

# Effect of Nutrients on Different Changes Associated With Aging

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**Abstract:** Aging, is the last stage in the human life span and influenced by certain changes such as physical, psychological and psychosocial changes. Physical changes include decrease in lean body mass, oral cavity changes, loss of visual & auditory functions, decrease in GIT function, loss of mineral mass and psychological changes include Alzheimer's disease, stroke and Parkinson while psychosocial changes include dementia, depression and social isolate. For healthy aging, diet should be nutrient dense and rich in antioxidants to improve immune function and ward off degenerative diseases. Laboratory screening is also essential to determine their health status. More studies are needed to determine the impact of different nutrition on changes associated with ageing and improving their overall quality of life.

**Keywords:** aging, nutrition, antioxidants, vitamin D, vitamin C

## 1. Introduction

Aging is characterized by diminished organ system reserves, weakened homeostatic controls, and increased heterogeneity among individuals, influenced by genetic and environmental factors. Changes associated with normal aging increase nutritional risk for older adults. Nutritional needs of the older individual are determined by multiple factors, including specific health problems and related organ system compromise; an individual's level of activity, energy expenditure, and caloric requirements; the ability to access, prepare, ingest, and digest food and personal food preferences (1). With increasing longevity, the proportion and number of persons in the age group of 60 years and beyond is increasing; women outnumbering men in this age group. The population of elderly has been projected to double from 6.23 crores in 1996 to 11.29 crores in 2016. With increasing age, there are metabolic changes and also reduction in physical activity and, as a result, energy requirement in elderly is substantially lower than younger adults. Elderly individuals also face problems in ensuring appropriate dietary intake because of alteration in taste with increasing age and loss of teeth (2).

## 2. Theories of Aging

**Population theory:** This theory assumes that the time it takes for development and maturity determines how long one lives (3).

**Cellular aging theory:** It is based on the assumption that continuous use couples with decreases in the division and maturation of new cells causes aging and ultimately death. Apoptosis eventually results in decreased numbers of viable cells. Somatic mutations, error catastrophe, free radical, glycation and alteration of genetic code are encompassed in the cellular aging theory (4).

**Organ based theory:** It involves endocrine, immune and pacemaker errors increasing over time and thus decreasing life span (5).

**Glycation theory:** This theory assumes that posttranslational protein modification by the linking of glucose to lysine residues results in diminished protein functionality which in turn decreases organ system viability and ends in death (6).

## 3. Effect of Nutrients on Changes Associated with Aging

**A. Physiological changes:** There are numbers of changes associated with aging such as decrease in lean body mass, loss of mineral mass, oral cavity changes etc.

**I Decrease in lean body mass:** Reaction time, ability to balance, and strength of muscles, tendons, and ligaments decrease with aging, limiting normal activity in some of the elderly. Accidents may increase and the ability to shop and prepare food may be hampered. The effect of supplementation of B-vitamins will reduce fracture incidence (65 years) with an elevated homocysteine concentration ( $\geq 12 \mu\text{mol/l}$ ) was investigated among elderly ( $n=2919$ ) either independently living or institutionalized. Intervention was provided in form of supplements. Experimental group were given a dose of VitB<sub>12</sub> (500ug) + folic acid (400ug) while control group were given a placebo tablet. Vitamin D (600 I.U) was included in both groups. Results had shown remarkable achievement in prevention of osteoporotic fractures in the control group (7). Another study examined the effect of zinc supplementation on accelerating the serum IGF-I response to EAA-(Essential amino acid) Whey protein. For the study, a sample size of 61 hospitalized elderly aged 66.7 to 105.8, with a mini-nutritional assessment score between 17 and 24 were enrolled. Activities of daily living; dietary intakes; serum IGF-I, IGF-BP3, osteocalcin and zinc were measured before and after 1, 2 and 4 weeks of protein supplementation. Results has proven that in the elderly, zinc supplementation accelerated the serum IGF-I response to EAA-Whey protein (8).

