33.8% were classified as having an adequate nutritional status; 37.1% were classified as being at risk of malnutrition and 29.1% were classified as malnourished. The individuals classified as malnourished presented a higher prevalence of needing a caregiver or tube feeding. The use of dietary supplements was lower in these latter two groups. Most (85%) of the studied population had a chronic disease and this percentage did not differ among the groups. All the IADL and ADL variables assessed were significantly more deteriorated among the malnourished individuals. Among the ADL variables, eating partial (42.9%) or complete (12.9%) dependence was found in more than half of the malnourished elderly, in 13.4% of those at risk of malnutrition and in 2.5% of those without malnutrition. Thus, it was concluded that malnutrition prevalence among the elderly admitted to the hospital was high, probably because of their vulnerability before the disease. There is an interrelationship between the nutritional status of the elderly and reduced functional capacity

Sarah Forster (2005) conducted a cross sectional study on 445 randomly selected hospitalized patients consented to nutritional status assessment derived from anthropometric, haematological, and biochemical data within 72 hours of admission. Nutritional status was compared between those age < 75 years and those aged 75 years or more. Using multiple regression models the association between age and nutritional assessment variables was carried out. The findings showed that patients aged 75 years or more had poorer nutritional status compared with those younger than 75 years. After adjusting for no nutritional clinical risk indicators, increasing age was strongly and

independently correlated with poor nutritional status. Significant independent association between former and current smoker's status and poor nutritional status was also observed. Subjects aged ≥75 years were significantly more disabled and had non significantly higher levels of co-morbidity and CRP concentration compared with those less than 75 years of age. Age alone affected both anthropometric, nutritional and biochemical measurements. BMI, MUAC, hemoglobin, serum albumin and plasma ascorbic were all significantly lower in persons > 75 years of age compared with those younger than 75 years. Riboflavin, vitaminD_3, red cell folate and vitamin B_{12} concentrations were significantly lower in those aged ≥75 years.

Mehta and Shringarpure (2004) studied nutrient intake of 50 elderly subjects of Baroda city, and they found that majority of men younger as well elderly age group met only 50-75% of the RDA for energy and protein. Intake of fat was more than 100% of the RDA by more than 3/4th of the total number of men and women. More than 90% of men from the free living population reported less than 50% of the RDA for fiber and iron.

In a study by Park et al (2003) on 84 female and 92 male from each age group of 20-49 yrs,65-74 yrs and > 75yrs found that body fat accumulation did not change with age. Most elderly men and women had more than three diseases where incidences of arthritis and gastritis were highest among elderly.

Mehta (1999) reported on effect of aging on nutritional status, diseases profile on 100 elderly men in three different income group ,finding showed that the mean anthropometric measurement of weight and BMI were higher in elderly HIG and MIG men as compared to the elderly men in LIG. Study by Nes et al (1992) showed that 14% of the 100 elderly women and 4% of the 100 elderly men had BMI below 18.5kg/m^2, 2% had BMI below 16.

Sarojini et al(1990) conducted a study on 152 elderly subjects in an urban area of Karnataka. The results revealed that only 1/4th (28.3%) of them had

normal weight, 29.6% were underweight, 31.6% were severely underweight and 6.6% overweight and 3.9% were obese.

Body composition changes that are associated with aging include loss of protein, the lean body mass, the most significant change. Peak bone mass is achieved at age 30-35yrs and decreases thereafter. In females the change appears after the menopause, with declining bone mass, resulting in varying degrees of osteoporosis(Rosenberg,1991).Beyond changes in the bone mass, decrease in skeletal muscle, total body water and increase in total body water and increase in total body fat account for other changes in body composition with aging (Kuczmarski,1989).

Olayiwola IO and Ketiku AO (2009) studied 305 Nigerian elderly from the Yoruba tribe of both rural and urban areas in the South Western zone of Nigeria for their nutritional status and indicators of nutritional vulnerability. They found that more than half of the respondents had an acceptable nutritional status with a BMI between 18- 25 (63%male; 58% female) while 15% of the males and 14% of the females were underweight with BMI below 18 and 3% of the males had severe malnutrition (BMI below 15) Regarding nutritional vulnerability they found that majority were either moderately vulnerable or (50% male; 50% female) highly vulnerable (39% male and 46% female). Thus, they concluded that under nutrition was common among the Yoruba elders and further women were more vulnerable than men

One of the cross sectional study among an elderly population aged 60 years and above in rural Bangladesh showed BMI < 18.5 kg/m^2, indicating chronic energy deficiency in 50% of the population. BMI revealed a prevalence of 26% for protein-energy malnutrition and 62% for risk of malnutrition. Health problems rather than age had a negative impact on nutritional status. Level of education and food expenditure were directly associated with nutritional status (Kabir et al, 2006).

Table 2: Potential contributors to nutritional problems in elderly people.

Physical factors	Social and psychological factors
Reduced total energy needs	Depression
Declining absorptive and metabolic capacities	Loneliness
Chronic disease	Social isolation
Anorexia	Bereavement
Changes in taste/odour perception	Loss of interest in food or cooking
Poor dentition	Mental disorders
Reduced salivary flow	Food faddism
Dysphagia	Socioeconomic factors
Lack of exercise	Low income
Physical disability (restricting the capacity to purchase, cook, or eat a varied diet)	Inadequate cooking or storage facilities
Drug-nutrient interactions	Poor nutrition knowledge
Side effects of drugs (anorexia, nausea, altered taste)	Lack of transportation
Restrictive diets	Shopping difficulties
Alcoholism	Cooking practices resulting in nutrient losses Inadequate cooking skills (men)

In one study conducted by Smitha M and Devi N (2007) health and nutritional status of 50 elderly living with their families and 50 elderly residing in old age homes in and around Tirupati, Chittoor,District, Andra Pradesh, India, was evaluated. The prevalence of anemia was higher in institutionalized elderly (52%) than in free living elderly (32%). The intake of leafy vegetables was less in both groups. Calcium intake was very low in institutionalized elderly. Hence lower food intake has been observed among the institutionalized elderly. Therefore institutionalized elderly requires more attention along with proper nutritional care.

iii. Physiological and Psychological Changes during Aging:

The human individual is a living wonder of structure and function- an interacting, integrated psychophysical system. Human ageing is a natural process of this system. Due to the increase in the life expectancy newer problems of health care, financial constraints, and diseases due to changed life styles have increased. Thus it becomes essential to understand aging which involves psychological and social contexts and factors affecting the process of aging, which is an irreversible and dynamic phenomenon.

In the Indian scenario, as such found in many developing countries health problems and medical care are the major concern among a large majority of the elderly. The health problem in West Bengal was studied by Chakraborthy (2005)in which he found that among the elderly (> 60 years) residing in a rural area neighboring to a cosmopolitan city showed that 72.6% of the elderly were suffering from chronic illnesses. The step-wise multiple logistic regression model showed that income, socio-economic status, absence of any affect on daily physical activity and accompanying persons were found to be inversely related to irregular treatment. Significant gap was seen between need and treatment provision particularly for visual and hearing problems.

Singh (2003) has stated that the nuclear family has steadily surfaced as the dominant form of residential unit in India. Urbanization, industrialization, migration and partition of parental property weakened family ties and put the family care of the elderly in jeopardy. Increasing migration of children, away from parents, in search of jobs or higher education and dual career families have , among other factors, led to a paucity of care giving younger adults, reducing the "Family" of senior citizens (in most cases) to just "husband-wife" units with mutual care (Jamuna and Kalavar, 2003)

Health management for older adults consists of determining the reasons for loss of independence in the elderly, some symptoms include the high incidence of dementia caused by psychological changes such as in the decline of mental and physical abilities, and the diminishing mental health and

cognitive functions leads many adults to seek assistance from family members or institutions.

Older patients frequently have many co morbidities in addition to cognitive and functional decline. For instance, in the United States, the average 75-year-old suffers from at least three chronic medical conditions and takes five or more medications (American Geriatric Society, 2000).

According to Eure (2005), blood pressure (elevated levels) among 80+ elderly is a major problem in US. Aggressive treatment is not possible in this age group people as they are reluctant and consider it as higher risk. Therefore, it is treated with combination of medications, diet and exercise.

Weight changes with aging are not totally predictable but in general, a person tends to gain weight up to about age 60 and then weight tends to steadily diminish. There is a change in body composition during this time with a decrease in lean muscle mass and an increase in body fat percentage. This change tends to occur throughout old age. This has implications for use of systemic medications and dosage. This is especially true when coupled with the expected decrease in vital organ function.

Bennett (2002) reported that low level of social engagement either have a direct effect on mortality or represent hidden health outcomes which act as a marker for later ill health.

A study carried out by Jadeja (2008) in pre and post menopausal women in different age group of 21 to 60 years and above from middle income group. The findings showed that body weight was higher in the age group of 51-55 years. After the age of 45 years a decreasing trend was observed in bone mineralization with increasing age. The number of osteopenic and osteoporotic subjects also increased as age increased beyond 40 years indicating high prevalence of low bone mass in the aging women.

Breast cancer is one of the common cancers among women. The incidence of breast cancer is increasing worldwide. Currently the lifetime risk of developing breast cancer varies from 1 to 7 in the United States (Seer, 2004), 1 in 8 in the United Kingdom to approximately 1 in 30 in India. The incidence is rising in developing countries and in India.

There are powerful economic, social, political and cultural determinants which influence how women age with far reaching consequences for health and quality of life, as well as costs to the health care systems. Poor economic status earlier in life is a determinant of health at all stages of life. The older women often reflect the cumulative impact of poor diets. Another determinant of health is education. Increased literacy for older women will bring health benefits for them and their families. Lack of good food and safe drinking water, a gender based division of domestic chores; environment hazards etc also have a cumulative negative impact on the health of women as they age.

A health survey was carried was out by J Sheela & M Jayamala (2008) in Coimbatore, on total 333 elderly women between the age group of 65 to 80 years. The results showed that nearly half (46.8%) of the women are suffering from joint pain for the past six months, 33 per cent of them are suffering from blood pressure, and 17.1 per cent of them have diabetics. Remaining 6.6 per cent, 4.8 per cent, 4.5 per cent, 2.7 per cent, 2.4 per cent, 1.2 per cent and 0.6 per cent of them suffer from diseases like heart problem, back pain, cough, nerve disorder, skin problem, ulcer, brain tumor, kidney trouble respectively.

Sinha (2002) carried out a study on 16 women and 11 men from slums aged 60 years and above, it showed that effect of aging on the life of an individual is both biologically and sociologically determined where physical ailments like loss of vision, impairment of hearing, joint pains and restricted mobility are the major problems faced by the elderly.

In a study of 120 healthy Indian women aged between 20 to 70 years, the quantitative ultrasound analysis revealed that 46 subjects were normal while

42 and 32 subjects had osteopenia and osteoporosis respectively (Chopra, 2000). The number of Indian women with low bone mass in this study was found to be 61.6 percent.

Joshi et al (2003) conducted a study on 200 elderly. They found that a total of 87.5% had minimal to severe disabilities and 66% of elderly people were distressed physically, psychologically, or both. The most prevalent morbidity was anemia, followed by dental problems, hypertension, chronic obstructive airway disease (COAD), cataract and osteoarthritis.

Pathak et al (1977) conducted a study on 449 elderly men and women aged ≥ 60 years in Bombay which revealed that the common disorders were the ones related to the cardiovascular system (19%), gastrointestinal system (22%), locomotor system (24%) and respiratory system (10%).

The onset of psychological problems starts appearing in old age, which may further tend to increase as the process of ageing continues. Morgan et al (1997) conducted a longitudinal study on 1042 people aged 65 years and above. He concluded that physical activity contributes independently to the promotion and maintenance of psychological well being in later life. Gertrudis et al (1998) conducted a community based study on 624 people aged 57 years and older and found that co-occurrence of motor and cognitive impairments, vision and hearing loss, depressive symptoms have aggravating effects on disability.

Tiwari and Srivastava (1998) carried out an epidemiological study on 7727 individuals belonging to geriatric (60-69 years) and non-geriatric (20-39 years) group in Mohanlalgunj (U.P). It was found that psychiatric morbidity was much higher in the geriatric population (42.2%) as compared to the non-geriatric population (3.97%).

Ongoing extensive developments such as urbanization, industrialization and consequent migration and erosion in value systems due to impact of market economy, have brought structural and functional changes in the family

(Ghokhale et at, 1998) All these aforementioned developments have lead to several changes in the living arrangements of elderly and has resulted in declining possibilities of family care. (Jamuna, 1999) In order for family care a more productive and satisfactory level a range of supportive physical, medical and social services must be provided to family. National public policy must begin to address the needs of family by supporting options other than institutional care for the disabled.

According to Dube (1999), it is the psycho- social problem which cripples most of the old aged people. There is a higher degree of financial uncertainty as suddenly they are distanced from the world of active work. Though physically and mentally capable of leading a productive life, these people are made to retire from active work and many of them fail to come to terms with social realities and thus suffer mentally and emotionally.

In addition to being susceptible to physical problems, the elderly are also prone to mental disorders. Reichstadt et al (2007) studied 72 older adults (60-99 years) to know their perceptions regarding contributors to successful ageing and found that older adults placed greater emphasis on psychosocial factors as being key to successful aging, with less emphasison factors such as longevity, genetics, absence of disease/disability,function, and independence.

Diem et al (2007) studied 4177 elderly women (>68 years) and found that depression in elderly women was associated with an increase in the rate of Bone Mineral Density loss.

Sound mental health status is found to be strongly associated to optimum social and physical health. Callhan et al (2005) carried out a randomized clinical trial involving 1801 depressed elderly subjects and reported that patients whose depression improved were more likely to experience improvement in physical functioning.

B. ROLE OF NUTRITION IN AGEING PROCESS

Nutrition plays a significant role in health promotion and in disease prevention and management. Variety, balance, and moderation are the keys to healthy eating; when these guidelines are not followed, unhealthy eating patterns can form that may negatively affect health status over time. People often find it helpful to work with a clinician to provide guidance on a variety of issues, including choosing healthy foods, planning healthy meals, food allergies or insensitivities, and socio-cultural factors. Obtaining nutrients directly from food is ideal, though supplementation may be necessary when advised.

Good nutrition is necessary for good health, and concern with diet is important, if certain illnesses are to be prevented. Good nutrition and good health are inseparable, and the effects of a faulty diet appear sooner or later. Nutrition is "the combination of processes by which the living organism receives and utilizes the materials necessary for the maintenance of its functions and for the growth and renewal of components" (Turner, 1959)

The interaction between nutrition and aging could be probed from two different approaches: a) with the biological ageing and associated physiological and structural changes in the body, the food preferences, food and nutrition intake, and at the same time, the nutritional requirements undergo considerable change. These are the impact of the ageing process on the aging individuals, their food intake and their consequences; b) the second approach explores whether specific foods and their nutrients can either slow down the aging process or accelerate it. Obviously, the biological clock of aging cannot be stopped to give immortality to man.

Health care professionals perform nutrition assessment to evaluate people's health from a nutrition perspective. Nutritional status is the condition of health of the individual as influenced by the utilization of the nutrients (Srilakshmi, 1993)

Good nutritional status is noted when man benefit from the intake of a well-balanced diet, Optimum nutrition means that the essential nutrients, namely carbohydrates, proteins, fats, minerals, vitamins and water, are supplied and utilized to maintain health and well being at the highest possible level.

