SUMMARY AND CONCLUSIONS

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Old age is a serious problem as it has assumed a greater magnitude in the present day world. According to the WHO, the 'world' is ageing. Throughout the world, there has been a steady increase in the average life expectancy of both males and females. Advancements in medical health technologies, increased awareness and better nutrition has resulted in a shift from a high mortality / high fertility to low mortality / low fertility, which consequently resulted in an increased proportion of older people in the total population. With this rapid growth comes a need to examine the health and nutritional problems in these people. The aging process is influenced by lifestyle, environmental factors, health care, nutrition, disease and genetic constitution of an individual.

The free radical theory of ageing has gained wide popularity in the last decade or so. This theory holds that aging may be due to the cumulative consequences of free radical reaction and their ultimate deteriorative damaging effects on cellular components resulting in various age related disorders. The two major disorders of aging in which free radical plays an important role and generally occurs with advancing age are - cardiovascular diseases (CVD) and cancer.

The human body has evolved several mechanism through which the damaging effects of free radicals can be counteracted. These are called as antioxidants. Though a wide variety of antioxidants in foods contribute to disease prevention, strong evidence supports the role of three antioxidants vitamins - vitamin E, vitamin C and β-carotene along with non-nutrients - flavonoids, against the free radical damage. The dietary pattern of the individuals differ from region to region, especially in Gujarat wherein the dietary pattern is towards more of consumption of fat rich foods and less towards consumption of fruits leading to imbalances and deficiencies in protective nutrients such as vitamins. Also an increase in the cardiovascular diseases and oral cancer has been consistently reported by the cancer registry based in Ahmedabad since past few years. Hence, it was thought worthwhile to carry out a study assessing the role of antioxidants in health and disease during aging process.

The specific objectives were to collect baseline information on socio demographic attributes, nutritional status, dietary intake along with lifestyle assessment in terms of activity pattern and addiction pattern on the men and women (aged 45 years and above) selected for this study. Antioxidants profile from diet was also evaluated in detail. The dietary antioxidants profile was substantiated with the antioxidants data in serum / plasma in a sub sample of men and women with CVD and oral cancer. The study also involved assessing the knowledge and practices of the caregivers of the elderly with respect to the role of antioxidants in the diets of the elderly. Two parts of the study being a case-control ones, also included a group of healthy individuals.

The study was divided into four sections :

SECTION I

EVALUATION OF SOCIO-DEMOGRAPHIC PROFILE, NUTRITIONAL STATUS, DIETARY PATTERN, LIFESTYLE FACTORS AND ANTIOXIDANTS PROFILE IN FREELIVING SUBJECTS (AGED 45 YEARS AND ABOVE).

Two hundred men and women (aged 45 years and above) belonging to the middle income groups were selected for the from the free living population of Vadodara for the first section of the study.

SECTION II

ASSESSMENT OF SOCIO- DEMOGRAPHIC PROFILE, NUTRITIONAL STATUS, DIETARY PATTERN, LIFESTYLE FACTORS, CLINICAL AND ANTIOXIDANTS PROFILE IN SUBJECTS SUFFERING FROM CARDIO VASCULAR DISEASES (45 YEARS AND ABOVE).

Hundred subjects (aged 45 years and above) comprising of men and women with CVD were selected from the Jivraj Mehta Hospital, Ahmedabad. Their respective controls were selected from the free living population. The socio-demography of the healthy controls in terms of age and economic status were matched with the cases to the extent possible.

SECTION III

COLLECTION OF DATA ON SOCIO- DEMOGRAPHIC PROFILE, NUTRITIONAL STATUS, DIETARY PATTERN, LIFESTYLE FACTORS, CLINICAL AND ANTIOXIDANTS PROFILE AND ORAL HYGIENE PRACTICES IN SUBJECTS WITH ORAL CANCER (45 YEARS AND ABOVE).

Hundred men aged 45 years and above suffering from oral cancer were selected for the section III of the present study. Their respective controls were enrolled from the free living population after matching for age and economic status.

SECTION IV

ASSESSMENT OF KNOWLEDGE AND PRACTICES OF THE CAREGIVERS REGARDING IMPORTANCE OF ANTIOXIDANTS IN THE DIET OF THE ELDERLY.

Thirty caregivers selected for the last phase, mainly comprised of the daughters-in-law, responsible for taking care of the elderly. These caregivers were selected from the freeliving population of Vadodara.

Tools and techniques used in the study have been briefly summaried as under.

The baseline information was collected from the subjects selected for sections I, II and III of the study with respect to the following :

a) **Socio-demography** : This was obtained using a questionnaire which included information on age, marital status, religion, ethnic group, educational qualifications, family composition and income.

b) **Nutritional status** : Nutritional status was assessed using anthropometric measurements like height, weight and body mass index (BMI).

c) **Dietary intake**: Data on dietary intake was assessed with respect to the changes made in the dietary intake in past 5 - 10 years, habitual dietary pattern, and amount of fat topping used. The dietary intake was also calculated using a 24 hour dietary recall method along with the food frequency. The mean nutrient intake were calculated for energy, protein, fat, fibre, calcium, iron and

antioxidants vitamins like β-carotene and vitamin C. Data on consumption of specific foods was collected on the basis of their frequency of intake. Major emphasis was placed on the use of antioxidants rich protective foods such as green leafy vegetables, vegetables rich in β-carotene and isoflavonoids. A list of fruits rich in β-carotene and vitamin C were also included specifically. Frequency of consumption of fat rich foods like sweets and snacks were also assessed.

d) **Activity pattern** : The data on the activity pattern was assessed by total self reported time spent in activities related to work and leisure along with time spent in sleep. The activity pattern of the subjects was then categorised under sedentary, moderate or heavy activity.

e) Addiction pattern: The addiction pattern was evaluated with respect to addiction to pan, supari, ghutka, cigarette and bidi smoking, alcohol consumption, along with tobacco chewing. The duration and frequency of addiction was also noted down.

f) **Other personality traits** : The self reported personality traits were also assessed with respect to experiencing of stress, anxiety and angry temperament.

g) Disease profile: Data on disease profile was obtained by a check list of health problems.

h) **Biochemical estimation**: Biochemical estimations were carried out on a sub sample of men with CVD and oral cancer along with their healthy controls. The estimations were with respect to the lipid profile (TC, TG, HDL-C, LDL-C and VLDL-C) and antioxidants status in blood. The antioxidants that were estimated were serum β-carotene, serum α-tocopherol and plasma vitamin C.

i) **Oral hygienic practices**: The data on oral hygienic practices was evaluated in men with and without oral cancer in phase III. The information pertaining to the cleaning and care of the oral cavity throughout the day, before and after meal, was collected.