**II Oral cavity changes:** The elderly often complain of a decreased ability to taste and enjoy food. Taste buds decrease in number and size, affecting sweet and salty tastes in particular. Taste intensity and hedonic responses to simple beverages was studied among gastrointestinal cancer patients. Intervention were given as five suprathreshold concentrations of each of the four test substances (sucrose in black current drinks, citric acid in lemonade, NaCl in unsalted tomato juice, and urea in tonic water) were used. The present study suggests that cancer patients, compared to healthy individuals, have a normal sensitivity, a normal liking for pleasant stimuli, and a decreased dislike for unpleasant stimuli (9). A sample size of young adults (32.4 years) and elderly (73.2 years) were selected for investigating that chemosensory stimulation can improve mucosal immunity. Intervention were provided as three different types of drops were applied to the tongue: (1) 'avor' drops (5% cocoa powder, 60% sugar, and 0.1% Irish cream odor); (2) sugar (60%); (3) water. The drops were delivered three times in 1 g doses in a 1 hour period. Foods (corn, carrots, chicken broth and onion soup) were tasted with and without monosodium glutamate. Each food (two solid and two liquid) was consumed three times in 6.5 g samples in a 1 hour period. Results showed that chemosensory stimulation can improve mucosal immunity by increasing salivaproduction and also by increasing the absolute concentrations of IgA (10).

**III Loss of bone mineral mass:** Loss of bone (osteoporosis) causes fractures that are often difficult to mend, resulting in long periods of decreased physical activity and social interaction, both of which affect eating behavior. The predictors of low bone mineral density in the elderly: the role of dietary intake, nutritional status and sarcopenia as investigated. Body mass index (BMI), serum albumin, energy and protein intake were studied in 352 elderly outpatients (216 women aged 73.5±5.3 years and 136 men aged 73.9±5.6 years). Observations showed that the prevalence of osteoporosis was 13% in men and 45% in women, while the prevalence of sarcopenia (50%) & hypoalbuminemia (5%) were similar in both genders. Results proved that men having a low Bone Mineral Density (BMD) with a BMI (<22) and a protein intake <65.7 g/day. Women carried some risk already in the BMI 25–30 class, a much greater risk and protein intake is <40 g/day also emerged as an independent risk factor (11). A population-based study designed to evaluate the causes and course of physical disability among 65 years older women (n=1002) who had participated in Women Health and Aging Survey (WHAS- I). The activity of glutathione peroxidase appears to be optimal when serum selenium concentrations are at least 1.27 μmol/L (100 μg/L) or greater. The baseline serum selenium concentrations at which there appeared to be a protective effect of selenium supplementation against cancer in two US trials was 1.34–1.54 μmol/L (106–147 μg/L). Results shown that selenium plays an important role in normal muscle function. A potential biological mechanism by which selenium could contribute to muscle weakness is through maintenance of an optimal concentration of glutathione peroxidase, a key antioxidant selenoenzyme, and/or selenoprotein (12). The effect of age on calcium absorption in postmenopausal women was studied among healthy postmenopausal women (n=262)

aged 40-87 years. Radio calcium absorption and serum vitamin D metabolites, parathyroid hormone (PTH), and other biochemical variables were measured. Research findings revealed that Radio calcium absorption was 28% lower in the 25 women aged >75 years than in the rest. It was significantly related to serum [1, 25(OH)<sub>2</sub>D], but it was not related to either [25(OH)D] or PTH or to any other measured variable. Age-related decrease in calcium absorption was also observed among postmenopausal women in addition to the decline that occurs at menopause. This decrease could be due to a decline in either the active calcium transport or diffusion component of the calcium absorption system. (13).

**IV Cardiovascular changes:** With aging, there is a decrease of about eight to ten percent per decade in the ability of the heart and lungs to supply oxygen to the muscles. This is mainly due to decreasing physical activity by the elderly. For investigating the vitamin D levels and whether supplementation may affect disease risk and mortality a sample of 10,899 men and women (aged 58 years) was selected for the intervention trials. Each subject was classified as to their vitamin D level, and categorized as deficient if the blood levels were lower than 30 ng/mL. The results revealed that more than 70% of the participants classified as vitamin D deficient and supplementation were provided according to their requirement. Vitamin D supplementation was associated with a 61% increase in survival, among studied subjects. Results also revealed that vitamin D deficiency was associated with a significant risk of coronary artery disease (CAD) and reduced survival (14).