Formulation of balanced diets for different population groups is essential for proper maintenance of health and nutritional status. This calls for adequate knowledge about nutritive value of foods, nutrient requirements and skills for planning meals.

Ageing is associated with increased susceptibility to many illnesses, including atheromas. Coronary Heart Disease (CHD) risk increases markedly with age in both men and women. CHD will be the most important cause of mortality by 2015. Cardio-vascular disease is a major public health problem. CHD stands first accounting for 7.2 million deaths all over the world (Basu et al., 2001)

The prevalence of CHD is significantly more in Hindu males as compared to Muslims and is associated with greater prevalence of hypertension and diabetes. After the age of 60, CHD is the primary cause of death among women. Decline in mortality rate has been slower among women than men (Srinivasan&Satyamurthy, 2002)

Gopalan et al., (1992) exhorts that the Indian elderly, especially the aged women, are at a high risk of chronic under nutrition. Malnutrition among the aged is caused by a number of factors such as condition of the family, poverty, ignorance, superstition, lack of food, poor environmental sanitation, increasing incidence of disease and disabilities which lead to alterations in dietary intake, absorption and metabolism of nutrients, endocrine imbalances, inability to chew, physical handicaps that preparation, loneliness and lack of interest in eating and misconceptions concerning diet, undesirable social custom and traditional prejudices and frequent infection.

Elderly people in India are seen to suffer from various other problems as well like physical disability, malnutrition, financial insecurity, loneliness etc.

Surveys carried out by the National Nutrition Monitoring Bureau have revealed that sizeable number of aged people suffer from chronic energy deficiency, as well as the deficiency of several micro nutrients including vitamins A, C & E. Also a host of physiological and biochemical changes occur as a result of ageing.The table below is a brief outline of several nutrients, their roles and benefits in the ageing process:

Table no 3: Role of Nutrients in Ageing

No.	Nutrient	Physiological Role	Specific Role in Aging
1.	Iron	Immune-competence	Preventing vulnerability of infectious disease
2.	Iron/folate	Synthesis of haemoglobin	Prevention of anemia and Maintaining appropriate level of activity in old age
3.	Calcium	Bone calcification	Preventing Osteoporosis
4.	Selenium	Antioxidant	Preventing free radical damage in biological process
5.	Vita-A Beta carotene, vita-C, E, lycopene	Antioxidant	Preventing free radical damage in old age e.g. arteriosclerosis, cataract, prevention of malignancies, control damage on other tissues and enzyme systems.

Vasundra (1996) conducted a study on health status of 409 aged persons in Banglore, which showed that majority (82.9%) of aged suffered from one or more illness during the survey period. The most important causes of illness reported were cataract (72.7%), anemia (12.6%), osteoarthritis (6.2%), chronic bronchitis (6.1%), hypertension (5.1%), constipation (4.2%) and peptic ulcer (3.1%)

A study conducted by Sabharwal et al (1996) on Indian institutionalized elderly above 65 years of age revealed adequate energy, protein, calcium and vitamin C intakes as compared to RDA while iron and vitamin A intakes were lower. A similar trend was reported by Gambhir et al (1996) among free-living elderly men aged 50 - 78 years belonging to middle-income group, though protein, calcium and vitamin A intakes were comparatively higher, significant decline in energy, iron, thiamine, B-carotene and total vitamin A intakes were also reported with increase in age.

Marshall et al (2001) conducted a study on 420 elderly (aged 79 years and above) living in the rural community of Lowa city. It was found that > 60% of subjects did not meet their needs for nutrients folate, vitamin D, vitamin E, Calcium & Magnesium and > 25% of subjects did not meet their estimated needs for vitamin B6, vitamin C and Zinc.

A number of studies have been conducted by a team of Research workers from the Department of Foods and Nutrition, M.S.Universityof Baroda, on free living geriatric population from HIG, MIG and the LIG, belonging to the local region. The findings of these studies have been reported by Mehta et al (1999), the dietary pattern data revealed that the consumption of major nutrients like energy, protein, iron, B-carotene and fiber were less than the RDA, whereas the intake of fat, calcium, and vitamin C were greater than the RDA in both the HIG and MIG elderly men and women. The studies conducted on LIG men and women revealed low intake of all nutrients when compared to the RDA.

Energy and nutrient intake was studied in young old, old- old and very old elderly by Volkert et al (2000) on 4020 elderly. An age related decline was observed for calcium intake in male and for dietary fiber, water, calcium, magnesium, iron, Vitamin A and thiamine intake in female participants, while the intake of energy, protein and fat was adequate in both the gender respectively.

Total energy intake decrease varied substantially with age, by 1000 to 1200 kcal in women. This resulted in concomitant declines in most nutrient intake(Wakimoto and Block 2001)

Since the decline in various functions of the body after a short period of reproduction is a universal phenomenon and since an individual of a species has more or less a fixed life span, the primary site at which ageing is determined may be at the genes. (Swaminathan,1998).

It has been reported in a study carried out by Jain and Phadnis (2007) that mean nutrient intake of energy, proteins, fats, carbohydrates and calcium is significantly higher in elderly having no physiological problems as compared to those suffering from one or more physiological problems.

Detailed national data on the dietary and nutritional status of the Indian elderly is not available. However the National Nutritional Monitoring Bureau (NNMB) collected some data on their current nutritional status using a 24 hr. recall method in the rural areas of Kerala, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, Gujarat& Orissa in 1996-97 and in 1994 in the states of Assam, Haryana, Himachal Pradesh & Punjab. In the 1996-97 study, 922 elderly were covered.The analysis showed that the average daily consumption of cereals met the RDA. The pulse consumption (29g) was less than the RDA (40g). Consumption of green leafy vegetables, rich sources of anti oxidants was 16 g. and this was much below the suggested level of 490g. Milk & milk products too (82g) was below the RDA (150g) Mean intake of micro nutrients like iron, vitamin A was below RDA. The extent of chronic energy deficiency (BMI less than 18.5) was 52% (NIN Annual report, 1999-2000).

Natarajan (1999) suggested a 25% less RDA for 60+ old people. According to him, the calorie requirement for a sedentary man who is between 60-69 years was 1970 k. cal and for a man of moderate work, was 2335k cal for a sedentary man of greater than 70 years, the calorie requirement was 1570k.cal and for a man off moderate work, was 1870k.cal.

Dietary proteins requirements in elderly people were determined by short term nitrogen balance techniques and using calculations recommended by the 1988 joint FAO/WHO/UNO expert consultations, a safe protein intake for elderly would be 1.0-1.25 gm/kg body weight (Campbell et al., 1994).

Data from the third National Health and Nutrition Examination Survey (NHANES III, 1994)as well as other studiesclearly demonstrate a linear decline in food intake from the age of 20 to 80 years in both men and women.

The average decrease in food intake was 1321 calories in males and 629 calories in females. This decrease in food intake was predominantly due to a decrease in fat intake (Silver AJ, 1993). In the study by Wurtman et al, (1988) older persons ate 55% less fat and 40% less carbohydrate than younger individuals. Protein consumption was equivalent in both age groups. Older persons were also less likely to snack between meals. Rolls et al(1995) found that older persons consumed less calories over a single meal compared to younger persons. However, when given a yoghurt preload, older subjects were likely to overeat compared to younger subjects, suggesting a failure of normal energy-setting mechanism that operate in younger persons. In another study by the same group, it was found that, in contrast to the young, older persons fail to develop sensory-specific satiety.

Lee and Frongillo (2001) revealed a significantly lower intake of energy, protein, carbohydrate, saturated fat, niacin, riboflavin, vitamin-B6, vitamin-B12, magnesium, iron and zinc in food insecure elderly persons living in New York. In addition the elderlies were 2.33 times more likely to report fair/poor health status and had higher nutritional risk.

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

Vitamin D deficiency is associated with bone loss and bone fractures, in order to identify the vulnerable population. Richard D (2000) carried out a study on 1053 older women aged ≥65 years who were participating in the Women's Health and Aging Study. The women were classified into 4 domains of physical disability. The results revealed that out of total 371 women with 0 or 1 domain of disability and 682 women with ≥2 domains of disability was observed, 6.2% and 12.6%,respectively, had vitamin D deficiency [serum concentrations of 25(OH)D < 25 nmol/L]. In univariate analyses, risk factors for vitamin D deficiency included increasing age, black race, low educational level, high body mass index, high triceps skin fold thickness, increasing level of disability, winter season, and elevated creatinine concentration. In

multivariate models, black race had a strong association with vitamin D deficiency when other risk factors. Conclusion obtained was that vitamin D deficiency is a preventable disorder, is an important public health problem among older women living in the community.

A cross sectional study on 838 men and 910 women aged 25-74 years reported nutrient densities of carbohydrates, vitamin B1, vitamin B12, vitamin C, vitamin E, folate, potassium, iron, magnesium, copper, and dietary fiber increased significantly ($p<0.05$) with age in both genders, whereas inverse trend was observed for total fat, saturated fatty acids, cholesterol and sodium (Schroder et al, 2004). In addition, elderly people who are poor may also not have regular access to enough food to maintain sufficient calorie consumption (Bhattacharya et al, 2004).

A study conducted by Crew KD (2009) in Columbia University on 103 pre-menopausal women with early-stage breast cancer reported that vitamin D deficiency is present in 74% of women and this deficiency is not corrected with daily supplementation of 400 IU/day.

Along with nutrients inadequacy, reduced fluid intake has been accounted in old age which can indirectly affect the overall health of the elderly.

In a study of people age over 70 years who were living in Australia, 10.1% subjects stated they did not drink 6-8 cup of fluid daily, and this proportion increases with age with in the sample (Cobia et al 1995).

Physiologic and functional changes during aging result in changes in nutrient needs. Research has shown that older adults do have specialized requirements for a variety of nutrients because of aging effects on absorption, utilization and excretion. Common Nutritional Problems faced by the elderly include malnutrition, obesity and vitamin and trace mineral disorders. With the increasing number of baby boomers reaching an older age, malnutrition is a serious problem today. Many of these elderly will end up in nursing homes and up to 85% suffer from malnutrition (Crogen, 2006).

Nutrition plays a large role in the severe problem of pressure sores due to protein loss. Adequate nutrition and protein are necessary in helping prevent and heal these pressure ulcers. Malnutrition makes pressure sores more likely and more difficult to heal (Dambach, 2005). The immune system is also hindered by malnutrition and this at risk population is already more susceptible to communicable diseases (Brownie, 2006). Conditions like pneumonia and bronchitis are much more serious in an elderly patient and malnutrition weakens their defenses.

Knowing that the elderly client has decreased bodily function related to consuming and absorbing nutrients is important. Diminishing taste and smell senses can make food less appetizing than in the past. Dental problems can make consuming foods difficult. Poor fitting dentures can cause difficulty and pain in chewing and swallowing (Crogen, 2006). Factors such as reduced stomach acid and absorption problems can make garnering nutrients from food difficult. These can be exacerbated by the various medications the elderly take (Eliopoulos, 2005). Motor coordination is sometimes affected by medications. Elderly often already have some motor coordination deterioration. Further impairment by medications can hinder them from adequate consumption in limiting their ability to feed themselves (Crogen, 2006).

According to Dunn (2007), many foods and strategies for increasing their consumption do not work. Serving smaller more frequent meals does not improve nutrition. Oral supplements are also not very beneficial and often go wasted or conflict with medications. However, fortified foods (foods with added vitamins and minerals) and nutrient dense foods (foods that naturally have large quantities of vitamins and minerals for the amount of calories they contain) have been found to be effective. Fortified foods work best when they taste like their regular counterparts. Nutrient dense foods have been found to be very effective in promoting nutrition (Dunne, 2007). Improving taste is one of the best and simplest ways of improving nutrition. In some cases it is more important that elderly patients simply consume calories. Elderly patients have the same taste preferences as they have had all of their life, and thus low

sodium, low fat meals are not always as appetizing as the normal version of a food with naturally high fat and sodium content (Calverley, 2000)

C. MALNUTRITION IN ELDERLY

Malnutrition will always be an issue for the ever growing elderly population. It is important that this issue be dealt with correctly in order to prevent pain and suffering, increased healthcare costs, staff burden, and mortality (Brownie, 2006). Malnutrition is a widespread and serious problem even among those with adequate income and normal body weight. It is more prevalent among institutionalized (staying in old age homes) elderly and rural people than among others. The general nutritional status of elderly is not good. More deficiencies are observed in micronutrients. In addition to poor absorption capacity deficient intake leads to very poor nutritional status

Inadequate nutritional intake is the predominant cause of malnutrition in older persons. Other causes of malnutrition are impaired digestion (caused by medical conditions e.g. atrophic gastritis or gastrointestinal tumors) and increased requirements during chronic diseases like dementia and acute diseases like infections. Malnutrition as a result of inadequate nutritional intake (quantity and/or quality) during aging could be a consequence of decreased physical activity (lower need for energy from food), anatomical changes (loss of tooth, swallow or chewing problems),physiological changes (diminished smell and taste performance), satiety related hormonal changes (e.g. leptin), medicine use, malignancies, dementia and depression, and social causes (isolation, stressful life event, poverty) Pirlich, M (2001). The table below shows the factors influencing nutritional inadequacy in the elderly population.

Table 4:- Factors influencing nutritional inadequacy in elderly population.

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

Inadequate nutritional intake and a fragile condition in elderly people may lead to increased morbidity and mortality. Furthermore, in general a marginal nutritional status and physical inactivity are positively associated with a decline in functioning, followed by an increase in dependency on health care in performing activities of daily living. More specifically; deficiencies of several micronutrients are related to different aspects of functioning (Beck AM, 2004).

Although only 1% of older adults who are independent and healthy are malnourished, the Health and Nutrition Examination Survey (HANES) data indicated that 16% of community-dwelling Americans older than 65 years consumed fewer than 1000 calories per day--a statistic that would place these persons at high risk for under nutrition. The nutritional risk increases in the community-dwelling elderly who are sick, poor, homebound, and have limited access to medical care. Malnutrition can become a major concern. The incidence of malnutrition ranges from 12% to 50% among the hospitalized

elderly population and from 23% to 60% among institutionalized older adults (Endoy MP, 2005). When not directly attributable to underlying disease, weight loss in the institutionalized elderly is most commonly due to depression, use of anorexigenic drugs, and dependency on staff for feeding.

Protein energy malnutrition (PEM) is a common, potentially serious and frequently under-diagnosed condition among elderly individuals. Community-dwelling elderly with PEM may exhibit reduced performance in the basic and instrumental activities of daily living as well as an increased incidence of hip fractures.[2]In the nursing home, PEM is associated with pressure ulcers, cognitive impairment, postural hypotension, infections, and anemia. Its presence in hospitalized elderly patients has been linked to prolonged hospital length of stay, increased in-hospital mortality, and the development of various complications such as infections and pressure ulcers (Kamel, 2000).

Also Millen (2001) studied 239 elderly (>65 years) and concluded that the nutritional status was poor in homebound persons of very advanced age with substantial co-morbidities and functional dependency.