SECTION IV

This section included assessment of knowledge and practices of the caregivers of the elderly.

a) **Knowledge and practices (KAP) :** The data on KAP of the caregivers was assessed in phase IV. The information was collected with respect to various aspects of the importance of antioxidants in the diets of the elderly using a pre-designed questionnaire.

The data collected in all the four sections was analysed using 't' test for analysing the nutritional status, and dietary intake. Odd's ratio was used to assess the relationship between food frequency, addiction pattern, personality traits and risk of occurrence of CVD and oral cancer. Stratified analysis was used after adjusting for age and sex in case of CVD and age and economic status in case of oral cancer.

Results are presented for each section seperately.

SECTION I

The results of this section are summarised below under the following heads:

a) **Socio-demographic profile**: Mean age of men from the freeliving population was 62 years whereas in case of women, it was 64 years. Forty percent of the men and thirty five percent of the women had completed their university level education.

b) **Nutritional status**: The nutritional status was assessed in terms of anthropometric measurements. The mean body mass index (BMI) of men (aged 45 years and above) was found to be 23 Kg/M^2 whereas it was 24 Kg/M^2 in women. More than 60 % of the subjects had BMI within the normal range whereas 31 % of the subjects were overweight. Obesity was found to be less prevalent among the subjects from the free living population.

c) **Dietary information :** Diet related information was noted in terms of changes made in food intake, dietary pattern, types of oil and fat consumed, fat topping, nutrient intake, mean intake of antioxidants rich foods, and food frequency.

i) ***Changes in food intake :*** . No major change in food consumption was reported by men and women from the free living population. Reduction in food consumption was mainly reported because of advancing age and due to chewing problems.

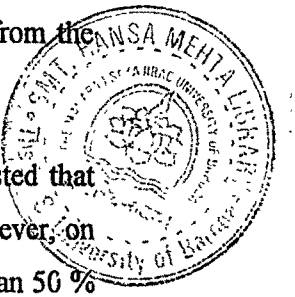
ii) ***Dietary pattern*** : The habitual dietary pattern of eighty nine percent of the subjects was found to be vegetarian. Higher percentage of elderly men and women were habituated to vegetarian diets as compared to their younger counterparts.

iii) ***Type of oil and fat consumed*** : Consumption of cottonseed oil (49 %) was highest among the subjects followed by the use of groundnut oil (38 %) for cooking purpose. Use of clarified ghee over dalda was reported by majority of the subjects (70 %).

iv) ***Fat topping*** : Use of fat as a topping was highest on frequently prepared roti and khichadi by majority of men and women from both the younger and elderly age groups.

v) ***Nutrient intake*** : Majority of men from the younger as well as the elderly age group met only 50 - 75 % of the RDA for energy and protein. Intake of fat was more than 100 % of the recommended allowances by more than $3/4^{th}$ of the total number of men and women. More than 90 % of the men from the free living population reported less than 50 % of the RDA for fibre and iron. Consumption pattern of minerals indicated at higher consumption of calcium than the recommended levels by majority of men from both the age groups (52 % and 62 % respectively). However, the iron intake was found to be < 50 % of the RDA by 80 % of the men. Antioxidants rich vitamins intake in terms of β-carotene indicated 25-50 % of the RDA met by more than 45 % of the men (45 years and above) and half of the younger women. Twenty one percent of the elderly women also reportedly met more than 100 % of the β-carotene requirements. Consumption of antioxidants vitamin C was noted to be more than 100 % of the

recommended allowances by majority of the younger and elderly men from the free living population (45 % and 53 % respectively).



The data on nutrient intake of women aged 45 years and above suggested that majority of women aged 45 years and above could meet 50-75 %. However, on comparison with the suggested RDA given by Natarajan (1991), more than 50 % of the elderly women could meet more than 100 % of the RDA for energy. Similarly, equal percentage of women (36 %) met protein requirements between 50-75 % of the daily recommendations. More than 80 % of the women from both the age groups reportedly consumed more than 100 % of the fat requirements. As against this, fibre and iron intake were on 25-50 % of the RDA in majority of the women. In women from both the age groups, calcium intake was found to be satisfactory as more than 80 % of the women met the RDA for calcium. Consumption of antioxidants rich vitamins such as β-carotene and vitamin C revealed that only 25-50 % of the β-carotene requirement was met by majority of the women (41 %) of the women. As against this, consumption of antioxidants vitamin C was reportedly more than 100 % of the recommended allowances by more than half of the total women subjects selected for this phase of the study.

Thus, consumption of nutrients like energy, protein, fibre, iron and β-carotene were below the recommended allowances whereas the dietary intake of fats, calcium and vitamin C exceeded the recommended intakes, by men and women from both the age groups.

Increase in educational level was found to have a direct relationship with the intake of antioxidants rich vitamins like β-carotene and vitamin C.

vi) ***Food frequency***: Cereal (bajra) intake was found to be frequent whereas consumption of protein was found to be non frequent by majority of men from the younger group (45-59 years) as well as by the elderly men (82 % and 67 % respectively).

Intake of GLVs by the younger men was found to be non-frequent in slightly higher percentage of men (52 %) whereas the elderly men were found to be consuming green leafy vegetables frequently.

Similar observations were noted for the consumption of vegetables rich in β-carotene. Sixty four percentage of the younger men were found to be consuming these vegetables frequently against same percentage of the elderly men who consumed GLVs on frequent basis.

Consumption of vegetables rich in isoflavonoids was reported by more than 70 % of the men from both the age groups as revealed from the above table.

Around 2/3rd of men (45-59 years) and 3/4th of the elderly men (60 years and above) were found to be consuming β-carotene rich fruits frequently. As against this, almost equal number of men from both the age groups had non frequent intake of citrous fruits rich in vitamin C.

Frequent consumption of non-vegetarian foods and milk and milk products was reported very few men (45 years and above). However, 52 % of the elderly men (60 years and above) were found to be consuming milk and milk products frequently.

Majority of men from both the age groups had non-frequent intake of all the types of sweets (80-100 %).

Non frequent consumption of deep fried, shallow fried and dry snacks were reported by more than 3/4th of the men from both the age groups.

