The role of antioxidants in health and disease is well documented. Various factors like changing lifestyles and environment have led to great changes in the health profile of the human population. Higher stress level among individuals, sedentary lifestyle and deficient diets have increased the onset of degenerative and non-communicable diseases like cancer, diabetes mellitus and cardiovascular disease. Increase in environmental pollution whether it is noise, dust, radiation or pollutants have directly or indirectly contributed to the aggravation and sometimes onset of the above mentioned diseases.

Free radicals are generated as a consequence of natural metabolism and aggravated by some of the above factors and recent focus is on quenching the free radicals when antioxidants come into play. Many compounds, especially, vitamins and minerals have been found to have antioxidant properties and recent focus is on phytochemicals present in foods as natural sources of antioxidants. Flavonoids, polyphenols, terpenoids and other compounds have been isolated from plant foods mainly from fruits and vegetables and have been proved to possess antioxidant properties. Since there are a wide range of compounds in a single food and more than the individual phytochemicals, it is the synergistic action of the compounds that benefit.

Hence the total antioxidant capacity of foods will be a useful measure to know their antioxidant capacity. This has shifted focus on overall dietary pattern and dietary total antioxidant capacity in the preventive therapy. There are a wide variety of Indian foods indigenous to India and the data on the antioxidant capacity of these foods is scarce.

Moreover, food intake influences plasma antioxidant capacity and hence the influence of diet on plasma antioxidant capacity needs to be assessed. Considering the above facts the study entitled “Total antioxidant capacity of
commonly consumed Indian foods and Plasma antioxidant status of Indian adults’ was undertaken with the following objectives.

To

• Select commonly used Indian foods

• Estimate the total antioxidants in the selected Indian foods represented as Oxygen Radical Absorbance Capacity (ORAC) and Ferric Reducing Antioxidant Power (FRAP) values

• Estimate the total phenols in the selected foods

• Evaluate dietary intake and the total antioxidant capacity of the diet of healthy adults.

• Analyse the plasma antioxidant status of selected healthy adults.

The study was conducted in two phases. In phase I, commonly used Indian foods were selected and their total antioxidant capacity was measured by Oxygen Radical Absorbance Capacity (ORAC) and Ferric Reducing Antioxidant Power (FRAP) assay using Trolox, a water soluble analogue of vitamin E, as the standard and the values presented as µmol of Trolox Equivalents per 100 g of food, fresh weight. The total phenolic content of food was estimated using the Folin ciocaltueau method using gallic acid as the standard and the values were presented as mg of Gallic Acid Equivalents per 100g of fresh weight. The foods, except fruits, were subjected to one method of cooking and the total antioxidant capacity and total phenols in cooked foods were also estimated.

In phase II, the influence of diet on plasma antioxidant capacity was analysed for which healthy adults, both men and women, between 30-60 years of age were selected. Their dietary intake was assessed by 24-hr recall and semi quantitative food frequency questionnaire. Fasting blood sample was drawn and the plasma total antioxidant capacity was estimated by FRAP analysis.
The salient findings of the study are presented below.

**PHASE I**

- Among cereals, oats had the highest antioxidant capacity of 1092.67 µmol TE/100g and 2063.41 µmol TE/100g by FRAP and ORAC respectively followed by finger millet and whole wheat. Rice varieties had the lowest values ranging from 91.15 µmol TE/100g to 138.08 µmol TE/100g by FRAP method. Grains tend to have the phytochemicals around the bran and hence whole grains have higher antioxidant values than dehusked or dehulled grains and hence rice varieties which are dehusked and polished before use have low antioxidant capacity than whole grains.

- Among cereal products, whole wheat flour had the highest TAC of 333.37 µmol TE/100g and the least was found in semolina. When compared with whole wheat flour, the TAC value of refined wheat flour decreased by 230.84 µmol TE/100g (FRAP) showing the influence of refining process on the antioxidant capacity of grains. Similarly the TAC values of broken wheat and semolina were respectively 75.6% and 92.5% less than whole wheat flour.

- The TAC values of both rice and wheat products were comparatively low. Puffed rice had 59.3 µmol TE/100g (43%) and 27.69 µmol TE/100g (10.6%) less TAC than raw rice by FRAP and ORAC assay respectively and rice flour had 82.5% and 16.6% less TAC by FRAP and ORAC assay less than raw rice. Among wheat products, whole wheat flour had the least difference and the highest difference in TAC values was observed in semolina which had 92.9% and 94.7% less TAC by FRAP and ORAC assay respectively. Refined wheat flour was also in similar trend with semolina. These observations indicate that processing has a significant effect on the TAC of cereal grains.

