Today there is unprecedented interest by consumers, public health organizations, and the medical community to improve health and wellness through dietary means. This interest arises in large part from the increased rates in adverse diet related health conditions such as obesity, late onset diabetes and cardiovascular diseases (Halliwell and Gutteridge, 2007). Clinical trials and epidemiological studies have established an inverse correlation between the intake of fruits and vegetables and the occurrence of diseases including inflammation, cardiovascular diseases, cancer and aging related disorders (Wang et al., 2012). The cancer and other disease preventing action supposedly reside in the fact that vegetables contain not only abundant nutritional bioactive compounds, but also a great quantity of non nutritional phytochemicals such as phenolics (Wach et al., 2007). Furthermore, vegetables are very low in calories and can usually be consumed in their fresh state, and also after processing and cooking. A calorie restricted diet decreases chemically induced tumour incidence and increases life expectancy, reducing oxidative damage, and altering rates of cell division. This fact not only attenuates the generation of reactive oxygen species (ROS) by liver mitochondria, but also alters the activities of the electron transport chain (Hwang and Bowen, 2007).

In general, antioxidant is a substance that opposes oxidation or inhibits reactions promoted by oxygen or oxides or peroxides, many of the substances being used as preservatives in various food products. The more biologically relevant definition of antioxidants is synthetic or natural substances added to products to prevent or delay deterioration by action of oxygen. In terms of biochemistry and medicine antioxidants are defined as organic substances that are capable of counteracting the damaging effects of oxidation in animal tissues (Huang et al., 2005). Halliwell et al. (2005) defined biological antioxidants as molecules which, when present in small concentrations compared to the bio molecules, can protect, prevent or reduce the extent of oxidative destruction of bio molecules. These antioxidants can deactivate reactive species by two major mechanism, namely electron transfer and hydrogen atom donation. Antioxidant compounds may also act as metal chelators and interfere with the pathways that regulate cell division and proliferation and detoxification; they also may regulate inflammatory and immune responses, and may have anti-ulcerative properties (Hamauzu et al., 2008). The area of natural antioxidants developed extremely in the past decade mainly because of limitation.
on the use of synthetic antioxidants (butylated hydroxyanisole-BHA, butylated hydroxytoluene- BHT, ter-butylhydroquinone- TBHQ, propyl gallate- PG and tocopherol) which cause liver damage and their possible toxic and carcinogenic effect (Akki et al., 2014). Therefore, the interest has increased for effectiveness of naturally occurring compounds with antioxidant properties (Brewer, 2011). The plant based or vegetable antioxidative property is mainly due to the phenolic compounds (phenols, flavonoids, tannins etc.), vitamin E, ascorbic acid and carotenoids (Huang et al., 2005).

The phenolic compounds comprise a diverse group of molecules classified as secondary metabolites in plants that have large range of structure and functions. These can be classified into water soluble compounds (phenolic acids, flavonoids, phenylpropanoids and quinines) and water insoluble compounds (tannins, lignins and cell wall bound hydroxycinnamic acid) (Rispail et al., 2005). Phenolic acids are divided in two groups: one derived from cinnamic acid and the other from benzoic acid. Hydroxycinnamic acid consists mainly of coumaric, ferulic and caffeic acid while the most commonly acids derived from the benzoic acid are gallic acid and ellagic acid. On the other hand flavonoids itself are the largest group of polyphenols and are divided into six subclasses: flavonols, isoflavones, anthocyanins, flavanols, flavones and flavanones. All of them share two benzene rings joined by a linear three carbon chain and a common carbon skeleton of diphenyl propanes. The tannins are a group of polyhydroxy flavan-3-ol oligomers and polymers with carbon-carbon linkage between flavanol subunits (Schofield et al., 2001). Another category of phenolics is stilbenes. Low quantities of stilbenes are present in human diet and their main representative is resveratrol, mostly in the glycosylated form (Delmas et al., 2006; Ignat et al., 2011). The fifth group of polyphenols comprises the lignans which are produced by oxidative dimerization of two phenyl- propane units usually occurring as glycosioles (Aehle et al., 2011).