Data on frequent / non frequent consumption of various foods by women (aged 45 years and above) was also assessed Cereal and pulse intake was found to be higher in the younger women as compared to the elderly women.

As compared to the younger women (54 %), higher percentage of the elderly women (58 %) reportedly consumed GLVs frequently.

Non frequent consumption of vegetables rich in β-carotene was indicated by majority of the younger women (54 %) as well as the elderly women (63 %).

Three fourth of the women (45-59 years) were found to be having frequent intake of isoflavonoids rich vegetables as compared to almost 2/3rd of their elderly counterparts.

Slightly more than 1/3rd of the younger women reported frequent consumption of β-carotene rich fruits as compared to only 26 % of the elderly women. More than 2/3rd of the younger women had frequent consumption of fruits rich in vitamin C as compared to 56 % of the elderly women.

Majority of the younger as well as the elderly women did not report consumption of non vegetarian foods.

On the contrary, consumption of milk and milk products was found to be frequent in higher percentage of the elderly women (54 %) as compared to their younger counterparts (45 %).

Non frequent consumption of milk based, khoa based and ghee based sweets was reported by almost 3/4 of the younger women. Between the women from two age groups, consumption of sweets was frequent in more younger women as compared to the elderly group.

Non-frequent consumption of dry, deep fried and shallow fried snacks was reported by higher number of elderly women as compared to their younger counterparts.

Thus, intake of antioxidants rich foods such as green leafy vegetables, vegetables rich in β-carotene and isoflavonoids along with fruits rich in β-carotene were found to be frequent in majority of the men and women selected for the present phase.

Consumption of fat and oil based sweets and snacks was found to be non-frequent by the subjects from the free living population.

d) **ADDICTION PATTERN :** Addiction pattern was found to be less prevalent in men from the free living population.

e) **ACTIVITY PATTERN :** More than 80 % of the men and women from the free living population had sedentary lifestyle.

f) **OTHER FACTORS :** Self reported personality traits such as stress, anxiety and hot temperament were reported by 30-40 % of the subjects. younger men and women (45-59 years) reported higher level of stress, anxiety and angry temperament than the elderly couterparts.

g) **DISEASE PROFILE :** Gastrointestinal and oral cavity problems were highest among men and women (aged 45 years and above).

SECTION II

The results of this section are summarised below under the following heads:

a) **Type of cardiovascular disease among the cases :** Majority of men (62 %) and women (71 %) were found to be suffering from myocardial infraction.

b) **Socio-demographic profile :** The mean age of occurrence of CVD in men was 60 years. Forty one percent of the cases had only school level education as compared to 43 % of the controls who had university education. The economic status of the subjects revealed that majority (90 %) of the cases belonged to the middle income group. The mean age of the occurrence of CVD in women was 66 years. The educational level of the women revealed that 26 % of the cases had school education as against 15 % of the controls who had higher education till university level. The economic status of the women revealed that more than 80 % of the subjects belonged to the middle income group.

c) **Nutritional Status :** Nutritional status measured in terms of anthropometric measurements revealed that 17 % of the men with CVD were obese as compared to

their healthy counterparts. Prevalence of obesity was found to be 15 % in women with CVD as against 7 % of their respective controls.

d) **Dietary Information :** Diet related information was noted in terms of changes in food intake, dietary pattern, types of oil and fat consumed, fat topping, nutrient intake, mean intake of antioxidants rich foods, intake of antioxidants foods with CVD risk and food frequency.

i) ***Changes in food intake :*** . No major change in food consumption was reported by men with and without CVD. Few changes that were made mainly attributed to general well being by the controls. These changes were in terms of reduction in consumption of fats and oils based food.

In case of women, no change in food consumption pattern was observed. However, reduced consumption of overall diet was reported by elderly women mainly because of decrease in their digestive capacity.

ii) ***Dietary pattern :*** Vegetarianism was pre-dominantly reported by more than 80 % of men with and without CVD. The habitual diet consumed by majority of women (78 % cases and 97 % controls) was also vegetarian.

iii) ***Types of oil and fat consumed :*** Consumption of groundnut oil was around 60 % by men with and without CVD followed by consumption of cottonseed oil. Majority of men with and without CVD reported more consumption of ghee over dalda (Cases - 66 % ; Controls - 81 %).

Data on type of oil used by women subjects pinpointed at almost equal consumption of both cottonseed and groundnut oil. The consumption of both these oils was around 50 % in cases and around 30 % in controls. The consumption of ghee (clarified butter) was reported by half of the cases and 3/4th of the control subjects.

iv) ***Fat topping*** **:** Consumption of roti with extra fat as a topping was significantly associated with the occurrence of CVD in men (OR=2.84) and women (OR=2.21).

v) ***Nutrient intake :*** Younger men with CVD met more than 3/4th of the energy and protein requirements as compared to their controls. Fat and calcium requirements

exceeded the recommended allowances in the younger men with and without CVD. Fibre and iron intakes by younger men with and without CVD were found to be less than half of the recommended allowances. A significantly higher intake ($p \leq 0.05$) of dietary β-carotene was observed in the healthy younger men who met more than $3/4^{th}$ of its requirement as compared to the cases who could not meet even the $2/5^{th}$ of the β-carotene requirements. Consumption of vitamin C was significantly higher ($p \leq 0.05$) in the younger men without CVD as compared to the cases. The intake of vitamin C by the younger men without CVD was more than double the recommended intakes whereas men with CVD could just meet the daily requirements for vitamin C.

The elderly men with CVD could meet more than $3/5^{th}$ of the requirements for requirements when compared to the recommendations given by the ICMR. On comparison with the suggested RDA given by Natarajan (1991), both the cases and controls fared better, meeting more than $3/4^{th}$ of the RDA for energy. Consumption of fat, which was exceeding the RDA in both cases and the controls, was noted to be significantly higher ($p \leq 0.05$) in the elderly men with CVD than their counterparts. Fiber intake was significantly higher ($p \leq 0.05$) in controls than in the cases (60 years and above) though they could hardly meet the $1/5^{th}$ of the recommended allowances for fat. There was no significant difference observed between the two groups as far as calcium recommendations were concerned as both the groups exceeded the calcium requirements. No significant difference was indicated in the iron intake of the cases and controls, who did not meet even half of the recommended levels for iron. Consumption of antioxidants vitamins such as β-carotene and vitamin C was reported to be significantly higher ($p \leq 0.05$) in the elderly men without CVD as against their diseases counterpart

Majority of the younger men with CVD, met 50-75 % of the RDA for energy as compared to 45 % of their healthy elderly counterparts who could meet only $1/4^{th}$ - 1/2 of the requirements for energy. Protein intake was noted to be 75-100 % of the RDA by 45 % of the cases whereas 54 % of the controls met only 50-75 % of the protein requirements. As against this, consumption of fat was found to be exceeding the recommended allowances by all the younger men with CVD as against 93 % of their controls. majority of the cases and controls could meet 25-50 % of the fibre and

iron recommendations. Ninety percent of the cases as well as the controls met more than 100 % of the calcium requirements through their daily diets. Data on consumption of antioxidants vitamins indicated higher percentage of the younger controls (25 %) having more than 100 % of the recommended allowances for β-carotene. More than 80 % of the younger men without CVD reportedly consumed more than 100 % of the vitamin C requirements as compared to 35 % of their diseased counterparts.