**V Vision and auditory function:** Loss of vision is the second greatest fear, next to death, among the elderly. Age-related cataract (ARC) and maculopathy (ARM) are two major causes of blindness worldwide. It is clear that oxidative stress is associated with compromises to the lens and retina. The prevalence and effects of age-related macular degeneration (AMD) and cataract are increasing in elderly. A multivitamin-multimineral supplement with combination of vitamin C, vitamin E, β-carotene, and zinc (with cupric oxide) is recommended for AMD but not for cataract. The results of observational studies suggest that a healthy lifestyle with a diet containing foods rich in antioxidants, particularly lutein and zeaxanthin, as well as n-3 fatty acids, appears beneficial for AMD and possibly cataract (15).

**VI Diabetes Mellitus:** It is one of the most common problems that elderly has to face due to decrease insulin sensitivity. Diabetic patients (n=1173) aged 65 years or older with serum HbA1c level of 7.4% were selected and divided into four groups by the percentage of total energy intake (%E) of carbohydrate C1=less than 55, C2=55-59, C3=60-64, C4=<65. Relations of %E of CHO to HbA1c and other metabolic parameters, energy intake and nutritional intake were examined. Conclusions: the carbohydrate energy ratio has no correlation with HbA1c levels. However, serum TGI's and HDL cholesterol levels decreased significantly, with an increase of %E of carbohydrate in men and in women & in patients with 65%E or more of CHO, serum TG's exceeded 150 mg/dl, which is not the recommended treatment target for diabetic patients. These results suggest that the ideal %E of carbohydrate for Japanese elderly type 2

diabetes is less than 65. The lower limit of %E of carbohydrate could not be determined from the present study (16). Dietary Glycemic Index (GI), Dietary Glycemic Load (GL), and Incidence of Heart Failure Events (HF) was studied among Middle-Aged and Elderly Women of 48–83 years old without baseline heart failure (HF), diabetes, or myocardial infarction who were participants in the Swedish Mammography Cohort, a prospective cohort study (n=36,019). Diet was measured using food frequency questionnaire (FFQ) Women were followed from January 1, 1998, through December 31, 2006. Observations included that over 9 years of follow-up, 639 of 36,019 women died of HF (n= 554) or were hospitalized for HF for the first time (n= 5585). Results proved that these were not significantly different in normal weight and overweight women. In this population, dietary GI did not appear to be associated with incident HF events. There was a suggestion of an association between dietary Glycemic Load (GL) and HF, which did not reach statistical significance (17). Another study examined the dietary glycemic index (GI) and dietary glycemic load (GL) that were associated with several adipokines and related metabolic risk markers of obesity and diabetes in a cross-sectional and longitudinal manner. For the experimental trial a sample size consists of 511 elderly community-dwelling men and women at high cardiovascular risk were recruited for the PREDIMED trial. Dietary data were collected at baseline and after 1 year of follow-up. The GI and GL were calculated. Plasma leptin, adiponectin and other metabolic risk markers were measured. Subjects in the highest quartiles of GI showed significantly higher levels of TNF and IL-6 than those in the lowest quartiles. Dietary GI index was negatively related to plasma leptin and adiponectin levels. Results suggested that the consumption of high-GI or high-GL diets may modulate plasma concentrations of leptin and adiponectin, both adipostatic molecules implicated in energy balance and cardio metabolic risk (18). Role of Incretin Therapies that includes a group of intestinal peptides that enhance insulin secretion after ingestion of food, as novel oral antihyperglycaemic treatments may prove significant in older persons. The two main categories of incretin therapy currently available are: glucagon-like peptide-1 (GLP-1) analogues and inhibitors of GLP-1 degrading enzyme dipeptidyl peptidase-4 (DPP-4). There was strong evidence that use of incretin therapy, in particular, the DPP-4 inhibitors, could offer significant advantages in older persons. Clinical evidence suggested that the DPP-4 are particularly suitable for frail and debilitated elderly patients because of their excellent tolerability profiles (19).