In a study by John (2002) on 762 free living healthy Adult human of 4 age groups (20-30 yrs, 35-54 yrs, 50-64 yrs, and 65 yrs older) suggested that the deficient food intakes in the elderly might be corrected or ameliorated by manipulation of non-physiological factors such as the number of other people present at meal, the palatability of meals, the time of day and location of meals.Thus, it is observed that health is not only biological or medical concern, but also has a significant personal and social concern.

Socioeconomic status and functional ability are often major indicators of nutritional status. Social factors that affect malnutrition include, living alone, financial concerns, and restrictive diets. Living alone, especially for men, results in the decreased intake of food. Elders experiencing financial concerns, such as poverty or low-income, may not be able to buy a sufficient amount of food. Many times choices need to be made between buying food and paying for other necessities such as medications, heat, rent, etc.

Cultures, religions, allergies, and preferences can also cause some elders to have more restrictive diets. These restrictive diets increase the risk for malnutrition, especially for protein malnutrition. Declines in functional status both physical and cognitive, affect a person's ability to shop for food and to prepare meals. Loss of instrumental skills related to activities of daily living (eg, shopping, transportation, meal preparation, housekeeping, taking medications, managing finances, using the telephone) leads to dependence on others. Medical factors such as dementia, polypharmacy, chronic illness, and depression can cause malnutrition in the elderly population as well. Dementia and cognitive disabilities can cause self-neglect and decreased food intake. Many older adults take multiple medications daily. These medications interact with food and impact absorption, metabolism, and excretion of nutrients Visvanathan & Chapman (2009).

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

Hale, et al (1981) conducted a study on 4200 non institutionalized elderly (≥65 yrs) and found that 39% had hypertension and in close to 25% of those detected, the hypertension was either untreated or poorly controlled. Disorders of special senses, especially vision (21%) and hearing (20%) was also prevalent. Close to half of elderly individual had no teeth, no denture or dentures that fit poorly or that they do not wear. This predisposed the elderly to malnutrition.

India is becoming an ageing society, traditionally the elderly enjoyed authority, security, honor, power, and prestige. But the changing factors in the society, globalization, migration and other factors lead to the weakening of traditional norms underlying such support. The number of elderly is enormously increasing. India currently has more than 70 million elderly. The 'caregivers'

number is dwindling and many elderly are joining old age homes. But the number of old age homes is about 356 and there are about 12 million elderly in need of institutional care.

Dietary changes seem to affect risk-factor levels throughout life and may have an even greater impact in older people. Relatively modest reductions in saturated fat and salt intake, which would reduce blood pressure and cholesterol concentrations, could have a substantial effect on reducing the burden of cardiovascular disease. Increasing consumption of fruit and vegetables by one to two servings daily could cut cardiovascular risk by 30 % (WHO, 2010).

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

Thus, nutrient intake of the elderly is very important as they are at a higher risk of developing chronic disorders, which may affect their nutritional status. Posner et al (1984) carried out a study on 53 elderly in Boston and showed that nutrient intake failed to meet the RDAs for major nutrients in 40 – 80% of the subjects.

A study conducted by Keller (1993) on 200 long-term care patients of Canada and found that malnutrition was associated with poor appetite, dysphagia, and dependency for eating, poor intake and age.

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

Gloth and Tobin (1995) studied 80 subjects, 65 years and above, comparing nutrient intake of frail home bound elderly population in community vs. elderly

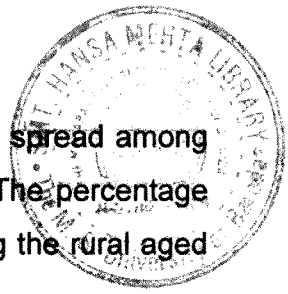
living in nursing home. They concluded that iron and vitamin –A deficiency was seen in frail homebound elderly.

A study conducted by Batra (2004) on Health problems of 300 elderly subjects reported that persons suffering from serious ailments increased from 18.67% to 48.67% when they were 70 + years old.

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

Aging produces a change in the ability to participate in physical activity which is accelerated beginning at approximately age 50. This is due to multiple factors which results in an increased difficulty for delivering oxygen to the tissues of the body. Decreased chest wall elasticity results in the moving of adequate air more difficult, thus more energy is expended to obtain additional oxygen required for exercise. There is decreased ventilation to perfusion ratio. The amount of available blood output from the heart to supply the skeletal muscles is decreased as well. There is an actual decreased in skeletal muscle mass. There are at least two major sub groups of the elderly. Those aged 65-75years (young old) who are generally very fit and active and those 75years and older (old old) who have a much higher prevalence of issues and disability(Sharma,1998).

Ageing is often associated with a deregulation of immune function. Iron deficiency may further impair immunity in older adults. Published reports on iron deficiency and immune response in humans are inconsistent. Most studies are focused on young children in developing countries and are often confounded by co morbid conditions, infections and nutrient deficiencies. Anemia is common in elderly and its prevalence increases with age. The most common causes of anemia in elderly are anemia of chronic disease and iron deficiency anemia (Smith, 2000).



Anemia had been the major nutritional problem and was wide spread among the rural subjects (89.3%) than the urban subjects (62.7%). The percentage prevalence of other nutritional problems was also more among the rural aged than the urban aged (Natarajan, 1999).

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

A study of the elderly women in urban slums of Delhi, revealed that the mean intake of all the nutrients except thiamin and total vitamin A, was below the RDI and there was an energy deficit of 200-400 K.cal (Ahuja et al., 1995).

Many old people live by themselves either with their spouses, alone, with their children or are attached to some relatives. A small proportion however stays in old age homes, either due to destitution, or by choice. With the decline of joint and extended families and many women and men being widowed or choosing to stay away from children due to various causes, there is growing need for old age homes either free or pay and stay variety. The diets in these homes may be different from those staying in families. A comparison was made of the nutrient composition of the diets consumed by institutionalized and home bound elderly (Vijayalakshmi, 1995).

Cognitive impairment, which is seen in some elderly people, is thought to be sensitive to vitamin and mineral status; folate, for instance is required for normal brain function and poor vitamin B status is known to adversely affect cognition in the elderly (Roubenoff et al. 2000).

The most significant change in gastrointestinal function with ageing is the reduction of gastric acid output in older people who have atrophic gastritis. Atrophy of the stomach mucosa becomes more common in old age and is estimated to affect one third of those over 60 years of age (Horwarth 2002). As a consequence, there is decreased secretion of gastric acid, intrinsic factor

and pepsin, which can reduce the bioavailability of vitamin B12, folate, calcium and iron.

Abla-Mehioet al (2003) studied nutritional status of 100 elderly men and women (aged 65 years and older) of four institutions in lebanon, and they revealed that elderly living at home had significantly higher mean body mass index and waist circumference than those living in institutions and they also found that elderly in the institutions consumed more amount of fat and less amount of dietary fibers. High prevalence of anemia (42.5%) and low albumin levels (27.5%) was observed among institutionalized elderly. In contrast, those living at home showed a higher prevalence of obesity and a lower calcium intake.

A study on healthy European adults (Heseker& Schneider 1994) suggested that, with increasing age, there is some impairment of vitamin C absorption. The diet should, therefore, include good sources of vitamin C, such as citrus fruit juice, fruit or vegetables. Furthermore, research on the Norfolk (UK) cohort of the European Prospective Investigation into Cancer and Nutrition (EPIC) found that people with a higher plasma level of ascorbic acid (vitamin C) had a lower mortality from all causes, and cardiovascular disease. Risk of mortality in the top 20% of plasma ascorbic acid concentration was about half of that in the bottom 20%(Khaw et al. 2001).

2. MENTAL HEALTH

A. DEFINITION OF MENTAL HEALTH

Mental health is a term used to describe either a level of cognitive or emotionalwell-being or an absence of a mental disorder. From perspectives of the discipline of positive psychology or holism mental health may include an individual's ability to enjoy life and procure a balance between life activities and efforts to achieve psychological resilience (WHO, 2007). Mental health is an expression of our emotions and signifies a successful adaptation to a range of demands. It was previously stated that there was no "official" definition of mental health. Cultural differences, subjective assessments, and competing professional theories all affect how "mental health" is defined.

Mental health is more than the mere lack of mental disorders. The positive dimension of mental health is stressed in WHO's definition of health as contained in its constitution: "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." Concepts of mental health include subjective well-being, perceived self-efficacy, autonomy, competence, intergenerational dependence and recognition of the ability to realize one's intellectual and emotional potential. It has also been defined as a state of well-being whereby individuals recognize their abilities, are able to cope with the normal stresses of life, work productively and fruitfully, and make a contribution to their communities. Mental health is about enhancing competencies of individuals and communities and enabling them to achieve their self-determined goals. It is also said that when someone lacks the ability to manage day to day events and/or control their behavior so that basic physical and emotional needs are threatened or unmet.

Mental health is the capacity of the individual, the group and the environment to interact with one another in ways that promote subjective well being, the optimal development and use of mental abilities (cognitive, affective and

relational), the achievement of individual and collective goals consistent with justice, and the attainment and preservation of the condition of fundamental equality (Davar and Dandekar, 2002). Mental health should be a concern for all of us, rather than only for those who suffer from a mental disorder.

Mental health problems affect society as a whole, and not just a small, isolated segment. They are therefore a major challenge to global development. No group is immune to mental disorders, but the risk is higher among the poor, homeless, the unemployed, persons with low education, victims of violence, migrants and refugees, indigenous populations, children and adolescents, abused women and the neglected elderly. For all individuals, mental, physical and social health is closely interwoven, vital strands of life. As our understanding of this interdependent relationship grows, it becomes ever more apparent that mental health is crucial to the overall well-being of individuals, societies and countries. Unfortunately, in most parts of the world, mental health and mental disorders are not accorded anywhere the same importance as physical health. Rather, they have been largely ignored or neglected.

Most recently, the field of Global Mental Health has emerged, which has been defined as 'the area of study, research and practice that places a priority on improving mental health and achieving equity in mental health for all people worldwide (Patel, V & Prince, M.,2010).

Mental health problems are among the most important contributors to the global burden of disease and disability. Mental and behavioral disorders are estimated to account for 12% of disability-adjusted life-years lost globally and 31% of all years lived with disability at all ages and in both sexes, according to year 2000 estimates. Yet, more than 40% of countries have no mental health policy, over 90% have no mental health policy that include adolescents and children, and over 30% have no mental health programmes (WHO, 2001).

Mental health can be defined as a state or condition on which an individual feels a sense of wellbeing. This gives them the capacity to live life in

fulfillment of what they want to achieve in accordance to the available resources. Though no concise definition exists, mental health is basically your attitude and approach to life. Psychological, environmental, genetic, or physiological factors have a profound effect on overall mental development.

Mental disorders in old age are not just due to ageing brain, but are due to losses associated with ageing, compromised quality of life, and socio economic problems. Widowhood and dependence increase vulnerability of women in old age. Some people with mental illnesses have aggressive behaviors while others are withdrawn and lack social interest. Each type of disorder has its own signs and symptoms therefore; diagnosis as well as treatment varies depending on the nature of the mental health problem.

Mental disorders affect people of all ages, cultures and classes. Well conducted epidemiological studies in several parts of the world have shown no fundamental differences either in the range of mental disorders or in the prevalence of severe and persistent diagnoses (Viswanathan& Wetzel, 1993). While mental illness occurs among all age groups, it is manifested in different ways. The problems of living may take different forms in children, in adolescents, adults, and in older people, the prevalence of mental disorders among the aging is likely to rise as life expectancy increases. And, in old age people may become high-risk candidates for depression and suicide. Mental health is fundamental to health and human functioning, characterized by the alteration in thinking, mood or behavior. Appropriate treatment can alleviate, if not cure the symptoms and associated disability of the mental illness. Today, integrative neuroscience and molecular genetics points some of the most exciting basic research opportunities in the medical science. Molecular and genetics tool are being used to identify the genes and proteins that might be involved in the origin of mental illness.

Mental health disorders commonly co-occur in patients with chronic pain. Prevalence rate reported since 12-month prevalence in population-based studies from on various subjects' ranges from 07-28% for depression, 04-17% for anxiety disorders and 0.8-5% for substance use disorders (Stang PE,

2006). In primary care clinic samples, rates of depression may be as high as 46% in individuals with pain conditions (Bair MJ, Robinson RL, Katon W, et al, 2003). Individuals with chronic pain conditions have high rate of primary care and emergency room visits, but little is known about mental health service use in individuals with chronic pain and co-morbid mental health disorders. In a survey of 409 adults with self-reported osteoarthritis or rheumatoid arthritis, 42% reported not receiving needed mental health services (Hagglund KJ, Clark MJ, Hilton SA, et al., 2005).

Mental illness impairs your ability to perform routine tasks, foster healthy relationships, or cope with anger or stress. It may be classified on the basis of extreme mood swings, irrational or destructive thought patterns, and behavioral problems.

Women report more worry and more cognitive variables associated with worry than men. Robichaud et al (2003) found that women reported more worry than men on two measures of the tendency to worry, as well as more worries about lack of confidence issues. Women also reported a more negative problem orientation and engaging in more thought suppression, a type of cognitive avoidance.

Mental health has been hidden behind a curtain of stigma and discrimination for too long. It is time to bring it out into the open. The magnitude, suffering and burden in terms of disability and costs for individuals, families and societies are staggering. In the last few years, the world has become more aware of this enormous burden and the potential for mental health gains. We can make a difference using existing knowledge ready to be applied. We need to enhance our investment in mental health substantially and we need to do it now.

B. MAGNITUDE OF MENTAL HEALTH PROBLEMS

Global scenario

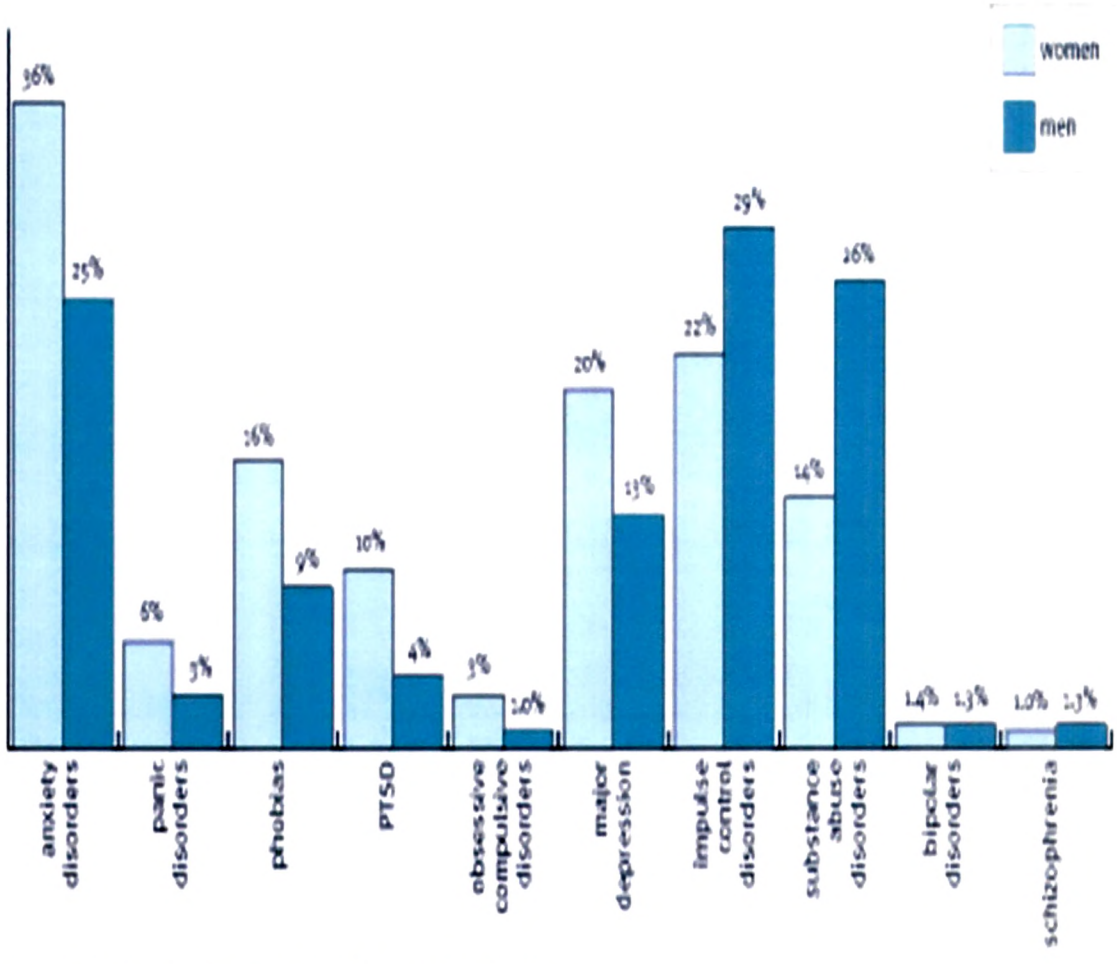
At the global level, mental health problems currently are said to constitute about 8 percent of the global burden of diseases and more than 15 percent of adults in the developing societies are estimated to suffer from mental illness (Desjarlais et al., 1995). Mental disorders are projected to increase to 15 percent of the global disease burden by the year 2020 (Lewis and Araya, 2001).