Energy intake was found to be 50-75 % of the recommended allowances by 40 % of the cases as against 53 % of the controls who met 1/2 to $1/4^{th}$ of the energy requirements when compared the RDA given by the ICMR. on comparison with the suggested RDA given by Natarajan (1991), 34 % of the cases could meet more than 100 % of the RDA against 40 % of the controls could meet 75-100 % of the RDA for energy. Protein intake was noted to be 50-75 % of the RDA by 40 % of the cases whereas 68 % of the controls met 75-100 % of the protein requirements. More than 90 % of the elderly men with and without CVD exceeded their fat and calcium intake from their diets. Fibre and iron intakes were found to be around $1/4^{th}$ to 1/2 of the recommendations by both the cases as well as the controls. β-carotene intake was found to be 25-50 % of the RDA by $2/5^{th}$ of the elderly men with and without cardiovascular diseases. Higher percentages of the elderly controls (78 %) met more than 100 % requirements for vitamin C as against $1/4^{th}$ of their elderly diseased counterparts.

In case of younger women with and without CVD, both the cases and controls met more than $3/4^{th}$ of the requirements for energy and protein, however, no significant difference was observed between the subjects. Fat and calcium intake were found to exceed the recommended allowances and were higher in the female cases as compared to their healthy counterparts. Fibre and iron intake were noted to be significantly higher in the younger women without CVD than those with CVD, though both the cases and the controls could meet less than half of the recommended allowances for these two nutrients. Consumption of antioxidants rich vitamins like β-carotene and vitamin C, though higher in the younger women without CVD, did not reveal any significant difference when compared with the cases.

The mean nutrient intake of the elderly women with and without CVD indicated that the consumption of energy was more than 2/3rd of the recommended allowances given by the ICMR in both the cases as well as the controls. On comparison with the suggested RDA by Natarajan (1991), the elderly women subjects could almost meet the complete recommendations. Both the groups could meet 3/4th of the RDA for protein. Consumption of fat and calcium were found to exceed the daily requirements by both the cases as well as the controls. Less than half to one fourth of the recommendations were met for iron and fibre intake respectively by the elderly women with and without CVD. Significantly higher consumption ($p \leq 0.05$) of antioxidants rich vitamins like β-carotene and vitamin C was observed in controls as compared to the cases. The cases could meet 1/3rd of the RDA for β-carotene against the controls who met more than 2000 μg of β-carotene requirements daily. The intake of vitamin C was above the recommended allowances in the elderly women with and without CVD.

Forty six percent of the younger women with CVD could meet 50-75 % of the RDA for energy and proteins as compared to the controls who met more than 75 % of the RDA for both the nutrients. Consumption of fat and calcium was noted to be far above the recommended levels by both the cases as well as the controls. On the contrary, fibre and iron intakes were found to be 25-50 % of the RDA by the younger women with and without CVD. Against 15 % of the younger women without CVD, only 7 % of the cases met more than 100 % of the RDA for β-carotene. Intake of vitamin C was found to be exceeding in higher percentages of the younger controls (69 %) as compared to 38 % of their diseased counterparts.

Thirty two percent of the elderly women (60 years and above) with and without CVD could meet 50-75 % of the energy requirements according to the RDA given by the ICMR. On comparison with the RDA suggested by the Natarajan (1991), majority of the subjects could meet more than 100 % of the energy requirements. Similarly, more than 100 % of the RDA for protein was met by almost double the percentage of controls than the cases. The consumption of fat and calcium exceeded the daily recommendations by both the elderly female cases as well as the controls. Majority of the women with and without CVD could meet only 25-50 % of the RDA for fibre and

iron. Almost one third of the elderly women without CVD could meet more than 100 % of the requirements for β-carotene as against none of the controls. More than 3/4th of the female controls (aged 60 years and above) met more than 100 % of the recommended allowances for antioxidants vitamin C as compared to 1/5th of the cases.

vi) ***Mean intake of antioxidants rich fruits and vegetables*** : The consumption of GLVs was found to be low in the younger and elderly men with CVD (175 gm and 180 gm) as compared to their healthy counterparts (196 gm and 215 gm). Similar observations were made for the consumption of fruits by the younger and elderly men with and without CVD (121 gm and 98 gm vs. 130 gm and 109 gm).

The mean intake of GLVs by younger and the elderly women with CVD was found to be less as compared to their respective controls (190gm and 206gm vs 220 gm and 230 gm). Similar findings were noted down for the consumption of fruits by the younger and elderly women with and without CVD (120 gm and 80 gm vs. 128 gm and 90 gm).

vii) ***Antioxidants intake in relation to CVD risk in the cases*** : Increasing intakes of antioxidants vitamins such as β-carotene and vitamin C showed highly protective effect in the highest quartile (OR=0.12 and OR=0.09 respectively) as compared to the lowest quartile of intake thereby showing a significant $\chi 2$ for trend for both the vitamins ($p<0.0001$ and $p<0.001$) in men with CVD.

A significant association (OR=0.10) was observed with highest intake of β-carotene in the fourth quartile as against the other three quartiles of antioxidants intake in case of women. However, a non significant decreasing trend in the second and the fourth quartile was observed in case of vitamin C intake in women with CVD. Thus, a declining trend of association was observed with the increasing intakes of β-carotene and vitamin C by the healthy subjects.

viii) ***Food frequency*** : A strong protective effect was revealed with the frequent consumption of green leafy vegetables (OR=0.43), vegetables rich in β-carotene

(OR=0.15), vegetables rich in isoflavonoids (OR=0.26) and other vegetables (OR=0.46) in men at 0.001 and 0.0001 levels.