### VII Immunocompetence

Up to 85 percent of the elderly suffer from at least one chronic disease (e.g. cancer and other life style diseases), with one-third requiring special diets because of them. A variety of diseases are more common among the elderly, including, high blood pressure, stroke and arthritis. The effect of zinc sulfate on immunologic response to recombinant hepatitis B vaccine was investigated through a clinical trial on 50 years old elderly (n=140) with a body mass index (BMI) <30 kg/m<sup>2</sup>, and without any co-morbid disease were recruited (51% female). Those who had negative hepatitis B core antibody (n=102) were randomly allocated to two groups. The trial group received hepatitis B

vaccine plus 200 mg zinc sulfate daily for 30 days and the control group received vaccine plus placebo. Results reported that the two studied groups were comparable in terms of age, gender, and smoking habits. The mean antibody production in the intervention & control groups was 116.93 and 157.37 IU/mL, respectively (p=0.22). No statistical differences were observed between the two groups in terms of proportion of people who were protected after vaccination (26.0% and 36.5% in people with and without zinc, respectively). This study revealed that zinc sulfate has no effect in level of immunity among elderly (20). Aging is associated with declined immune function, particularly T cell-mediated activity, which contributes to increased morbidity and mortality from infectious disease and cancer in the elderly and nutritional intervention may be a promising approach to reversing impaired immune function and diminished resistance to infection with aging. While Caloric restriction (CR) vitamin E, Zinc, Probiotics, Omega 3 fatty acid conversely, the immunosuppressive effect of fish oils on T cell-mediated function has raised concerns regarding their impact on resistance to infection (21). Low zinc status may be a risk factor for pneumonia in the elderly and the dysregulation of the immune system associated with increasing age, decreases resistance to pathogens, and is associated with increased incidence and duration of pneumonia, increased use and duration of antimicrobial treatment, and increased overall mortality in the elderly. Inadequate stores of zinc might, therefore, be a risk factor for pneumonia in the elderly. Randomized, double-blind, controlled studies are needed to determine the efficacy of zinc supplementation as a potential low-cost intervention to reduce morbidity and mortality due to pneumonia in this vulnerable population (22).

**B. Psychological Changes:** These are the second major changes that elderly people has to face. Psychological changes like Alzheimer, Parkinson, Stroke and multiple sclerosis are an incurable and progressive neurologic degenerative disorder that leads to a gradual loss of independence and is one of the leading causes of death among elderly people. Folate and vitamin B<sub>12</sub> status in relation to anemia, macrocytosis, and cognitive impairment in older Americans in the age of folic acid fortification was investigated among the subjects (n=1459) that had normal serum creatinine concentration and no history of any disease. Low vitamin B<sub>12</sub> status as a serum vitamin B-12 concentration <148nmol/L or a serum methylmalonic acid concentration >210 nmol/L-the maximum of the reference range for serum vitamin B<sub>12</sub> replete participants with normal creatinine. In the group with a low vitamin B<sub>12</sub> status, serum folate >59 nmol/L (80th percentile), was associated with anemia and cognitive impairment. Results: In seniors with low vitamin B<sub>12</sub> status, high serum folate was associated with anemia and cognitive impairment. When vitamin B<sub>12</sub> status was normal, however, high serum folate was associated with protection against cognitive impairment (23). Another study examined the vitamin B<sub>12</sub>, apolipoprotein E genotype and cognitive performance in community-living (aged > or =55 years) in a sample size of 539 older adults. A battery of neuropsychological tests, including the Mini-Mental State Examination (MMSE) for global cognition, was administered at the baseline assessment. The interaction of vitamin B<sub>12</sub> and APOE