In the United States alone, according to the National Institute of Mental Health (1991) about 20 percent of the population suffers from a diagnosable mental disorder during any six month period. It is also estimated that at least 15 million people at some time in their lives will suffer from a truly severe, long-term disability (Vishwanathan and Wetzel, 1993).

In India, according to a north Indian Survey, the rate of psychiatric morbidity is 82 per 1000 population. This survey estimated that about 15 million people suffer from one or the other serious psychiatric illness and about 30 million people suffer from depressing and socially incapacitating emotional disorders (Bhatia, 1990 as cited in Ray, 1993). Prabhu and Raghuram (1987) have estimated that more than 30 million individuals suffer from mental illness every year and that 0 .175 million new cases are added every year.
The mental health needs of the population seem to be enormous while provision for service appears meager. Mental morbidity rate in India is 10-20 persons per thousand of the population at any point of time. In India about 10 million people are said to be suffering from serious psychiatric disorder at any point of time. The number of individuals with neurotic and psychosomatic disorders is estimated to be around 20-3- million. This does not include persons with problems of alcohol and drug dependence, which is growing both in urban and rural areas (Nadkarni& Das, 1993).

Mental illness has reached an alarming proportion over the globe and has become a vitally important issue for the nations in terms of morbidity, mortality and huge economic burden. Apart from the established biological and genetic reasons, the current disruption of social fabric as a result of changing political scenario, violence and terrorism has affected the psyche of millions of individuals in this era. 450 million people in the world suffer from a mental or behavioral disorder (W.H.O, 2003). W.H.O. "2001", states that 33% of the years lived with disability (YLD) are due to neuropsychiatric disorders, unipolar depressive disorders alone lead to 12-13% of years lived with disability and rank as the third leading contributor to the global burden of diseases. Four of the six leading causes of years lived with disability are due to neuropsychiatric disorders like: depression, alcohol use disorder, schizophrenia and bipolar disorder. Figure no mention below depicts the gender differences and the prevalence rate of the mental health disorders occurrence. More than 150 million suffer from depression at any point in time, nearly one million commit suicides every year, 25 million suffer from schizophrenia, 38 million suffer from epilepsy and more than 90 million suffer from an alcohol or drug use disorder (World Health Report, 2001) figure below indicates the gender based prevalence rate of mental disorders.

Figure 2.3: indicates the gender based prevalence rate of mental disorders.



Source: Kessler RC, Berglund PA, Demler O, Jin R, Merikangas KR, Walters EE (2005)

Attending to the health needs of the growing number of older people who may frail, disabled or cognitively impaired is a task of immense magnitude. There are an estimated 4 million old people with serious mental disorders and another 25-30 million with minor disturbances. The existing mental health care service is barely adequate to provide the required services. Major disorders in age are functional disorders followed by organic psychoses, prevalence of neurotic disorders being relatively low. Psychiatric illness in old age is not an isolated event. Old people have at least 6-12 symptoms and 2 0r 3 diagnosis are common. Physical illness, disability and handicaps are often associated with depression. In a large number of cases physical illness plays an

aggravating role in depression, dementia and senile dementia of Alzheimer's type are likely to increase with longevity and it will pose serious problems of long term care giving that will tax the resources of family and nation.

The World Health Organization is striving to shift mental health from the periphery of health policies and practice to a 'more prominent position in the field of global public health, through the world health report 2001 and the Mental Health Global Action Project. The recent global burden of disease report estimates that neuropsychiatric disorders account for 9.9% of disease burden' and 1.9% of premature deaths even in low income and middle income countries (Lopez A et al, 2006) By 2020, mental disorders are likely to account for 15% of disability adjusted life years lost to illness and depression is expected to become the second most important cause of Global Burden of Disease. WHO's World Mental Health Survey Initiative is a response to the scarcity of comparable data In mental health, especially in the developing world (Ahmad Mohit, 2006). It finds that the community prevalence of mental health problems is 17% in Lebanon, 15% in Netherlands and 18% in France. The lowest rate is reported in Nigeria, Shanghai and Italy and the highest rates in the USA and Ukraine.

In India out of 3 adults attending primary or general health care suffers from a clinically significant mental disorder (Vikram Patel, 1998). Among the Indian states, Kerala has the highest rate of suicide, which is almost three times the national average. Our state contributes 10.1% of all the suicides in India while our population forms only 3.4% of the nation's population (P.N. Suresh Kumar, 2004). Currently available data show that suicidal phenomenon which occurs in Kerala is different from the west in a variety of ways. Second and third decade seems to be the most susceptible for Kerala suicides. The gender difference in suicide is diminishing. Depression and substance use disorder are the common mental health problems underlying suicides. Kerala also has the highest rate of per capita alcohol consumption in the country.

C. ROLE OF NUTRITION IN MENTAL HEALTH OF WOMEN

Many people understand the connection between nutrition and a physical disease state, but only half of the people are aware of the connection between nutrition and mental health. Nutrition, however, can play a key role, both in the onset, severity, and duration of mental illness.

Diet has an effect on mood and cognitive function (Rogers, 2001). There is some evidence that deficiency or supplementation of nutrients can affect not only mood, but also behavioral patterns. A number of studies have shown that acute tryptophan depletion produces depressive symptoms and results in worsening of mood (Neumeister et al., 1998). Folic acid deficiency may also correlate with depression, and it has particular effects on mood, cognitive as well as social functioning (Reynolds, 2002). Recently, it has been reported that, low dietary folate is associated with elevated depressive symptoms (Tolmunen, 2003).

In general, a low-fat diet may hav3e negative effects on mood. And altered dietary fat intake can lead to acute behavioral effects such as drowsiness, independent of energy consumption. A high intake of proteins also seems to increase alertness. Increased dietary serine and lysine may be linked to the pathogenesis of major depressive disorder. Apart from specific nutrients or vitamins, certain foods may have an effect on mental wellbeing.

The balance of protein and carbohydrate consumed in a meal can influence brain serotonin (5-hydoxytryptamine) neurotransmission by alerting the availability of tryptophan for uptake into the brain. Tryptophan is the precursor amino acid of serotonin and paradoxically, high carbohydrate intake tends to increase brain uptake of tryptophan. Serotonin is involved in the modulation of various aspects of mood and behavior, including depression, aggression, impulsivity, sleep and appetite (Rogers, 2001)

The brain is a chemical factory that produces serotonin, dopamine, norepinephrine and other brain chemicals 24 hrs a day. The only raw

materials for their syntheses are nutrients, namely, amino acids, vitamins, minerals etc. If the brain receives improper amounts of these nutrient building blocks, we can expect serious problems with our neurotransmitters. For example, some depression patients have a genetic pyrrole disorder that renders them grossly depleted in vitamin B-6.

Serotonin levels can be controlled through the diet. A diet deficient in omega-3 fatty acids may lower brain levels of serotonin and cause depression. Complex carbohydrates raise the level of tryptophan in the brain resulting in a calming effect. Vitamin C is also required for the conversion of tryptophan into serotonin.

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Cognition can be defined as the ability to use simple-to-complex information to meet the challenges of daily living. So, careful attention to diet helps protect the aging brain from problems with nerve cell signals involved in memory and cognition. Vitamin B6and magnesium deficiencies have been associated with autism and have been effectively used in the treatment of autistic children. Iodine deficiency can reduce intelligence levels and is especially devastating for pregnant women and their children, causing miscarriage, stillbirth or neonatal death. Neuromuscular, speech and hearing abnormalities are common among children of iodine deficient mothers.Lack of Cobalamin (B12) may lead to severe neurological disorders in strict vegetarians, especially in infants and toddlers. There is evidence that B12 deficiency may contribute in delaying psychomotor development and retarded growth in macrobiotic children.

As expected, cognitive performance is related to nutritional status. Good nutrition, both long term and current may protect cognitive functions as we age. In recent studies the amino acid homocysteine was linked to decreased cognitive function. People with high levels of homocysteine and low levels of folate have a significantly poorer ability to recall.

Eating breakfast regularly has been reported to improve performance and lead to a more positive mood, better memory and feelings of calmness. The high blood glucose after eating breakfast is one of the key reasons for the improvement in mental performance. Omitting breakfast and dinner negatively affects cognitive functioning.

The body of evidence linking diet with mental health is growing at a rapid pace. As well as its impact on feelings of mood and general wellbeing, the evidence demonstrates its contribution to the development, prevention and management of specific mental health problems.Chronic hunger and energy deprivation profoundly affects mood and responsiveness. The body responds to energy deprivation by shutting or slowingdown nonessential functions, altering activity levels, hormonal levels, oxygen and nutrient transport, the body's ability to fight infection, and many other bodily functions that directly or indirectly affect brain function. People with a consistently low energy intake often feel apathetic, sad, or hopeless.

Ryan and Shea (1996) estimated that 16% of elders ingest less than 1000 kcal/day, which is below their recommended caloric requirement. This decrease in nutrient intake could result in the onset of affective disorders such as depression and dementia among elderly.

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

Haller et al (1996) conducted a cross section study on 880 elderly subjects to assess their mental status. It was found that depression was more prevalent in these subjects aged 74 – 79 years and that higher plasma levels of certain vitamins (B-12, C) and carotenoids was associated with lower risk of developing dementia.

Franco et al (2005) conducted a community based survey among 394 postmenopausal women and found that higher dietary intake of lignans is associated with better cognitive function in postmenopausal women.

Reynolds (2002) reported that over the past 35 years numerous studies have shown a high incidence of folate deficiency correlated with mental symptoms, especially depression and cognitive decline in epileptic, neurological, psychiatric, geriatric, and psycho geriatric populations.

Clarke et al (1998) conducted a case-control study of 164 patients with Alzheimer's disease, cognitive decline was significantly associated with raised plasma homocysteine and lowered serum folate (and vitamin B-12) concentrations.

Rue et al (1997) conducted a study on 137 elderly volunteers who were studied for six years, and found that those with higher intake of B complex and vitamins A, C, and E had better scores on tests of abstract reasoning and visual-spatial function.

Wang et al (2001) in a three-year Swedish study of 370 healthy elderly who were at least 75 years of age, found that those with even slightly low levels of vitamin B12 and folate had twice the risk of developing Alzheimer's disease as did those with normal levels of these vitamins.

Morris et al (2004) conducted a population study of more than 3,000 Chicago residents aged 65 and older, those with the lowest intake of vitamin B3 (niacin) were 70% more likely to develop Alzheimer's disease than those with the highest intake, and their rate of cognitive decline was about twice as fast.

Thus the researchers concluded that dietary niacin might protect against Alzheimer's disease and age-related cognitive decline.

Hassing et al (1999) reported that replacement of B vitamins in deficient individuals often improves short-term memory and language skills. Elderly subjects who are low in folic acid show impairment in both word recall and object recall, suggesting a vital role for folic acid in memory function in later life.

Requejo et al (2003) conducted a study on 168 elderly aged 65 – 90 years to see the influence of nutrition on cognitive function in free living elderly population of Madrid region in Spain and concluded that subjects with satisfactory intellectual function generally had a better diet especially greater intake of vitamins (folic acid, vitamin C). This shows the importance of correct nutrition in its maintenance.

A study done on 32 subjects, including 16 subjects with dementia of Alzheimer's type (mean age 75 years) and 16 comparison subjects with a mean age of 73.1 years. Patients with dementia of Alzheimer's type had a significantly lower mean score on the modified mini-mental state after acute tryptophan depletion than after receiving placebo. The comparison group showed no significant difference. Results showed that acute tryptophan depletion significantly impaired cognitive function in patients with dementia of the Alzheimer type (Porter et al, 2000).

Researchers from Johns Hopkins University in Baltimore examined data from the Cache County, Utah, population study (n = 4,740) and found combined use of vitamins C and E was associated with reduced prevalence and incidence of Alzheimer's (Zandi et al, 2004).The most common nutritional deficiencies seen in patients with mental disorders are of omega–3 fatty acids, B vitamins, minerals, and amino acids that are precursors to neurotransmitters (Young SN, 2007). Accumulating evidence from demographic studies indicates a link between high fish consumption and low incidence of mental disorders; this lower incidence rate being the direct result

of omega–3 fatty acid intake(Reis LC, Hibbeln JR, 2006)One to two grams of omega-3 fatty acids taken daily is the generally accepted dose for healthy individuals, but for patients with mental disorders, up to 9.6 g has been shown to be safe and effective (Von Schacky CA, 2006) Majority of Asian diets are usually also lacking in fruits and vegetables, which further lead to mineral and vitamin deficiencies.

Micronutrient status can affect cognitive function at all ages. Vitamin deficiencies could influence memory function and might contribute to age-associated cognitive impairment and dementia. Vitamin B6, comprising three chemically distinct compounds pyridoxal, pyridoxamine, and pyridoxine, is involved in the regulation of mental function and mood. Vitamin B6 is also an essential homocysteine re-methylation cofactor, and deficiency is associated with increase in blood homocysteine levels. Homocysteine is a risk factor for cerebrovascular disease and may also have directly toxic effects on neurons of the central nervous system. Neuropsychiatric disorders including seizures, migraine, chronic pain and depression have been linked to vitamin B6 deficiency. Epidemiological studies indicate that poor vitamin B6 status is common among older people. Hyperhomocysteinaemia has been suggested as a cause or mechanism in the development Alzheimer's disease and other forms of dementia. Supplementation with B vitamins including vitamin B6 has been shown to reduce blood homocysteine levels (Malouf R, Grimley Evans J, 2003).