Frequent consumption of fruits rich in β-carotene and vitamin C was also found to be negatively effected (P<0.0001) with the occurrence of cardiovascular diseases (OR=0.10, OR=0.15 respectively).

A highly significant positive association was observed with the frequent consumption of milk, khoa and ghee based sweets (OR=5.32, OR=8.48 and OR=3.05 respectively) in men with CVD. Similar observations were made for frequent consumption of deep fried snacks (OR=9.28).

Frequent consumption of vegetables revealed a protective effect of intake of vegetables rich in β-carotene (OR=0.25) at 1 % level. A non-significant negative effect was observed with the frequent consumption of GLVs (OR=0.56), vegetables rich in isoflavonoids (OR=0.34) and other vegetables (OR=0.42).

Consumption of fruits rich in β-carotene gave a strong protective effect against the occurrence of disease (OR=0.30). However, a non-significant risk was observed with the frequent intake of vitamin C rich citrous fruits (OR=0.29) which was higher in the controls.

A non-significant risk was observed in small number of cases who reportedly consumed milk, khoa and ghee based sweets frequently (OR= 1.18, OR=3.11 and OR 3.11 respectively) with the occurrence of CVD.

Frequent consumption of deep fried snack which was higher in the cases gave a strong positive association in cases (OR=9.50) whereas consumption of shallow fried (OR=0.34) and dry snack (OR=1.00) gave a non-significant risk with the occurrence of CVD in women.

Thus, frequent consumption of green leafy vegetables, vegetables rich in β-carotene and isoflavonoids along with fruits rich in β-carotene and vitamin C gave a strong

protective effect against the occurrence of CVD in the men and women without CVD. The beneficial effect of fruits and vegetables was especially strong in elderly even after adjusting for age.

Consumption of sweets and deep fried foods were found to be a risk factor for the occurrence of cardiovascular disease.

e) Addiction pattern : Addiction to smoking bidis was found to be ten times higher in the cases as compared to their healthy counterparts thereby indicating a strong risk factor with the incidence of cardiovascular diseases at 5 % level. Higher percentage of the men with CVD also reported tobacco chewing (17 %) as against 6 % of the controls giving a weak association with the disease. A positive effect was also observed with alcohol addiction which was reported by almost double the percent of the men with CVD as compared to the controls.

Six percent of the cases were addicted to cigarette smoking since past 30-40 years as against similar percentage of the controls who were addicted since past 10-20 years. Addiction to bidi was reported by higher percentage of the cases (69 %) as compared to the controls (96 %). Number of cigarettes and bidis smoked per day was more (> 25 per day) in higher percentage of the men with CVD as compared to their healthy counterparts.

Seven percent of the cases were addicted to alcohol since 15-25 years whereas similar percentage of the controls were addicted since more than 35 years. Alcohol intake was found to be more than 100 ml per day by 12 % of the alcohol drinker men with CVD against 9 % of the controls reportedly consumed 50 - 100 ml of alcohol per day.

Nine percent of the men with CVD were addicted to tobacco since 25-35 years as against 3 % of the men without CVD who were addicted since 15-25 years. Higher percentage of tobacco addicts in cases, chewed more than 2 gm of tobacco per day (7 %) than controls who chewed less than 0.5 gm of tobacco per day.

Addiction pattern was not reported by women with and without CVD in the present phase of the study.

f) Other factors : A weak association was observed with occurrence of anxiety (OR=1.21) and hot temperament (OR=1.90) with the occurrence of CVD in men.

A non-significant association was found between stress and anxiety and occurrence of CVD (OR=0.87 and OR=0.87 respectively) in women.

g) Disease profile : Gastrointestinal tract problems were found to be highest in men with and without CVD. More than 63 % of the cases as compared to 44 % of the controls reported problems related to the central nervous system.

Gastrointestinal tract problems were also found to be highly prevalent in majority of the women with and without CVD. Locomotor problems were noted in more than 50 % of the female healthy subjects whereas similar percentage of the cases reported oral cavity problems.

h) Stratified analysis of various factors according to age and sex

Stratified analysis was done to further analyse the relationship of various factors with the occurrence of CVD after adjusting for age and sex.

a) ***Relationship of consumption of GLVs with CVD according to age and sex*** A non-significant positive association was indicated with frequent consumption of GLVs in younger and elderly men and women with CVD (OR=0.40,OR=0.46 and OR=0.54, OR=0.62).

b) ***Relationship of consumption of vegetables rich in β-carotene with CVD according to age and sex :*** A highly protective effect was observed with frequent consumption of vegetables rich in β-carotene in younger and elderly men after adjustment for age at 0.001 level (OR=0.17 and OR=0.14). The association was significant even in elderly women at 1 % level (OR=0.21). However, a weak protective effect was observed in case of younger women with CVD (OR=0.35).

c) ***Relationship of consumption of vegetables rich in isoflavonoids with CVD according to age and sex :*** Frequent consumption of vegetables rich in isoflavonoids gave a strong protective effect in younger ($p<0.05$) and elderly men ($p<0.001$) after adjusting for age (OR=0.29 and OR=0.23 respectively). However, a non-significant negative association was indicated in women from both the age groups (OR=0.21 and OR=0.42 respectively).

d) ***Relationship of consumption of fruits rich in β-carotene with CVD according to age and sex :*** Age adjusted positive association was observed with frequent intake of fruits rich in β-carotene in younger ($p<0.05$) and elderly men ($p<0.001$) without CVD (OR=0.29 and OR=0.23 respectively). The association was still strong at 1 % level in case of elderly women (OR=0.22). However, a weak negative effect was observed in case of younger women without CVD (OR=0.54).

e) ***Relationship of consumption of fruits rich in vitamin C with CVD according to age and sex :*** Frequent consumption of fruits rich in vitamin C was found to be positively associated at 0.001 level after adjustment for age in men (OR=0.11 and OR=0.18 respectively). However, in case of women, age adjusted association failed to give a significant negative effect with the consumption of vitamin C rich fruits (OR=0.21 and OR=0.35 respectively).

j) ***Biochemical parameters :*** Significantly higher values for were observed for TC and HDL-C ($p < 0.001$) in men with CVD. On the contrary, high density lipoprotein fraction was found to be significantly higher in men without CVD ($p < 0.001$).