epsilon4 on cognitive function was examined in a linear mixed-effects model for MMSE and in a multiple linear regression model for neuropsychological test scores. Results reported that a significant interactions between natural log-transformed vitamin B<sub>12</sub> and APOE epsilon4 were also found for the Digit Span Backward Longest Sequence (P for interaction = 0.013) and Rey Auditory Verbal Learning Test immediate recall (P for interaction = 0.005). Better performance in these 2 tests was associated with vitamin B-12 in APOE epsilon4 carriers but not in APOE epsilon4 non-carriers. The association between vitamin B<sub>12</sub> and cognitive function was moderated by APOE epsilon4 status (24). The longitudinal association of vitamin B<sub>6</sub>, folate, and vitamin B<sub>12</sub> with depressive symptoms among older adults was studied over time 1–3 years. The study sample consisted of 3503 elderly (n=65 years) from the Chicago Health and Aging project. Dietary assessment was made by food frequency questionnaire (FFQ). Incident depression was measured by the presence of four depressive symptoms from the ten scores version of the Center for Epidemiologic Studies Depression scale. Results showed that higher total intakes, which included supplementation, of vitamins B<sub>6</sub> and B<sub>12</sub> were associated with a decreased likelihood of incident depression for up to 12 years of follow-up, after adjustment for age, sex, race, education, income, and antidepressant medication use. For example, each 10 additional milligrams of vitamin B<sub>6</sub> and 10 additional micrograms of vitamin B-12 were associated with 2% lower odds of depressive symptoms per year (25). High serum calcium levels are associated with faster decline in cognitive function with increase in age. (26).

**C. Psychosocial Changes:** These are the third major changes that elderly people has to face. These changes include Dementia, Depression, Alcohol Abuse and Social isolation. Senility, also called senile dementia or organic brain syndrome affects about 60 percent of the elderly to varying degrees. Some of the problems associated with senile dementia include impairment of memory, judgments, feelings, personality, and ability to speak. Senile dementia of the Alzheimer's type accounts for at least half of all dementia in old age. Alcohol abuse is related to liver and the size and function of the liver decreases steadily with aging. The content of glycogen and vitamin C in the liver decreases, and its ability to synthesize protein is diminished. Alcohol becomes more toxic to the liver as its ability to detoxify ethanol decreases. The kidneys also decrease in size and function. The number of kidney nephrons decreases and the membranes thickens, decreasing the ability of various substances to pass through. Thus the aged kidney may be inefficient in the removal of metabolic waste products. The older individual may also be susceptible to dehydration, resulting from a diminished thirst mechanism. Relationship between vitamin D levels and depressive symptoms among elderly selected from a National Survey Population was studied. Data were analyzed from 2070 participants aged ≥65 years who had participated in the 2005 Health Survey for England. Serum 25-hydroxy vitamin D (25(OH) D) levels and depressive symptoms (Geriatric Depression Scale) had been measured. Covariates included age, sex, social class, season of examination, and physical health status. Results revealed that depressive symptoms were associated with clinical vitamin D deficiency (25(OH) D) levels <10 ng/mL;

present in 9.8%) independent of other covariates but not with broader deficiency states. This association was not modified by season of examination. Vitamin D deficiency is associated with late-life depression in northern latitudes (27).

#### 4. Conclusion

The global populations of people aged 60 years and older will more than double, from 542 million in 1995 to about 1.2 billion in 2025. The International Day of Older Persons is celebrated every year on 1st October. An estimated 17.3 million people died from CVDs in 2008. By 2030, almost 23.6 million people will die from CVDs, mainly from heart disease and stroke. The cornerstone of geriatric nutrition is well balanced diet optimal nutrition to delay the leading causes of death and diseases like Heart disease, cancer, stroke, diabetes. Increasing the intake of nutrients rich in antioxidants contributes to increase longevity and helps in healthy aging. So Geriatrics Nutrition is a very sound and healthy approach to deal with the elderly nutrition.

#### 5. Future Scope

Diet rich in variety of antioxidant such as lycopene, selenium and vitamin C may help the elderly people to combat the degenerative disease associated with ageing. This study came out with the impact of nutrition on different changes associated with ageing which may help dietitians and health professionals to provide sound solutions for the better health and quality of life of elderly.

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