These behaviors occur due to the lack of nutrition supply to the brain. The brain requires high energy and nutrient supply. It comprises, in fact, 20% to 30% of all the energy consumption of the body during rest periods. Thus, any change in diet or nutrition level of the body directly reflects in the mental functioning. Chronic energy deprivation, such as the case of malnourished people, results to the eventual shutting down of the body by decreasing its activities and redirecting all its energy sources towards the systems that require higher energy supply. This results to altered levels of activities, changes in hormonal levels, lessened immune system efficiency and transport of nutrients and oxygen to certain body parts, all of which could directly or

indirectly influence mental health. People with extremely low nutrition are more likely to become sad, depressed and emotional as compared with those who have adequate nutrition.

3. DEPRESSION

A. DEFINITION OF DEPRESSION

Depression is a common mental disorder that presents with depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, low energy, and poor concentration. In generaldepression is a psychological disorder that affects a person's mood changes, physical functions and social interactionsthese problems can become chronic or recurrent and lead to substantial impairments in an individual's ability to take care of his or her everyday responsibilities.

Depression as a psychiatric disorder is different from feelings of sadness or lowness that we may experience in day today life following setbacks or losses that are faced. Depressive disorder is identified on the basis of its persistence, severity, duration and the presence of other symptoms, which can be distinguished from the feelings of sadness that a person normally feels. At its worst, depression can lead to suicide, a tragic fatality associated with the loss of about 850 000 lives every year. Depression often centers around the lack of purpose in your life and the thought that it might even be better to end it. This is the point which is critical and could result in suicide.

B. MAGNITUDE OF DEPRESSION

Worldwide, life expectancy is increasing. Currently about 10% of the world's population is made up of older adults (aged 65 and above). This figure is set to rise steadily, to as much as 30% in some societies (Moussaoui, 1999). For mental health this will mean an increase not only in the neurodegenerative conditions, such as Alzheimer's disease, but also of depressive disorder. This

affects about one in 10 people aged over 65, making it the most common of the mental health disorders of later life.

Depression is the leading cause of disability as measured by Years Lived with Disability (YLDs) and the 4th leading contributor to the global burden of disease Disability Adjusted Life Years (DALYs) in 2000. By the year 2020, depression is projected to reach 2nd place of the ranking of DALYs calculated for all ages and both sexes. Today, depression is already the 2nd cause of DALYs in the age category of 15-44 years for both sexes combined.Depression occurs in persons of all genders, ages, and backgrounds (WHO, 2010).

Depression is a stress related illness. It is the most common mental illness. One in six women suffer and one in nine men. In India – According to a north Indian Survey, the rate of psychiatric morbidity is 82 per 1000 population. The report of this survey estimated that about 15 million people suffer from one or other serious psychiatric illness and about 30 million people suffer from depressing and socially incapacitating emotional disorders Bhatia MS, 2000 &Prabhu and Raghuram (1987) gave an estimate that more than three crore individuals suffer from mental illness every year and that 1.75 lakh new cases are added every year.

Epidemiological studies point to an increase of morbidity in older persons. In a study of psychiatric morbidity of elderly population Rural West Bengal (Nandi, et al 1997) the rate of mental morbidity was as high as 612/1000 population in the 60-64 age group. Depression was the most common disorder in old age, the rate being 522/1000 population. Women had higher rate of depression (704/1000) in the sample.

Depressive disorder is a global health problem. According to the World Health Organization (1999) by 2020 depression will be the leading illness associated with negative impact and disease burden. This is true of all adult age groups but the following facts, derived from recent evidence, are pertinent to depressive disorder in later life:-

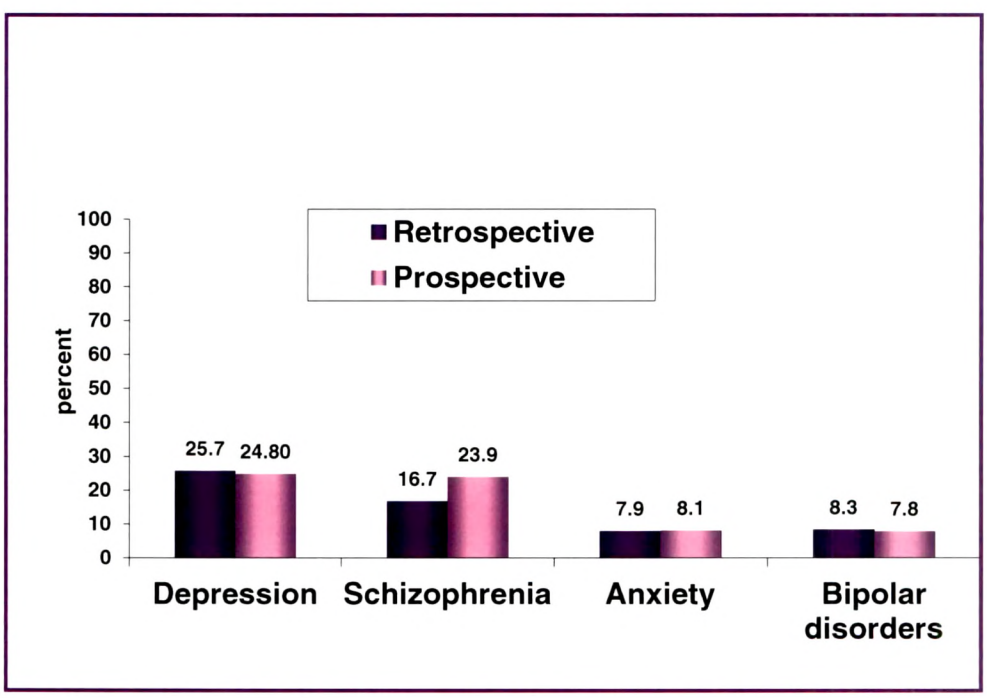
- As a cause of morbidity depression already ranks alongside the eight most disabling medical conditions, including heart disease (NIH)
- It leads to inappropriate use of hospital beds (Ingold et al, 2000) and
- It leads to a greater risk of hospitalization and prolongs periods of hospitalization for physical disorder (Huang et al, 2000).
- It is the single most important predictor of suicide in older people (World Psychiatric Association, 2005)
- It is a cause of disability in its own right, it also adds to disability from physical disorder when present and leads to greater physical decline (Penninx et al, 2000).
- It leads to reduced compliance with medical treatments (NIH)
- It reduces quality of life
- It is an independent predictor of mortality
- It increases healthcare utilization costs
- Patients with bipolar disorder (although this is relatively uncommon in later life), consume approximately four times more mental health care than those with unipolar depression (Bartels et al, 2000).

An attempt was made by Women study research centre (2005) in research based study on mental health and ageing to find out the prevalence of mental disorders as reported in public and private psychiatric health set-ups across the six major cities of Gujarat from the retrospective and prospective data, the most prevalent disorders in the given sample were depression, schizophrenia, bipolar disorders and anxiety disorders as the Figure 2.4- shows. According to the World Health Report 1997 mood disorders, including depression and anxiety, are two most prevalent mental health disorders worldwide.

Diane and Susan (2003) point out that the 2:1 ratio for prevalence of depression in women and men has been documented across different countries and ethnic groups. Besides prevalence, differences have also been reported between men and women in the nature of depressive symptoms, course of illness and response to treatment.

The result of the survey showed that between 50 and 60 percent of the reported mental health disorders across the six cities of Gujarat were depression and schizophrenia. Anxiety and bipolar disorders constituted about 8 percent each of all the reported cases. Mainly the reasons for the occurrence of this disorders as mentioned by the psychiatrists of each city revealed that the successive occurrence of natural disasters and communal violence in Gujarat in the recent past has contributed significantly to the number of reported cases of depression, trauma and anxiety (The Mission Report, 2003). A 1999 study by IFSHA, a Delhi based NGO, which collected data from State run institutions for mental health across the country, has also found that depression was the most common mental health illness (41 percent), followed by anxiety (29 percent) and psychosis (29 percent) (Purewal, 2003).

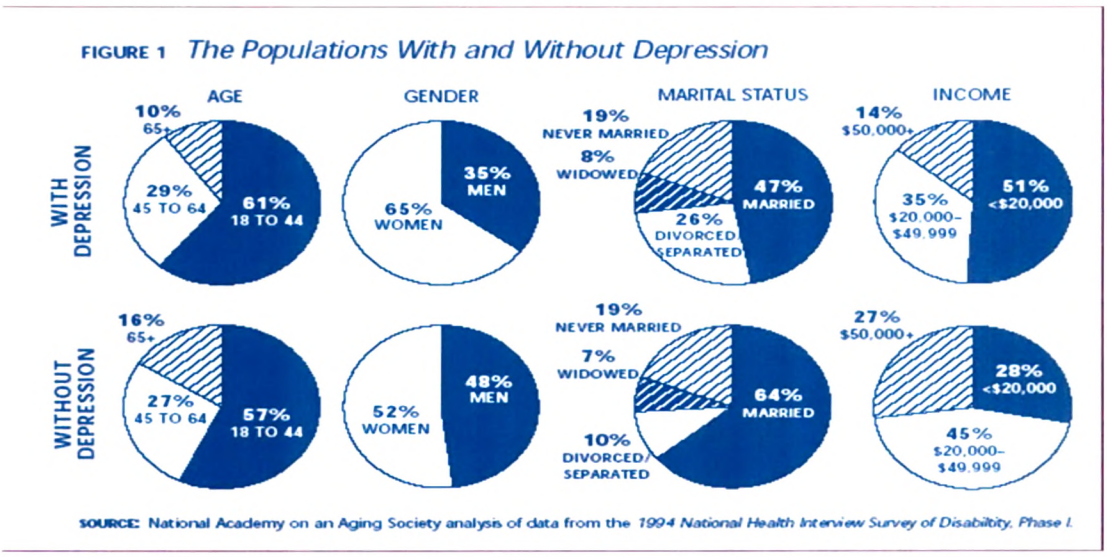
Figure 2.4: Most prevalent disorders in retrospective and prospective data



C. DEPRESSION IN WOMEN

Depression is a pervasive and impairing illness that affects both women and men, but women experience depression at roughly twice the rate of men (Blehar MC, Oren DA. 1995). Researchers continue to explore how special issues unique to women— biological, life cycle and psycho-social-may be associated with women's higher rate of depression. Thus women tend to suffer more than men.

Figure 2.5: The representation of population with and without depression



It can be seen from the figure that more than half of the subjects within age group of (18 to 44 years) are suffering from depression followed by 29 percent in the age group of 45 to 64 years. With respect to gender difference 65 percent of the women are suffering from depression compared to men (35 percent) which is similar to the ratio of 2:1 as per prevalence rate. Further 47 percent of the men are married whereas in case of women 26 percent amongst them are separated/divorced, 8 percent widowed and 19 percent unmarried.

The prevalence and diagnosis of mental health conditions are found to vary with gender. Women are more likely to be diagnosed with depression, anxiety disorders and eating disorders, whereas men are more likely to be diagnosed

with substance abuse and certain types of personality disorders such as antisocial personality (Eichier and Parrot, 1987). According to the United Nations, women have higher rates of mental illness throughout the world (Women's International Network, 1993) in which depression and anxiety top the list (Vishwanathan and Wetzel, 1993). Women, regardless of their nationality or socio-economic status, have significantly higher rates of depression than do men. The chances that a woman will experience major depression at sometime during her life time range anywhere between 10 percent and 25 percent (APA, 1994).

Psychological causes--Depression is one of the most important treatable causes of weight loss in older persons. In the outpatient setting, depression has been shown to be one of the most common causes of weight loss in older adults (Nemeroff CB, 1984) In nursing home settings, depression was consistently recognized as a major cause of weight loss and failure to thrive among residents. Depression is associated with increased corticotropin releasing factor, a potent anorectic agent, in the cerebrospinal fluid. In addition, depressed patients have many symptoms that can lead to weight loss, including weakness (61%), stomach pains (37%), nausea (27%), anorexia (22%), and diarrhea. (20%)[97] Successful treatment of depression has been shown to reverse weight loss in nursing home residents (R. R. Hajjar,2004).

There are several factors which are responsible for causing depression in women as mentioned below:

i. **Nutritional factors**: Food contributes to the quality of life, through psychological social and physical mechanisms. Malnutrition is an impairment of health resulting from a deficiency, excess or imbalance of nutrients. Depression leading to Malnutrition or vice a versa is a vicious cycle that cannot be broken unless proper nutrient care and intervention strategies are developed to reduce the frequency and aggravation.

ii. **Genetic factors** - There are researches suggesting a genetic or familial link to some of the psychiatric disorders, including depression (Recognizing Depression 2003). A study on interaction of genetic factors with stressful life events found that genetic factors influence the risk of onset of major depression in part by altering the sensitivity of individuals to the depression including effect of stressful life events (Kendler, et al., 1995).

iii. **Environmental factors-** Environmental factors related with depression can be further classified into: socio-cultural factors, socio-economic factors, and stressful experiences.

iii a. Socio-cultural factors: Changes in society at large be it changes due to transition from traditional to modern value systems and structures or from a collectivist approach to individualism, create dynamics that may lead to depression. An example of this is changing family patterns. Breaking down of the joint family and proportionate increase in nuclear families is found to be associated with increased rates of depression due to lack of confiding relations, support of elders and increased responsibilities causing stress (Sethi and Manchanda, 1978).

iii b. Socio-economic factors: Socio-economic status has an important bearing on the kind of problems, coping capacities and self-esteem of individuals. There are several research studies which suggest that incidence of depression is higher in low-income, slum dwelling, uneducated and working class people especially women (Brown and Harris, 1978; Blacker and Clare, 1987; Blue, et al., 1995).

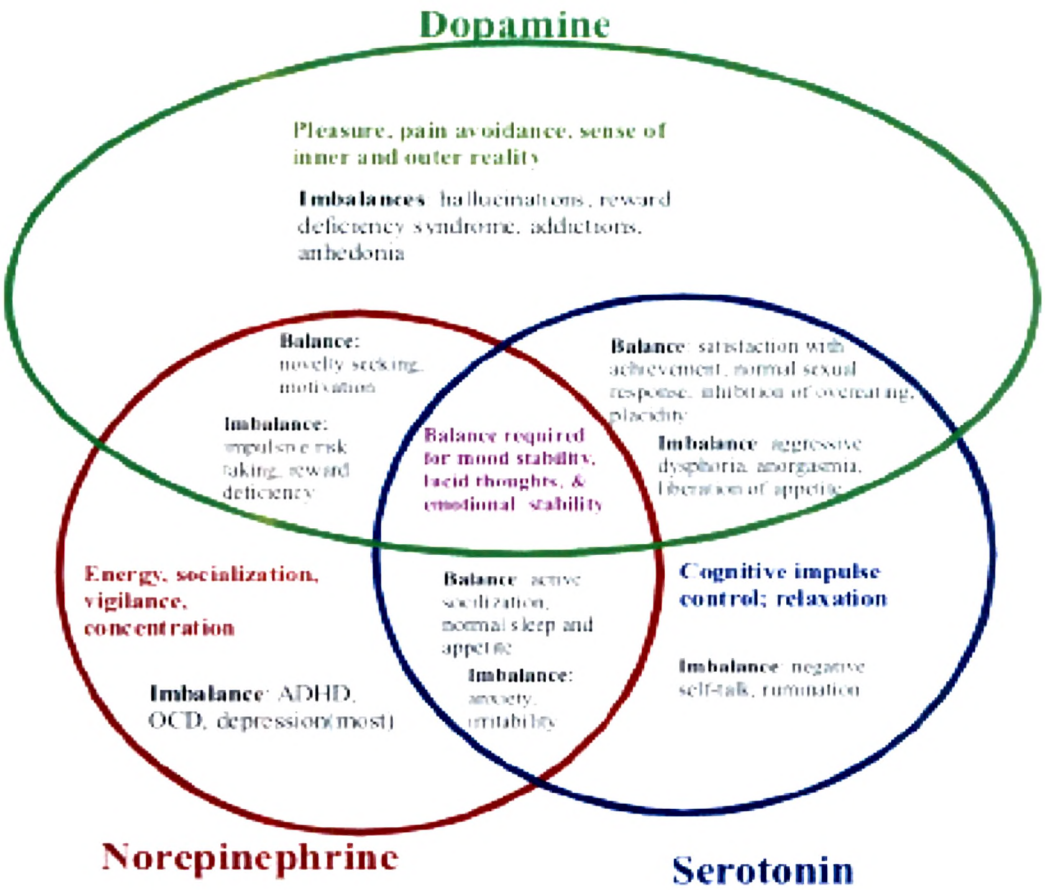
iii c. Stressful experiences: Any of the above mentioned factors, i.e. social, cultural or economic difficulties could cause stress to individuals. There are several stressful life events that are found to be associated with depression.