The data on lipid profile of women with and without CVD indicated significantly higher values for low density lipoprotein fraction in female cases($p < 0.001$).. On the other hand, good cholesterol i.e HDL-C was noted to be significantly higher in women without CVD as compared to the cases.

Mean values of antioxidants in the sub sample of men and women with and without CVD. The values of all the three antioxidants i.e vitamin E, vitamin C and β-carotene were found to be significantly higher ($p<0.05$) in men and women without CVD as compared to their respective cases.

Thus, higher levels of triglycerides, total cholesterol and LDL cholesterol along with lower levels of HDL cholesterol were significantly associated with increased risk of CVD.

Serum α-tocopherol, serum β-carotene, and plasma vitamin C were significantly higher in the men and women without CVD as compared to their diseased counterparts.Higher values for antioxidants vitamins in blood were observed in subjects consuming increased levels of these nutrients through diets.

SECTION III

The results of section III are summarised as follows :

a) **Site Of Oral Cancer Among The Cases**: The site of oral cancer in majority of men was sides of tongue followed by buccal mucosa and gums.

b) **Socio-demographic Profile** : The mean age of the occurrence of oral cancer in cases was 57 years. Illiteracy was as high as 3 times in the cases as compared to the controls. The economic status of the subjects revealed that slightly more than half of the total cases and controls were from lower middle income group and the other half belonging to the lower income group.

c) **Nutritional Status** : The data on the nutritional status assessed in terms of anthropometric measurements indicated that undernutrition was prevalent in $1/4^{th}$ of the total cases. One tenth of the men with and without oral cancer were found to be overweight.

d) **Dietary Information** : Diet related information was noted in terms of changes in food intake, dietary pattern, types of oil and fat consumed, nutrient intake, mean

intake of antioxidants rich foods, intake of antioxidants foods with oral cancer risk and food frequency.

i) *Changes in food intake :* The major changes made by the men with oral cancer were in hard to chew foods.

ii) *Dietary pattern* : Forty seven percent of men with oral cancer were found to be vegetarian against 84 % of their healthy counterparts. Higher percentage of the cases were also found to be consuming non-vegetarian diets (22 %) as compared to the controls (3 %).

iii) *Types of oils and fats consumed*: Consumption of groundnut oil was found to be higher by men with oral cancer (48 %) against more than $3/4^{th}$ of the men without oral cancer who were found to be consuming cottonseed oil in their daily diets.

iv) *Nutrient Intake* : The energy and protein intake was found to be significantly higher in men with oral cancer than their controls. fat intake, which was significantly higher in men with oral cancer, exceeded the daily recommendations by both the cases as well as the controls. Fibre and iron consumption was far below the RDA meeting only around $1/5^{th}$ and $1/4^{th}$ of the recommendations respectively by men with and without oral cancer. The calcium requirement was found to be exceeding the recommended allowances by the controls whereas it was deficient by 92 mg in cases.

Intake of antioxidants vitamins like β-carotene was noted to be significantly higher in men without oral cancer, the amount consumed by the subjects was far below the recommendations. Cases could meet less than $1/4^{th}$ of the RDA for β-carotene against their healthy counterpart who met just above $1/3^{rd}$ of the β-carotene requirements through their daily diets. Men with oral cancer could meet just above half the recommendations for vitamin C against more than $3/4^{th}$ of the RDA met by their healthy counterparts.

The nutrient intake data, on men (60 years and above) with and without CVD was also evaluated. Less than half of the recommendations for energy (ICMR) were met by the subjects. However, on comparison with the suggested recommendations given by Natarajan (1991), slightly more than 3/5th of the RDA were met by both the cases as well as the controls. Between the cases and controls, significantly higher protein consumption by men with oral cancer was observed ($p \leq 0.05$). The fat consumption was found to exceed the recommended levels by both the cases as well as the controls. Fibre intake was found to be less than 1/4th of the daily requirements by the elderly men with and without oral cancer. Elderly men with oral cancer could meet 3/4th of the RDA for calcium against controls who exceeded the calcium requirements, thereby showing a significant difference ($p \leq 0.05$) between the two. Around one forth of the iron requirements could be met by the cases as compared to slightly higher intakes by the controls.

A significantly higher β-carotene consumption was reported in the controls as compared to the cases. The elderly men with oral cancer could meet just below 1/4th of the RDA for β-carotene against controls who could meet slightly above 2/5th of the β-carotene requirements. Half of the RDA was met for vitamin C by the cases as compared to the controls who met around 3/4th of the vitamin C requirements.

The consumption of energy and protein was found to be between 25-50 % of the RDA by majority of younger and elderly men with and without oral cancer. Around 3/4th of the cases consumed more than 100 % of the recommended allowances for fat as compared to 55 % of their healthy counterparts. One third of the healthy men against 12 % of the cases consumed 25-50 % of the fibre requirements through daily diets. Half of the total men with oral cancer could meet less than 50 % of the calcium requirements against 59 % of the controls who could meet more than 100 % of the RDA for calcium. Similar levels were met for iron intakes by half of the total subjects with and without oral cancer.

Consumption of antioxidants vitamins like β-carotene was less than half of the recommended allowances by all the cases as against 84 % of the controls. Vitamin C intake was found to be between 1/4th - 1/2 of the RDA by majority of men with and

without oral cancer (24 % and 35 % respectively). One forth of the healthy men could also meet more than 100 % of the RDA for vitamin C against 16 % of the controls.

Majority of the elderly men with and without oral cancer were found to be consuming 25-50 % of the RDA for energy given by ICMR. However, on comparison with the energy recommendations suggested by Natarajan (1991), half of the total men with oral cancer and 41 % of the controls could meet 50-75 % of the RDA for energy. Similar observations were made for protein intake by men without oral cancer against 52 % of the cases who met 25-50 % of the protein requirements. Majority of the subjects could meet more than 100 % of the recommendations for fat. Similarly, more than 90 % of the subjects could meet only 25-50 % of the fibre and iron recommendations. Calcium intake was found to be more than 100 % of the RDA by 54 % of the controls against 36 % of the cases.

Data on consumption of antioxidants vitamins like β-carotene suggested that all the men with oral cancer could meet only less than half of the RDA for β-carotene against 79 % of their healthy counterparts. On the contrary, 32 % of the controls and 21 % of the cases could meet more than 100 % of the RDA for vitamin C.