- The TAC and TP values of cereals decreased after cooking. A significant reduction was observed in TAC values in both FRAP and ORAC assay. In FRAP assay, the highest reduction was observed in Finger millet where
the decrease was by 284.86 µmol and in ORAC assay the highest reduction was in Jowar which was 1220.87 µmol. Cooking of whole grains, semolina and broken wheat significantly reduced their TAC values.

- The TAC of pulses ranged from 5246.81 µmol TE/100g in soybean to 1879.16 µmol TE/100g in red gram dhal by ORAC assay and 563.61 µmol TE/100g in rajmah to 26.97 µmol TE/100g in Bengal gram whole( white) by FRAP assay.

- The total phenols ranged from 345.2 mg GAE/100g to 54.43mg GAE/100g. Rajmah had the highest total phenolic content followed by Green gram whole and Bengal gram (whole, black) while Green gram dhal had the least total phenolic content.

- Beetroot had the highest TAC value (3989.52 µmol TE/100g) by ORAC assay and ranked the second highest in TAC by FRAP assay followed by Koorkankilangu.

- Koorkankilangu had the highest phenolic content of 559.39 mg GAE/100g followed by Yam. The Onion varieties had the lowest phenolic content.

- Contrary to the TAC values cooked cereals and pulses, the TAC values of root vegetables increased considerably after cooking. The increase observed was between 12.8 percent and 49.9 percent by ORAC assay, and by FRAP assay the highest increase was observed in potatoes which increased from 5.34 µmol TE/100g to 217.15 µmol TE/100g (3963 percent).

- In both assays curry leaves had the highest antioxidant capacity and spinach had the least. The amaranth varieties ranked second and had higher TAC values than drumstick, coriander, mint and fenugreek leaves. Curry leaves have also been reported to have comparatively the highest antioxidant capacity by other antioxidant assays. Among fresh leaves, Curry leaves had the highest phenolic content of 703.42 mg GAE/100g and mint leaves had the least total phenols of 154.01 mg GAE/100g.
Among fruits pomegranate had the highest TAC and TP values.

Comparitively green leafy vegetables had the highest antioxidant capacity followed by fruits and vegetables.

**PHASE II**

The assessment of dietary intake of healthy adults revealed that

- A majority did not consume whole grains or millets. The average consumption of cereals among men was 327g and among women it was 230g. The intake of vegetables and fruits was less than the recommended dietary intake for Indians and the consumption of green leafy vegetables was very less which was 13.7 g in women and 12.4g in men.

- The calorie intake from the diet almost met the requirements and the contribution of carbohydrates, proteins and fat to the calories was 67, 10 and 23 percent in men and 63,10 and 27 percent in women.

- The average dietary TAC was 1748.3 µmol TE and 1968.9 µmol TE in women and men respectively. The average dietary TP was 462.5 mg GAE and 525.8 mg GAE in women and men respectively.

- The food intake by 24 hr recall and semi quantitative food frequency questionnaire was comparable.

- The blood parameters, namely, fasting blood glucose, lipid profile, urea, uric acid were within the normal range in all the subjects.

- The plasma TAC ranged between 300 – 900 µmol TE/ L in the selected subjects. The average plasma TAC in women was 537.67 µmol TE/ L and in men it was 650.5 µmol TE/ L.

- No correlation was observed between the blood parameters and plasma TAC except for uric acid levels, where a significant positive correlation was observed.
The analysis of intake of food across the quartiles of plasma TAC revealed that the fruits and vegetables, especially, green leafy vegetables significantly contribute to the plasma TAC.

Green leafy vegetables, despite the low intake, contribute to 38 percent and 48 percent of dietary TAC in men and women respectively followed by fruits. They were also the major contributors of the dietary TP content.

In conclusion, foods commonly consumed in India, especially, green leafy vegetables, some root vegetables and fruits have high antioxidant capacity. Cooking of foods has a profound influence on antioxidant capacity. The dietary TAC influences the plasma TAC and hence inclusion of foods rich in TAC will improve the plasma TAC. The TAC and TP values of foods will be useful in choosing antioxidant rich foods. However, further in-depth research validating the association between the above variables and gender differences in Plasma TAC need to be done to strengthen the results.