IV. Hormonal factors: All women are at risk for emotional swings when they experience extreme hormonal shifts. The role of hormones in depression is not clear, but female hormones undoubtedly play some role in premenstrual dysphoria, postpartum depression, and seasonal affective disorder (SAD). These forms of depression recede or stop after menopause. Evidence for hormonal causes of depression is mostly based on observations of depression during specific stages in female development.

THE PSYCHOBIOLOGY OF DEPRESSION

There are both short-term and long-term consequences of depression the underlying psychobiology of depression depicts the changes that occur in the brain that may be associated with depression, especially long term depression. The figure 2.6 below clearly indicates the mechanism of neurotransmitters involved in causing depression. Depression causes or results from a disturbance in several of the brain's neurotransmitters, most importantly **serotonin**, **norepinephrine**, **dopamine**, and GABA. Depression can *result from* a decrease in the level of serotonin, norepinephrine, and dopamine, or their receptors. Conversely, depression can both cause and be caused by decreases in these neurotransmitters is very important. It means that remission of depression can be approached from both the pharmaceutical or psychotherapy side (more below). The most important of these neurotransmitters in terms of depression are norepinephrine, serotonin, and dopamine

Figure 2.6: The Role of Neurotransmitters in Depression



Modified from Katz, N.B. 2005. Neurotransmitters: the bridges of the brain. Institute for Natural Resources Health Update: Home Study 01200. 2 pp.

Depression in elderly is often overlooked because the physical symptoms of depression are thought to be age related. Diagnosing depression in the elderly may be difficult in late life due to the presence of medical comorbidity, cognitive impairment, multiple losses, heterogeneity and atypical features. Reported prevalence rates for clinical depression in older individuals aged 65 years range from 11% to 25% among patients in primary care and nursing home settings and about 3% among healthy elderly living in the community (Brown et al., 2002; Lebowitz et al., 1997). Depression in elderly could be a result of chronic illnesses. Certain medications have also been linked to depression in elderly. As people age they become biologically vulnerable to depression. This is because of dysregulation of brain neurotransmitter

secretion. An elderly person suffering from an illness is prone to develop depression.

D. ROLE OF NUTRITION IN DEPRESSION

Nutrition can play a role in alleviating some of the symptoms of depression. There are many vitamins and nutrients needed to helping the body in its proper function. Numerous studies have reported associations between deficiencies of folate or vitamin B12 and psychiatric symptoms including depression and dementia. Some workers have hypothesized that in the elderly cognitive impairment and organic psychosis are often associated with B12deficiency.

Botez et al (1984) selected a group of 49 depressed patients with low folate levels. After seven to eleven months of folate supplementation the patients were found to be lessening in the complaints of easily fatigued and distracted, and the scores on all the sub-tests of the Wechsler Intelligence Scale increased, particularly those measuring non-verbal rather than verbal skills. The elderly as a group have a higher risk of micronutrient deficiency than young adults.

Goodwin et al (1983) correlated biochemical indices of vitamin status and cognitive functioning in the elderly. They reported significant correlations between folate, riboflavin; vitamin C and B12 status and memory capacity. The levels of riboflavin and folate were also positively related to the ability to think abstractly. Chome et al (1986) followed up these findings and compared elderly who had a deficiency of at least one vitamin, with those who did not. The deficient group produced poorer score son tests of mood. However, supplementation failed to alter psychological functioning, although the authors suggested that this may have reflected a small sample size.

Two trials have examined selenium intake and depressed mood in non-depressed adults. A double-blind crossover trial found daily supplementation

of 100 µg selenium in 50 adults significantly improved depressed mood over 5 weeks (compared to placebo) (Rayman M, Thompson A, 2005) and a RCT found no effect of a range of dosages of selenium supplementation in 448 older adults over 6 months (Benton D, Cook R,1991)

Recent studies have suggested a link between folate deficiency and dementia onset. Researchers from the Geriatric Division in Mendrisio, Switzerland, investigated the relations of mild cognitive impairment, Alzheimer's and vascular dementia with serum levels of homocysteine, folate and vitamin B12.

Quadric et al (2004) in his study included 228 patients, consisting of 55 non-demented controls, 81 mildly cognitively impaired subjects, and 92 demented subjects. Hyperhomocystenimia was significantly associated with dementia and Alzheimer's, as low folate status, leading the researchers to suggest folate deficiency may precede the onset of dementia.

A cross-sectional study carried out on 2682 men aged between 42-60 years of age from eastern Finland showed that depressed men had a lower absolute daily intake of folate and pyridoxine than the others. Only 23.6% of the men consumed the recommended dietary allowance (RDA) of 300mg/d of folate (Tolumunen et al, 1984)

A cross-sectional study on 880 elderly subjects, aged 74-79 years, to assess their mental status found that depression was more prevalent in these subjects and higher plasma levels of certain vitamins and carotenoids were associated with lower risk of developing dementia (Haller et al., 1998).

Clinical deficiencies of B vitamins in the elderly have been implicated in brain related disorders inducing reversible dementia, depression and electrophysiological dysfunction, including convulsions. A study conducted on 79 male subjects aged 54-81 years. They observed an association between lower plasma concentrations of Vitamin B-12 and folate and higher concentration of homocysteine with poor spatial coping skills and cognitive performance (Riggs et. al., 1996).

Recent evidence suggests that naturally occurring low cholesterol concentration are associated with depression. Suarez (1999) conducted a study on 121 adult women aged 18-27 years found significant association between low lipid and lipoprotein concentration with higher rates of depression and anxiety.

Omega 3 fatty acids are long-chain polyunsaturated fatty acids. The two most important for depression are eicosapentanoic acid (EPA) and docosahexanoic acid (DHA), which are found in fish or are made in the body from alpha-linolenic acid (another omega 3 fatty acid, found in flaxseed, walnuts and canola oil). An increase in rates of depression in Western countries has paralleled a change in diet to one favoring omega 6 over omega 3 fatty acids; across countries there is a strong negative association between fish consumption and depression; and lower concentrations of omega 3 have been found in the blood of depressed people. Possible mechanisms include omega 3's effects on the fluidity of cell membranes, which leads to changes in signaling within and between brain cells; and omega 3's anti-inflammatory effects, as depression may be caused by an overactive inflammation response.

Although there have been several reviews of omega 3 fatty acids for depression only one study has evaluated omega 3 as a single treatment for depression in sufficient participants (Parker, G, 2006). A double-blind RCT of 35 depressed adults with low fish intake who took 2 g DHA or placebo daily for 6 weeks found that omega 3 supplementation was no better than placebo in reducing depression symptoms. A single RCT of 49 healthy adults examined the effect on depressed mood of supplementation of 4 g fish oil (containing 1,600 mg EPA and 800 mg DHA), or placebo for 35 days (Fontani G, 2005). Depressed mood reduced significantly in the omega 3 groups but not in the placebo group.

In 1993, Christensen and colleagues studied the relation between carbohydrate craving and depression and found that carbohydrate helped in improving the symptoms of depression. Also the anti-depressant effect of

tryptophan via the production of serotonin has been revealed where the underlying notion is that because serotonin is synthesized from tryptophan and the brain tryptophan level is dependent on both the diet and uptake of tryptophan into the brain decreased the availability of tryptophan by restricting the dietary intake of this amino acid should therefore decrease the amount of serotonin that can be synthesized.

Certain dietary risk factors for physical ill health are also risk factors for depression and cognitive impairment. Although cholesterol lowering has been suggested to increase vulnerability to depression, there is better support for an alternative hypothesis that intake of n-3 long-chain polyunsaturated fatty acids can affect mood (and aggression). Possible mechanisms for such effects include modification of neuronal cell membrane fluidity and consequent impact on neurotransmitter function. Stronger evidence exists concerning a role for diet in influencing cognitive impairment and cognitive decline in older age, in particular through its impact on vascular disease. For example, cognitive impairment is associated with atherosclerosis, type 2 diabetes and hypertension, and findings from a broad range of studies show significant relationships between cognitive function and intakes of various nutrients, including long-chain polyunsaturated fatty acids, antioxidant vitamins, and folate and vitamin B12. Further support is provided by data on nutrient status and cognitive function. Almost all this evidence, however, comes from epidemiological and correlation studies. Given the problem of separating cause and effect from such evidence, and the fact that cognitive impairment and cognitive decline (and depression) are very likely to be significant factors contributing to the consumption of a poor diet, greater emphasis should now be placed on conducting intervention studies. (Peter, U.K.2001).The possibility that the taking of vitamin supplements may influence mood was explored by Benton D (1995). One hundred and twenty-nine young healthy adults took either 10 times the recommended daily dose of 9 vitamins, or a placebo, under a double-blind procedure, for a year. Males taking the vitamins differed from those taking the placebo in that they reported themselves as feeling more 'agreeable' after 12 months. After 12 months the mood of females taking the vitamin supplement was significantly improved in

that they felt more 'agreeable', more composed and reported better mental health. These changes in mood after a year occurred even though the blood status of 9 vitamins reached a plateau after 3 months: this improvement in mood was associated in particular with improved riboflavin and pyridoxine status. In females baseline thiamin status was associated with poor mood and an improvement in thiamin status after 3 months was associated with improved mood.

Lindeman et, al (2000) conducted a study to compare serum vitamin B12, C and folate concentrations in a randomly selected sample of elderly (age 65 years or older) male and female Hispanics and Non-Hispanic whites. The results revealed that males and Hispanics had lower serum vitamin B12, C and folate concentrations than females and NHW respectively. Participants taking a multivitamin supplement (MVI) had higher serum vitamin concentrations than those not taking MVI. There were significant associations between serum folate concentrations and measures of cognitive function, not seen with B12 or C, or between any of the vitamins and affective function. The most significant associations observed were those between serum folate and various measures of cognitive function, even after adjusting for presence of depression

In a random sub sample of 412 persons ages 60-64, being in the lowest quartile of homocysteine was associated with fewer depressive symptoms, after adjusting for sex, physical health, smoking, creatinine, folic acid and B12 levels. Being in the lowest quartile of folic acid was also associated with increased depressive symptoms, after adjusting for confounding factors, but adjustment for homocysteine reduced the incidence rate ratio for folic acid to a marginal level. Vitamin B12 levels did not have a significant association with depressive symptoms. While white-matter hyperintensities had significant correlations with both homocysteine and depressive symptoms, the brain measures and total antioxidant capacity did not emerge as significant mediating variables (Sachdev PS, et al, 2005)

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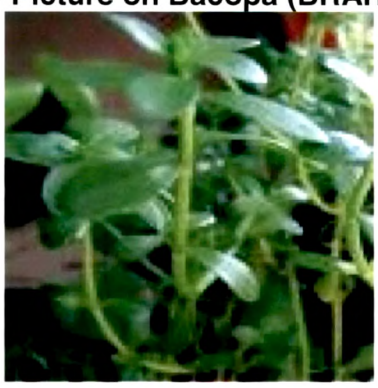
4. NON-PHARMACEUTICAL MANAGEMENT OF DEPRESSION:

A. BRAHMI- POTENTIAL HERBAL REMEDY

Figure 2.7- Picture on Bacopa (BRAHMI) leaves



THE MEDHYA RASAYAN OF AYURVEDA

Brahmi is a great '**medhya**' or intelligence promoting herb. It is a great immunostimulant, tranquilizing, mind pacifying, neuroleptic, psychotropic herb with great action on Nervous system - anticonvulsant, antispasmodic, cholinesterase inhibition, CNS depressant or sedative, neuromuscular blocking, anesthetic and mild barbiturate potentiating effect. Besides it has antiviral, anti-bacterial, anti-tumor, antipyretic, antihistaminic or anti-allergic effects.

1. **Ayurvedic Classification Of Bacopa:**

It is present in following groups of Ayurvedic herbs.

- **Bitter** section of herbs.
- '**Prajasthapana**' or helpful in having children and retaining the embryo or fetus in womb.
- '**Vayasthapana**' or promoting the span and quality of life.

2. **Commonly Mistaken For:** This medicinal ayurvedic herb has been commonly mistaken for Gotu kola.
3. **English Name:** Brahmi or Water hyssop, Pennell, Herb-of-Grace.
4. **Family:** Scrophulariaceae.

5. **Sanskrit Name:**
   - **Mandukiparni** - because its leaves resemble the frog.
   - **Manduki** - because it is found near the water bodies like the frog or it spreads like the frog on land or it is being utilized by a sage known as 'Manduka'.
   - **Brahmi** - it has the potential to enhance intellect on use or it is related to the creator God Brahma's power of wisdom Goddess Saraswati.
   - **Saraswati** - its relation to Goddess Saraswati, the goddess of wisdom and learning.
6. **Medicinal Parts:**
   - Whole plant
   - Stem and leaves
7. **Chemical Ingredients of Bacopa Monnieri:**
   - **Alkaloids:**Hydrocotyline, Brahmine, Herpestine
   - **Glycoside:** the fresh leaves contain Asiaticoside in the concentration of 10-45 mg per kg. Another glycoside, Thanakunicide is also present.
   - Vallerine, bitter substances, pectic acid, fatty acids, tannin, volatile oil, ascorbic acid, thanakunic acid, asiatic acid,
   - Brahamoside, Brahminoside, Brahmic acid, Isobrahmic acid, Stigmasterol
   - **Flavonoids:**Apigenin, Luteonin
   - **Additional Phytochemicals:**Betulinic acid, Wogonin, Oroxindin, including Betulic acid, Stigmastarol, beta-sitosterol, as well as numerous Bacosides and Bacopasaponins, and amino acids like alpha alanine, Aspartic acid, Glutamic acid, and Serine, and its esters, Heptacosane, Octacosane, Nonacosane, Triacontane, Hentriacontane, Dotriacontane, Nicotine, 3-formyl-4-hydroxy-2H-pyran ($C_6H_6O_3$), and its 7-glucoside.
   - **Saponins**: d-mannitol, Acid A, and Monnierin ($C_{51}H_{82}O_{21}3H_2O$, mp 262-63°); Hersaponin [mp 232 - 34° (decomp.)], **Bacoside A**

[C41H68O134H2O, mp 250° (decomp.)], and **Bacoside B** [C41H68O135H2O, mp 203° (decomp.)]