Thus, a gross dietary inadequacy was observed with all the nutrients in men with oral cancer. Significantly higher intakes of β-carotene and vitamin C were observed in men without oral cancer as compared to the cases.

vi) ***Mean intake of antioxidants rich fruits and vegetables*** **:** The consumption of green leafy vegetables (GLVs) was found to be higher in younger men without oral cancer as compared to their diseased counterparts (180 gm vs 215 gm). Similar observations were made for fruit intake, which was noted to be lower in cases than control (74 gm vs 85 gm).

Like the consumption pattern observed in younger men subjects, intake of GLVs was found to be lower in elderly men with oral cancer than their healthy counterparts (201 gm vs 250 gm) . Similar, elderly male controls reported higher consumption of fruits as compared to the cases(65 gm vs 76 gm)..

vii) ***Food frequency*** : Frequent consumption of cereal 'bajra' and pulses did not give any significant association with the occurrence of oral cancer (OR=1.44, OR=0.67 respectively).

A protective effect was observed with the frequent consumption of GLVs (OR=0.48; *p* for trend=0.01), vegetables rich in β-carotene (OR=0.34; *p* for trend=0.0005) and vegetables rich in isoflavonoids (OR=0.56, *p* for trend=0.0005) against the disease in men without oral cancer.

Consumption of fruits rich in β-carotene, frequently, gave highly significant protective effect against the occurrence of oral cancer, in the controls (OR=0.33, *p* for trend=0.0001) whereas a non-significant negative association was also observed with frequent intake of vitamin C rich citrous fruits (OR=0.47, *p* for trend=0.06).

Intake of non-vegetarian foods (including poultry) gave a strong positive association in cases with the occurrence of oral cancer (OR=6.00). However, a weak positive association was observed with frequent intake of milk and milk products in men with oral cancer (OR=1.17)

A non-significant positive association was indicated with frequent intake of milk based sweets (OR=2.16) whereas a strong risk was observed with frequent consumption of khoa and ghee based sweets by men with oral cancer (OR=3.50, *p* for trend=0.001 and OR=3.62, *p* for trend=0.01 respectively).

Consumption of deep fried (OR=1.46) frequently by cases gave a non-significant positive association whereas intake of shallow fried snacks (OR=2.02) was found to be a strong risk factor in the occurrence of oral cancer.

Thus, frequent consumption of green leafy vegetables, vegetables rich in β-carotene and isoflavonoids along with fruits rich in β-carotene and vitamin C gave protection against oral cancer in the controls.

e) **Activity Pattern :** On an average, 48 % of the total subjects were found to be engaged in 5-8 hours of sleep along with work related and leisure time activities.

f) **Addiction Pattern :** A strong positive association was observed with smoking bidi (OR=3.33, $\chi 2$=12.58, $p < 0.0001$), alcohol consumption as well as tobacco chewing with the occurrence of oral cancer (OR=4.45, $\chi 2$=19.44, $p < 0.0001$ and (OR=2.25, $\chi 2$=3.92, $p<0.05$).

More than one third of men with oral cancer against 40 % of the controls were found to be addicted to smoking bidis since past 20-30 years followed by 23 % of the cases and controls reporting bidi addiction since 10-20 years. Majority of bidi smokers in cases (59 %) smoked more than 25 bidis per day as compared to only 5 % of their healthy counterparts. Less than 1/3rd of the men without oral cancer were found to be smoking less than 10 bidis per day.

Higher percentage of men with oral cancer (13 %) reported addiction to alcohol drinking since 15-25 years against 7 % of their healthy counterparts who were addicted to alcohol since 5-15 years.The data on amount of alcohol consumed per day was found to be more than 100 ml in more than 1/4th of the men with oral cancer. Majority (10 %) of alcohol drinkers in controls reportedly consumed less than 50 ml per day.

Tobacco addiction was found to be present in 7 % of the men with oral cancer for more than 35 years against same percentage of their healthy counterpart, who were addicted since 15-25 years. The amount of tabocco chewed per day was found to be more than 5 gm in 7 % of the cases as compared to 3 % of the controls.

Thus, addiction to smoking bidis, alcohol consumption paired with tobacco chewing increased the risk of developing oral cancer in the men.

g) **Other factors :** A highly significant association was observed in cases reporting stress (OR=3.47, $p < 0.001$). Anxiety and hot temperament which were reported by higher number of cases than controls, were also found to be positively

associated with the occurrence of oral cancer, though the association was not statistically significant (OR=1.30 and OR=1.39 respectively).Thus, stress and anxiety were found to be associated with the occurrence of oral cancer.

h) **Disease profile :** Oral cavity problems were highly prevalent in men with oral cancer. More than 3/4th of the cases reported various oral cavity problems such as missing teeth, cavities, difficulty in chewing against 45 % of the controls. Sixty percent of the cases and 44 % of the controls reported gastrointestinal problems like constipation and flatulence.

i) **Biochemical parameters :** High density lipoprotein (HDL) cholesterol was significantly higher in men without oral cancer than the cases ($p < 0.01$). Higher values were also obtained for TC, LDL-C and VLDL-C in cases.

Significantly higher values for serum α-tocopherol and plasma vitamin C ($p < 0.001$) were observed in men without oral cancer. Serum β-carotene was found to be higher in controls, however the difference between the case and the controls was not significant.

Thus, low serum α-tocopherol and plasma vitamin C were associated with the occurrence of oral cancer in men.

SECTION IV

The results of this section are summarised as follows:

a) **Knowledge of the caregivers :** It can be seen that 80 % of the caregivers had knowledge about various disorders commonly occurring with advancing age. Around 3/4th of the caregivers could tell about the physiological changes taking place in an elderly. Sixty percent of the caregivers knew about the common health complaints of the elderly. However, these health complaints were only with respect to constipation, and flatulence. More than 57 % of the caregivers had knowledge regarding the changes to be made in the diets of an elderly. These changes were mainly in terms of change in consistency of the diet. Forty two percent of the

daughters-in-law of the elderly felt the importance to consider various changes taking place with advancing age while planning / preparing meals for the elderly.

Importance of fruits and vegetables could be told by only 40 % of the caregivers. However, the responses varied from fruits and vegetables being important sources of essential nutrient to they being important for body building and normal functioning of the digestive system. When asked about the nutrients present in fruits and vegetables, only 38 % of the caregivers had knowledge about vitamins. The daughters-in-law also thought that fruits and vegetables are rich sources of carbohydrates, fats, protein, calories, and sugar. The subjects also felt that these food stuffs are rich in vitamin D and provide RBCs and heamoglobin.