- Sterols

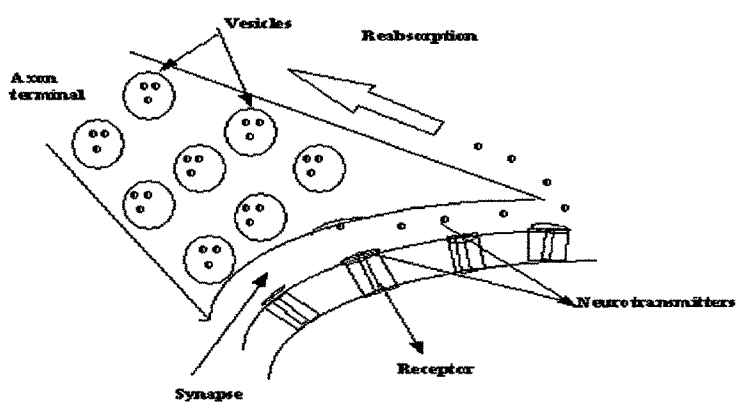
8. **Some Phytochemistry of Bacopa Monnieri:**
   - Monnierin gave glucose, arabinose and an aglycone ($C_{30}H_{48}O_4$, m p 235-37°) on hydrolysis.
   - On hydrolysis, Bacosides A and B gave glucose, arabinose and bacogenins A_1,A_2, A_3, and A_4.
   - Bacogens A_1 and A_2 are apimers, and A_4 is an ebelin lactone.
   - Smith-de Mayo degradation of bacoside A gave jujubogenin and pseudojujubogenin.
   - Bacopa's alkaloids **brahmine, herpestin** are highly toxic when administered at doses of **0.5 mg per kg of body weight**.
   - This harmful alkaloid is found in very low concentrations. The extract of bacopa up to a dose of 5 gm per kg of bodyweight didn't reveal any toxicity on oral intake. The LD50 (Lethal Dose's 50%) of the bacopa extract was 17gm per kg.
9. **Ayurvedic Properties of Bacopa Monniera:**
   - Qualities: **light**
   - Taste: **bitter**
   - Sub-taste: **astringent**
   - Vipaka: **sweet**
   - Active principle or Virya: **Cold**
   - Specific effect: Medhya or promoting the intellect or enhancing the functions of brain
10. **Ayurvedic Herbal Formulation of Bacopa Monnieri:**
    - BrahmiPanaka: A kind of soft beverage prepared by Brahmi and usually used in summer.
    - Brahmi oil:
    - Saraswataristham
    - SaraswataGhritam
    - Brahmivati or tablet

11. The Mechanism of Memory

The hippocampus, the brain's seat of memory, is located in the temporal (left and right) sides of the brain. It processes signals sent to the brain by the senses into the templates of memory, which are then stored in other parts of the brain, creating a long-term memory. Signals are converted into electrical impulses in the nerve cells due to a rapid change in protein composition. These impulses are then conducted across neurons (nerve cells) and through synapses, which connect nerve cells. This process continues until the bonds between the nerve cells strengthen, and memory is created.

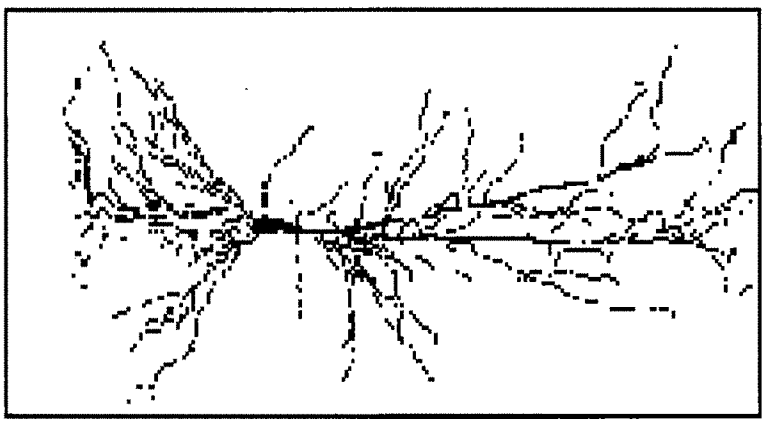
Normal synaptic activity is a process mediated by neurotransmitters. Each neuron is a single nerve cell. It has one or more arms called axons that send signals (impulses) and one or more arms called dendrites that receive signals. When a signal is transmitted through an axon terminal, spherical bodies called vesicles fuse with its membrane. Neurotransmitters are released when the vesicles burst open into the synaptic space, the minute space between the sending and receiving cells used to discharge neurotransmitters ("passengers"). To end the signal, the axons reabsorb some neurotransmitters; and the enzymes in the synapse neutralize the other neurotransmitters. (Fig. 2.8)

Figure 2.8: Schematic representation of the mechanism of synaptic activity



It is evident that a disruption in any part of normal synaptic activity would affect memory. This normally occurs with advanced age and continuous electrical activity, which wears out the synapses. As a result, new memory creation is impaired and memory loss occurs. Chemical substances and plant extracts that are known to restore the memory work in different ways. The bacosides are the memory chemicals in Brahmi. According to scientists at the Central Drug Research Institute located in Lucknow, India, the bacosides help to repair damaged neurons by adding muscle to kinase, the protein involved in the synthesis of new neurons to replace the old ones. Depleted synaptic activity is thus restored, leading to augmented memory functions.

Figure 2.9: A pyramidal cell from the hippocampus: the sites of memory are located on the "branches"



12. Clinical Indications

a. Cognitive Effects

i. Adults

Bacopamonniera has been studied clinically for its acute and chronic effects on cognitive function. In adults, it appears only chronic administration is associated with cognitive-enhancing effects. In a double-blind, placebo-controlled trial of 38 healthy volunteers (ages 18-60), subjects were given a single dose of 300 mg Bacopamonniera extract (standardized to 55-percent combined bacosides A and B) or placebo. Subjects were tested two hours after drug administration. coinciding with maximum pharmacodynamic effect.

Acute administration of this dose of Bacopa extract resulted in no significant changes in cognitive function when compared to baseline values. Parameters assessed included attention, working and short-term memory, verbal learning, decision making, memory consolidation, executive processes, planning and problem solving, speed of information processing, and motor responsiveness. (Nathan PJ,2001)

On the other hand, significant cognitive-enhancing benefits have been demonstrated with more chronic administration of Bacopa extracts. Australian researchers conducted a double-blind, placebo-controlled, 12-week trial utilizing the same patient selection criteria and same dose of Bacopa extract (300 mg daily) containing 55-percent combined bacosides. Forty-six healthy volunteers (ages 18-60) were randomly and evenly divided into treatment and placebo groups. The same series of tests administered in the acute dosage trial were administered at baseline, five, and 12 weeks after treatment began. At the end of the 12-week study, results indicated a significant improvement in verbal learning, memory consolidation, and speed of early information processing in the treatment group compared to placebo. These effects were not observed at baseline or at five weeks. These results may be attributed to Bacopa's antioxidant properties and/or its effect on the cholinergic system. (Stough C,2001).

ii. Anxiety and Depression

Bacopa's traditional use as an anti-anxiety remedy in Ayurvedic medicine is supported by both animal and clinical research. Research using a rat model of clinical anxiety demonstrated a Bacopa extract of 25-percent bacosideA exerted anxiolytic activity comparable to Lorazepam, a common benzodiazapene anxiolytic drug. Importantly, the Bacopa extract did not induce amnesia, side effects associated with Lorazepam, but instead had a memory-enhancing effect. (Bhattacharya SK,1998)

A one-month, limited clinical trial of 35 patients with diagnosed anxiety neurosis demonstrated that administration of Brahmi syrup (30 mL daily in two divided doses, equivalent to 12 g dry crude extract of Bacopa) resulted in a

significant decrease in anxiety symptoms, level of anxiety, level of disability, and mental fatigue, and an increase in immediate memory span. Other changes noted were increased body weight, decreased respiration rate, and decreased systolic blood pressure. (Singh RH,1980).

iii. Epilepsy

Although Bacopa has been indicated as a remedy for epilepsy in Ayurvedic medicine, research in animals shows anticonvulsant activity only at high doses over extended periods of time. Early research in India demonstrated that hersaponin (an active constituent) exhibited protection against seizures in mice. (26) A more recent Indian study also examined the anticonvulsant properties of Bacopa extracts in mice and rats. Researchers determined that intraperitoneal injections of high doses of Bacopa extract (close to 50 percent of LD50) given for 15 days demonstrated anticonvulsant activity. When administered acutely at lower doses (approaching 25 percent of LD50), anticonvulsant activity was not observed. (Martis G,1992)

iv .Gastrointestinal Disorders

In vitro, animal, and human studies have investigated the effects of Bacopa extracts on the gastrointestinal tract. In vitro studies by Dar A, Channa S (1999) have demonstrated direct spasmolytic activity on intestinal smooth muscle, via inhibition of calcium influx across cell membrane channels. This property suggests Bacopa extracts may be of benefit in conditions characterized by intestinal spasm such as irritable bowel syndrome (IBS).

A double-blind, randomized, placebo-controlled trial of 169 patients with IBS compared the effects of an Ayurvedic preparation containing Bacopamonniera and Aeglemarmelos to standard therapy (clidinium bromide, chlordiazepoxide, and psyllium). Subjects were divided into five subgroups based on type of IBS, and randomly assigned to standard drug treatment, botanical treatment, or placebo for six weeks. Treatment was administered orally as 5 g drug, botanical, or placebo three times daily. Data analysis revealed standard drug therapy to be superior to the Ayurvedic preparation, except in patients with IBS characterized by diarrhea. This result was attributed to the

Aeglemarmelos, a commonly known antidiarrheal in India, although the two botanicals were not given separately, so individual effects cannot be confirmed. Ayurvedic therapy was superior to placebo in all parameters examined, but no benefit could be linked specifically to the Bacopa portion of the Ayurvedic preparation. (Yadav SK,1989).

v. Cardiovascular Effects

Use of Bacopa as a "cardiotonic" is frequently mentioned in Ayurvedic medicine texts, but no clinical studies have been conducted. In vitro research using rabbit aorta and pulmonary artery has demonstrated Bacopa extract exerts a vasodilatory effect on calcium chloride-induced contraction in both tissues. It is believed to exert this effect via interference with calcium channel flux in tissue cells. Dar A, Channa S (1999)

Vi. Hypothyroidism

A study in mice demonstrated high doses (200 mg/kg) of Bacopa extract increased the thyroid hormone. T4, by 41 percent when given orally. T3 was not stimulated, suggesting the extract may directly stimulate synthesis and/or release of T4 at the glandular level, while not affecting conversion of T4 to T3. While this study indicates Bacopa extract does have a stimulatory effect on thyroid function, the doses were very high and the typical 200-400 mg daily dose in humans may not have the same effect. (Kar A,2003).

Vii .Protection from Drug Toxicity

In vitro and animal studies have demonstrated Bacopa extracts may have a protective effect against certain drugs and their negative side effects. An in vitro study using guinea pig ileum isolates examined the effect of Bacopa extract on drug-induced morphine withdrawal. Addition of 1,000 [micro]g/mL Bacopa extract to the tissue isolates prior to injection of morphine significantly reduced the naloxone-induced withdrawal effects, an effect that may be attributed to the anticholinergic and calcium antagonistic activity reported by other researchers. (Dar A, Channa S,1999)

Neither extract resulted in gross behavioral changes at these concentrations. (Martis G, Rao A, 1992)

15. Dosage

Traditional daily doses of Bacopa are 5-10 o of non-standardized powder, 8-16 mL of infusion, and 30 mL daily of syrup (Brahmi). Dosages of a 1:2 fluid extract are 5-12 mL per day for adults and 2.5-6 mL per day for children ages 6-12. For Bacopa extracts standardized to 20-percent bacosides A and B the dosage is 200-400 mg daily in divided doses for adults, and for children, 100-200 mg daily in divided doses.

B. INTERVENTIONAL STUDIES WITH OTHER HERBS

Due to increasing problems of elderly much more attention must be paid to the overall nutrient density of the diets of the elderly. Although it is possible to achieve a balanced diet by eating a variety of foods, it is evident that an enormous gap lies between the ideal and the reality of what many people actually can or choose to eat. For individuals at all stages of life, and particularly older people, whose frailty or circumstances may compromise optimal nutrition, food supplements can serve as an effective way of meeting their needs for micronutrients and other substances with physiologically beneficial effects (Richardson, 2007).

Herbal drugs constitute a major share of all the officially recognized systems of health in India *viz.* Ayurveda, Yoga, Unani, Siddha, Homeopathy and Naturopathy, except Allopathy. More than 70% of India's 1.1 billion populations still use these non-allopathic systems of medicine. Currently, there is no separate category of herbal drugs or dietary supplements, as per the Indian Drugs Act. However, there is a vast experiential-evidence base for many of the natural drugs. This offers immense opportunities for Observational Therapeutics and Reverse Pharmacology.

Evidence-based herbals are widely used in the diverse systems and manufactured, as per the pharmacopoeia guidelines, by a well-organized industry. Significant basic and clinical research has been carried out on the

medicinal plants and their formulations, with the state-of-the-art methods in a number of Institutes/Universities. There are some good examples. Indian medicinal plants also provide a rich source for antioxidants that are known to prevent/delay different diseased states. The antioxidant protection is observed at different levels. The medicinal plants also contain other beneficial compounds like ingredients for functional foods. Hence, the global knowledge about Ayurveda and Indian herbals will hopefully be enhanced by information on the evidence-base of these plants. This will yield rich dividends in the coming years.(Ashok, D.B, 2007).

Patel (2003) carried out a food based intervention on 20 institutionalized elderly subjects and found significant rise in the mean nutrient intake of both male and female elderly subjects ($P \leq 0.05$). There was significant change in the anthropometric measurements of the elderly males ($P \leq 0.05$). The study reported beneficial effects of soy feed intervention in elderly in the institutionalized elderly subjects.

Mehta & Chauhan, (2007) studied 20 institutionalized elderly subjects and found that after 3 months of soy food supplementation, significant rise in the nutrient intake along with significant improvement in the anthropometric measurements like weight and BMI was found ($P \leq 0.05$). A significant difference was observed in the mean Hb values of elderly male after intervention (a rise of 0.5mg %). There was a reduction in TC and significant rise in HDL-C values (37.83±2.67 to 41.56±2.02 mg/dl) found. The study showed beneficial effects of long term consumption of soy feeds on health and nutritional status of theinstitutionalized elderly.

Shrivastav and Mehta (1997) carried out a study on 50 hospitalized patients with swallowing disorder out of which 15 patients were selected and the effect of dietary modification (fermented cereal pulse based gruel to which 5% gm ARF was added to adjust the viscosity) was seen on them after 7 weeks of intervention. The result showed that about 41.4% increase was found in the intake of processed gruel and the study indicated beneficial effect of

fermentation with respect to food consumption by geriatric patients suffering from swallowing disorders.