Slightly more than $1/3^{rd}$ of the caregivers had knowledge about the importance of making changes in the diet of an elderly if they are suffering from any disorders. However, the only changes that they thought necessary were with respect to the minor complaints like mastication problems in which case soft or steamed food should be given.

Less than one third of the caregivers knew about the relationship between various health complaints and disorders with diet. Once again, the responses were only in terms of higher salt intake leading to hypertension, sugar in case of diabetes, and less water intake resulting in constipation.

Thus, it can be concluded that caregivers were ignorant about various physiological changes and disorders occurring with advancing age. Also, limited knowledge with respect to the relationship between diet and degenerative disorders was seen among the care givers. Certain level of misconception regarding beneficial role of antioxidants rich foods and nutrients rich in fruits and vegetables were also noted among the caregivers of the elderly.

b) **Practices of the caregivers :** More than 3/4th of the caregivers did not practice preparing separate meals for the elderly. The major reason being lack of time for preparing separate meals. Twenty two percent of the caregivers felt that preparing separate meals was very laborious.

Less than 1/5th of the daughter-in-law prepared separate meals for the elderly. these separate meals were in terms of bland diets made for the elderly with very little amount of spices and oil added.

Overall, 1/5th of the caregivers knew about these dietary guidelines for the elderly. One third of the caregivers included green leafy vegetables and fruits in the diets of the elderly. However, only 16 % of the caregivers gave these foods liberally to the elderly.

Only 12 % of the caregivers encouraged elderly to consume more than 8 glasses of fluids in a day. The subjects were found to be mainly giving encouragement for increased water consumption. Very few daughters-in-law encouraged the elderly to increase the consumption of vegetable soups and fruit juices.

Thus, it can be concluded that the actual practices of the knowledge about dietary needs of the elderly were found to be very rare by the caregivers. Cooking green leafy vegetables separately for the elderly was practiced by very few caregivers due to unavailability of the time. Also, the caregivers were not found to be encouraging the elderly to consumed more serving of fruits in either whole or juice form even though they had the adequate knowledge about the benefits of these food for the elderly.

Thus, the present study has indicated that the frequency of fruits and vegetables is inversely associated with cardiovascular diseases and oral cancer. Nutrients in whole foods, such as fruits and vegetables, may have a synergistic effect not available through dietary supplementation. It appears clear that the greatest reduction in disease risks will come from changes in deleterious lifestyle habits; benefits from such changes have been shown beyond a reasonable doubt. The benefits of smoking cessation in reduced mortality from cardiovascular diseases and cancer are

significant. Evaluation of the evidence between nutrients and health should include the entire spectrum of available scientific evidence - from cell biology, animal studies, clinical trials, and epidemiologic surveys - and consider the quality, strength, consistency, and biological plausibility of this evidence.. When assessing the completeness of a balanced portfolio of scientific evidence for making public health recommendations for selecting a particular type of food, such as fruits and vegetables, fortified food products, or nutrient supplements, the cost to the individual or health care provider is not an unimportant factor. It is worth appreciating that relative to drug and other medical therapies, nutritional interventions are very inexpensive. Thus from the present study, following recommendations can be made

RECOMMENDATIONS

- The present study doubtlessly indicates that an association exists between inadequate antioxidants status and increased risk for or poor outcome of several age-related diseases, including CVD and cancer.

- Antioxidants micronutrients do also show beneficial effects in the prevention of the chronic degenerative disorders. This effect, however, would be much stronger and consistent for antioxidants rich fruits and vegetables than for single vitamin supplements.

- This study provides additional evidence to increase fruit and vegetable intakes because the increased consumption of fruits and vegetables can enhance the plasma antioxidants capacity in humans and is associated with a lower risk for CVD and cancer.

- We recommend nutritional interventions in terms of increased consumption of fruits and vegetables as a feasible strategy in the population in comparison to other strategies such as drug treatment or caloric restrictions.

- Lifestyle changes such as excercising regularly and cessation of smoking, alcohol consumption or tobacco chewing along with higher fruit and vegetable intake would further reduce the risk of various chronic degenerative diseases.

- With the increase in age, leading to alteration and atrophy of taste buds makes the elderly prefer more of sweet, sour or salty foods. Hence, these changes should be kept in mind while planning meals for the elderly.

- Continuation of the common practice of taking two major meals a day which was observed even in the present study produce undesirable gastrointestinal disorders due to smaller gastric volume and reduced digestive enzymes. Smaller and more frequent meals are thus advocated.

- Awareness of these changes occurring with advancing age should be created among elderly themselves and their care-givers both in families to improve the health of the elderly as well as their quality of life.

- Better information, education and communication techniques will have to be utilized in multi-generational families regarding several aspects of life-style, especially dietary intake, eating and snacking habits, smoking and drinking addiction and increased occurrence of several chronic degenerative disorders. Every IEC measure, including dietary guidance targeted for the elderly within a multi-generational family should consider this as a critical issue and make efforts to overcome this.

- There is a need to develop illustrated guidelines and imparting nutrition health education in simple regional languages for assisting elderly and their care-givers in formulating adequate diet to be consumed in individual homes.

SUGGESTIONS FOR FUTURE STUDIES

- Establishing biochemical profiles of elderly individuals till recently was a neglected area. The normal reference values for adult individuals were and are commonly adopted for comparison of the biochemical parameters for the elderly sometimes leading to erroneous interpretation of diagnosis and the clinical stages of many diseases. Hence, more number of studies are required with healthy elderly individuals in different age segments to establish the biochemical profiles of elderly and also observe the variation in these parameters with increasing age.

- There is also a need to develop recommended dietary allowances for the elderly with respect to various nutrients especially energy taking into consideration various physiological changes taking place with advancing age, reduced activity level and also the accompanying different health complaints and disorders.

- Further research is required to improve our understanding of the bioavailability and function of antioxidants vitamins in our body.

- Properly designed clinical trials are required to arrive at the exact recommended dietary allowances for the Indian population with respect to the antioxidants vitamins that are required to give protection against various chronic degenerative disorders.

- Studies should be carried out to identify other nutrient and nutrient components in fruits and vegetables which act as antioxidants and prevent against the free radical damage.

- Role of antioxidants should be evaluated for specific disorders.

- Long term follow up studies are needed on antioxidants pattern from the adulthood and followed up till old age to establish their role in aging process.

- More in-depth studies are required to unfold the knowledge about the mechanism of action of protective factors in prevention of certain diseases.