Gleason et al (2008) carried out a preliminary study of the safety, feasibility and cognitive efficacy of soy isoflavone supplement in older men and women in the age group of 62-89 years in USA. The subjects were divided as experimental and control. Experimental group was given 100 mg/day Soy isofalvone and matching tablets to the placebo for 6 months. It was seen that isoflavone treated subjects improved on tests of visual spatial memory ($P<0.01$) and constriction ($P<0.01$), verbal fluency ($P<0.01$) and speeded dexterity ($P<0.04$). The data suggested that administration of 100 mg/day of isoflavones was well tolerated and it was found beneficial in older adults.

In recent years, there is a tremendous interest in the possible role of nutrition in prevention of disease. In this context, antioxidants, especially derived from natural sources such as Indian medicinal plants and herbal drugs derived from them, require special attention. Antioxidants neutralize the toxic and 'volatile' free radicals. Antioxidants have many potential applications, especially in relation to human health, both in terms of prevention of disease and therapy (Halliwell B,1997). Cellular damage induced by oxidative stress has been implicated in the etiology of a large number (>100) of human diseases as well as the process of ageing. Various antioxidants may prevent and/or improve diseased states (Yoshikawa T, 2000). These include the intracellular antioxidant enzymes and the dietary or oral supplements in the form of vitamin C, vitamin E, β-carotene, zinc and selenium.

In old age reduced blood supply in the brain is reflected in physiological changes that are reduced memory, inability to learn, lower ability to integrate new information and to organize appropriate responses, lowered capacity to cope up with psychological stresses. Ayurvedic systems of medicine are full of safe, non-toxic herbal medicines which are in use for thousands of years. There are many remedies mentioned in 'Ayurveda' which helps in the mental well being of elderly. There are few departmental study carried out based on the Ayurvedic Supplementation

Ayurvedic systems of medicine are full of safe, non-toxic herbal medicines which are in use for thousands of years. 'Ashwagandha', 'Brahmi' and 'Shankhpushpi' are some well known remedies mentioned in Ayurveda for its beneficial effects on mental and cognitive function.

'Shankhpushpi' (Convolvulus Pluricaulis) is mainly advocated for use in mental stimulation and rejuvenation therapy. It is also used as a brain tonic which helps in improving memory. The active components found in the shankhpushpi are glycosides, coumarins, flavnoids, and alkaloids. The major coumarin found in the shankhpushpi is scopoletin which is known to lower down the blood pressure and it helps in regulating the serotonin levels. Ethanolic extract of the plants are also known to lower down the total cholesterol and triglycerides level.

In Placebo-Controlled Study impact of BR-16A (Mentat) a complex herbal preparation contains ingredients like Ashvagandha, Malkangni, Mandookaparni, Shankhpushpi and Jalbrahmi was studied in 59 Mentally Retarded Children(MRC).The efficacy of this remedy was further evaluated in 19 MRCs with epilepsy. With the active drug Mentat, it was possible to note a reduction in seizure frequency.Dave et al, (1993)

Siripurapu et al (2005) studied Evolvulusalsinoides (EA) for its antiepileptic and immunomodulatory properties by injecting crude ethanolic extract of EA in rodents. Adaptogenic activity was assessed in rats subjected to acute and chronic unpredictable stress. They administered EA (100 mg/kg) orally for 3 days in adult male Swiss mice, and they found it effective in decreasing scopolamine induced deficit in passive avoidance test. The improvement in the peripheral stress markers and scopolamine induced dementia by EA in the present study indicates the adaptogenic and antiamnesic properties of EA.

Bihaqi et al (2009)investigated neuroprotective effects of aqueous extract from Convolvulus pluricaulis (CP) against aluminium chloride induced neurotoxicity in rat cerebral cortex. Daily administration of CP (150 mg/kg) for 3 months along with aluminium chloride (50 mg/kg) decreased the elevated enzymatic activity of acetylcholine esterase and also inhibited the decline in

Na^+/K^+ATPase activity which resulted from aluminium intake. Oral administration of CP preserved the mRNA levels of muscarinic receptor 1 (M1 receptor), choline acetyl transferase (ChAT) and Nerve Growth Factor-Tyrosine kinase A receptor (NGF-TrkA). Thus, the study showed neuroprotective potential of CP.

There are a variety of interventions available to prevent and correct mental health problems. In the past few years, herbal intervention has come up as a potential treatment of both depression and anxiety. Brahmi, Ginseng, Gingko biloba and Ashwagandha are some of the common herbs used for the treatment of depression.

Mehta and Shah (2006) carried out a study on 'Brahmi' supplementation on moderately depressed women. Intervention was carried out for the period of 6 weeks. 'Brahmi' was supplemented to 150 women of Baroda city, showed significant change ($p \leq 0.05$) in the depression level of the elderly women.

Another study carried out by Chauhan and Patil (2007) on 'Ashwagandha' supplementation for the period of 10 weeks on 60 depressed and non-depressed free living elderly women of Baroda city. They found that, subjects with moderate depression before intervention reduced to 66% normal and 34% mild category

Ashwagandha is classified as tranquilizer, adaptogenic and anti-inflammatory. The herbal drug is found to be decrease the degree of anxiety and depression and can be used as antidepressant. Along with Panax ginseng and Tribulusterrestris, ashwagandha was found to give improvement over all psychomotor functions including adaptability of patients, to various stresses and in the building of tissues. The methanolic extract of the drug inhibited the specific binding of GABA showing receptor mediated anticonvulsant activity in mice (Dandiya, 1990; Singh et al: Ahmuda et al:1991; Kulkarni et al, 1993).

'Shankhpushpi' (Convolvulus Pluricaulis) is mainly advocated for use in mental stimulation and rejuvenation therapy. It is also used as a brain tonic which helps in improving memory. The active components found in the

shankhpushpi are glycosides, coumarins, flavnoids, and alkaloids. The major coumarin found in the shankhpushpi is scopoletin which is known to lower down the blood pressure and it helps in regulating the serotonin levels. Ethanolic extract of the plants are also known to lower down the total cholesterol and triglycerides level.

Gargi Nag and Bratati De (2008) carried out the study on shankhpushpi to analyze its antioxidant and acetylcholinesterase inhibitory properties. Five varieties namelyClitoreaternatea, Canscoradecussata, C. diffusa, Evolvulusalsinoides, E. nummularius of shankhpushpi were studied. And it was found that all the plants (except C. ternatea) inhibited acetylcholinesterase in a dose dependant manner, significantly scavenged DPPH radical and superoxide radical and chelated metal ions. Total antioxidant capacity (equivalent to ascorbic acid) of the plant extracts was also good. It was found that C. decussata has the highest acetylcholinesterase inhibitory activity. Antioxidant activity in all systems (except metal chelation property) was highest in C. decussata.

Borage (Boragoofficinalis or Echiumamoenum)

Borage is a herb originating in Syria. The flowers of the plant can be used in herbal teas. Although the plant is used in traditional Iranian medicine for mood enhancement, its antidepressant mechanism is unclear.There has been one small randomized controlled trial (RCT) (Sayyah M, 2005). A total of 35 adults with mild to moderate major depressive disorder received either placebo or 375 mg of aqueous extract of borage flowers daily for 6 weeks. By week 4 there was a small significant difference in levels of depression symptoms between the two groups, with lower levels in the borage group. Results at week 6 were similar but no longer statistically significant.

Ginkgo biloba

Extracts from the leaves of the Ginkgo biloba (maidenhair) tree are available in tablet form from health food shops. Its antidepressant mechanism is proposed to be a reduction in the production of stress hormones (Spinella M, 2005). Ginkgo may also be effective for the treatment of impaired cerebral circulation in the elderly, one symptom of which is depressed mood.

C. ALTERNATIVE THERPHY

Research suggests that depressive disorders exist on a continuum, with sub threshold symptoms causing considerable population burden and increasing individual risk of developing major depressive disorder. An alternative strategy to professional treatment of sub threshold depression is population promotion of effective self-help interventions that can be easily applied by an individual without professional guidance.

Self-help approaches for depression are commonly used, particularly for milder forms of depression and are perceived as helpful by the public (Jorm, AF,2004) [However, some self-help methods in common use are probably self-defeating (for example, substance use). If effective informal self-help methods could be identified, they could be used as a cost-effective way of reducing sub threshold depressive symptoms. Health promotion campaigns on other major sources of disease burden, such as heart disease and cancer, routinely include information on actions that can be taken to reduce risk.

i. Self-Care or Complementary Depression Treatments

Antidepressant medication, psychotherapy, or combinations of the two represent the most common treatment for depressive illness. However, a variety of self-care approaches also can be used to help alleviate depression. These include:

- acupuncture
- exercise
- light therapy or phototherapy (for seasonal affective disorder (SAD) only)
- massage therapy
- relaxation

Some of these self-care approaches may be used as an adjunct to pharmacological and psychotherapeutic treatments, while others are used alone. Scientific evidence supports several non pharmacological approaches for reduction of depressive symptoms, such as exercise (both aerobic and

anaerobic), relaxation techniques, and at least one herbal remedy. It is important to consult your healthcare provider before beginning any exercise program. It also is important to inform your doctor about any nutritional supplements or herbs that you are taking so as to avoid harmful drug interactions.

ii. Relaxation Therapy for Depression

Relaxation therapy consists of techniques primarily aimed at decreasing physical and mental tensions. These include muscle relaxation, diaphragmatic breathing, autogenic training, guided imagery, meditation, biofeedback, hypnosis, Zen meditation, yoga, and other therapies involving mind and body. While not normally used as an exclusive treatment for depression, relaxation techniques, as many studies suggest, may be as effective as antidepressants. Combination treatment (i.e., relaxation therapy with antidepressant medication) may be more effective at relieving depression than are antidepressants alone. Scientists believe that these relaxation therapies reduce depression by distracting the mind from negative thoughts, improving mental focus, promoting a sense of mastery and self-control, and by decreasing sympathetic nervous system activity (responsible for increasing heart rate and metabolism).

Above studies showed positive impact of various herbal interventions on the health of elderly. All studies reflect beneficial effect of intervention. Thus, keeping in mind the problems of elderly like poor nutritional status, disability and depression the study was planned to evaluate intervention effects of folic acid and brahmi supplementation on nutritional, mental and physical health profile of adult and older depressed women above the age of 40 years. and study its impact on health and nutritional status of elderly subjects.

iii. Meditation

Meditation refers to a variety of self-regulation practices that focus on training attention and awareness. Different forms may emphasize concentration on something (such as an inner sound or the breath) as in transcendental meditation, or awareness of thoughts without judgment, as in mindfulness

meditation or vipassana. Although meditation is often undertaken to achieve spiritual or religious goals, this is not a requirement of practice, and it has even been combined with Western treatments, such as mindfulness-based stress reduction, and mindfulness-based cognitive therapy. Meditation aims to reduce anxiety and promote relaxation. Additionally, mindfulness meditation may be helpful for depression because it leads to a distancing of self from negative thoughts and reduces rumination.

Non-clinically depressed

Five RCTs have evaluated the effects of meditation on depressed mood or symptoms in non-clinically depressed individuals, with inconsistent results. An RCT in 73 elderly of transcendental meditation versus other mental relaxation or concentration tasks or waitlist found no significant difference in depression between groups after 12 weeks (Alexander, C, 1989). An RCT in 42 young adults that compared mindfulness meditation with guided visual imagery for 3 weeks found that neither intervention had an effect on depressed mood (Kingston J, 2007). In contrast to these two trials, three RCTs found an effect. An RCT in 150 adults who participated in a week-long Buddhist meditation retreat found that the meditation group had significantly reduced depression symptoms compared with the delayed treatment control group (Disayavanish P ,1994). An RCT in 61 adults who were assigned to 1 of 2 meditation groups or a control group, found that those assigned to the group using an Indian Vedic mantra (hypothesized to be particularly helpful for depression) had a significantly greater reduction in depression symptoms after 28 days of meditating, compared with either the control group or the group using a mantra composed of meaningless Sanskrit syllables. Finally, an RCT that induced a depressed mood in 177 young adults found that a short mindfulness meditation significantly improved mood more than a distraction or rumination task (Wolf DB,2003).

iv. Computerized interventions

Computerized interventions consist of the presentation of information via the internet or computerized cognitive behavior therapy (CBT), which is the

provision of structured sessions of CBT via computer. The delivery method can be over the internet or via interactive CD-ROM, and the level of professional involvement can vary from none to substantial. Although some computerized CBT packages are only available through a health professional, there are some which are freely available on the internet (Spek V, Cuijpers P, *2007).*

A meta-analysis of 5 RCTs examined the effects of internet-based CBT on depression over weeks or months in a total of 1,982 adults recruited from a mix of clinical and community sources (Titov N.2007). The meta-analysis showed an overall small difference in depression between the internet CBT and control groups (fixed effects analysis d = 0.27, 95% CI 0.15 to 0.40; mixed effects analysis d = 0.32, 95% CI 0.08 to 0.57). The trials were of reasonable to good quality and had no professional involvement in four. Similarly, another review of eight RCTs found that computerized CBT without professional involvement had a small effect on depression, but that computerized CBT with professional involvement had a bigger effect, similar to that achieved in face to face CBT. The author proposed that the smaller effect on depression of unsupervised computerized CBT could be due to low completion rates caused by the absence of a motivating professional. Only one RCT has examined the use of a depression information website. This intervention was found to produce significantly greater change in depression than a control condition and was not significantly different from web-based CBT.

A controlled trial in 59 adolescent males of Mood GYM, an internet-based CBT program, compared 5 weekly sessions of in-class use of Mood GYM with the usual personal development class scheduled at that time. There was no significant difference in change in depression symptoms between the two groups. However, compliance was low, with only 40% completing at least half of the Mood GYM program. Thus, the evidence for computerized interventions for depressive disorders appears promising, particularly if a professional is involved. Pure self-help computerized CBT is not as helpful, but is a potentially beneficial option for those who are sufficiently motivated to

complete the program on their own. There is insufficient evidence to determine the helpfulness of computerized interventions in those without depressive disorders

v. Aromatherapy

Aromatherapy is the therapeutic use of essential oils, which are highly concentrated extracts of plants. Essential oils can be diluted in carrier oils and absorbed through the skin via massage, or heated and vaporized into the air. Essential oils said to have antidepressant effects include bergamot, geranium, jasmine, lavender and Egyptian rose (Perry N,2006). They are available from health food shops or pharmacies. The antidepressant mechanism is unclear, but may be due to the odor either being perceived as pleasant or triggering memories and emotions that affect mood. Alternatively, the oil's chemical constituents may be absorbed into the blood stream and have pharmacological effects

One RCT has examined aromatherapy's effects over minutes on depressed mood in non-clinically depressed adults. A total of 73 adults were exposed to water or essential oils of lavender or rosemary for 10 min whilst they completed a stressful mental task. At the end of the task there was no significant difference in depressed mood between groups (Burnett KM, 2004)

Above studies showed positive impact of various techniques, therapies and herbal interventions on the health of elderly. All studies reflect positive and beneficial role of intervention. Thus, keeping in mind the problems of elderly like poor nutritional status, deficient nutrient intake, disability and depression the study was planned with providing herbal intervention in order to combat depression and evaluate study its impact on health and nutritional status of elderly subjects.

The methods and materials used to achieve this intervention are described in the next chapter.