The main phytochemicals which are responsible for antioxidant properties are phenolic compounds. The antioxidant activity of phenolics is mainly due to their redox properties, which allow them to act as reducing agents, hydrogen donators, and singlet oxygen quenchers. The effectiveness of antioxidants to scavenge free radicals of foods depends on the bond dissociation energy between oxygen and phenolic hydrogen, the bond dissociation energy for O-H of the phenolic antioxidants also predicts the stabilization of antioxidant radicals. The lower the bond dissociation energy for the O-H group of the antioxidants, the more stable the antioxidant radical. The antioxidants with
low bond dissociation energy are thus more efficient hydrogen donors and better antioxidants. The O-H bond strength of phenolic antioxidants is affected by substitution of hydrogen in a benzene ring. The antioxidant activity of the phenolic antioxidants is dependent on the balance between the electron donating effect of the substituents and the stearic crowding around the phenolic OH groups which is related to the position of the substituent’s (Amorati et al., 2007). Many mechanisms have been proposed to explain biological protective effects of polyphenols, which, for several years, have been often ascribed mainly to their antioxidant capacity. However, this view is now challenged by recent findings, and more complex actions are being investigated. Because of very low bioavailability of polyphenols and difficult translation of in vitro findings regarding antioxidant actions in to in vivo actions, the overall cellular antioxidant activity of the polyphenols appears to be debatable. The food scientists have only recently begun to evaluate the actual contribution of these bioactive compounds, such as active antioxidants, after their consumption. The ingestion of fruits containing a large amount of polyphenols is not usually correlated with highest concentrations of active metabolites of these polyphenols (capable of antioxidant effects) in the human body (Manach et al., 2004; Palafox-Carlos et al., 2011). This can generally be explained by differences in bioaccessibility and bioavailability of polyphenols from fruits and other foods, which directly influence antioxidant effects in vivo (Manach et al., 2004; Palafox-Carlos et al., 2011).

Considering these findings, in the past few years, the dimensions of research on polyphenols have expanded beyond antioxidant activity unveiling several nutritional, pharmaceutical and biological activities of these compounds in light of more complex molecular level mechanisms (Visioli et al., 2011). Studies have demonstrated that, besides antioxidant and anti-inflammatory capacities, phenolics may engage with cellular signalling flow, controlling the action of transcription factors and subsequently affecting the expression of those genes involved in cellular metabolism and cellular survival (Chiva-Blanch and Visioli, 2012; Giampieri et al., 2014; Forbes-Hernandez et al., 2014). The beneficial effects of polyphenols in skin applications as anti-inflammatory agents has been ascribed to the capacity of polyphenols in altering signal transduction and epigenetic regulation of gene expression (Pastore et al., 2011; Pastore et al., 2012; Rhodes et al., 2013). Another indirect way through which polyphenols may exert antioxidative protection is that these bioactive compounds might increase gene transcription of a factor
that regulates enzymes involved in the antioxidant function (Na and Surh, 2008). The biological effects of polyphenols on metabolically active tissues affect insulin sensitivity, inflammation, lipid metabolism which could be triggered by activation of peroxisome proliferation activated receptors (PPARs) by polyphenols (Cho et al., 2010).

For estimation of antioxidant activity, the extraction of phenolic compounds is most important step and the selection of an appropriate solvent system is one of the most relevant steps in optimization the recovery of TPC, TFC and other antioxidant compounds from sample (Goli et al., 2004). The solvent extraction is most frequently used technique for isolation of plant antioxidant compounds. The wide range of polyphenolic compounds are embedded in the plants having different structure and chemical formula therefore, no specific or appropriate solvent is recommended for optimal recovery of total phenolic content (Prior and Gu, 2005). The recovery of phenolic compounds in different solvents is influenced by the polarity of extracting solvents and the solubility of this compounds in the solvent used for the extraction process (Lapornik et al., 2005). Polar solvents are frequently employed for the recovery of polyphenols from a plant material. With change in solvent polarity its ability to dissolve a special group of antioxidant compounds gets altered and influences the antioxidant activity estimation (Zhou et al., 2004). For the change in solvent polarity, vapour pressure and viscosity of antioxidant compounds that are being dissolved in the solvent also varies. As a result of this the observed antioxidant activity of the extracts also varies (Turkmen et al., 2005; Alothman et al., 2009). The most suitable of these solvents are water, ethanol and methanol (Naczk and shahidi, 2004; Peschel et al., 2006; Hayouni et al., 2007) acetone, propanol (Antolovich et al., 2000). Along with the extraction solvents, extraction method is also an important step in the isolation, identification and optimization of the recovery of antioxidant compounds. There is no single and standard method for extraction of polyphenolic compounds. Although, solvent extraction is the most commonly used technique for the isolation of phenolic compounds (Bucic-Kojic et al., 2007). Solvent extraction as a function of the biomass status may be liquid-liquid extraction or solid-liquid extraction. Inspite of extraction solvent and methods, there are various parameters like temperature, time of extraction and nature of sample, which may also affect the yield as well as antioxidant potential of the extracts.

The measurement of antioxidant potential in vegetables is influenced by many factors. Due to the complex nature of phytochemicals, no agreed single standard method
can be used to determine the antioxidant capacity accurately (Umesh et al., 2010). There is an increasing demand for highly sensitive and selective analytical method for the determination of polyphenols (Liu et al., 2008). Despite a great number of investigations, the separation and quantification of different polyphenolics remains difficult, especially the simultaneous determination of polyphenolics of different groups (Tsao and Yang, 2003). A number of spectrophotometric methods have been developed for the quantification of plant phenolics. The Folin-Ciocalteu assay is widely used for determining total phenolics (Lapornik et al., 2005) while the total flavonoids content can be determined using a colorimetric method based on the complex action of the phenolic compounds with aluminium chloride (Huang et al., 2009). The main disadvantage of the spectrophotometric assay is that these only give an estimation of the total phenolic contents. These methods neither separate and nor gives quantitative measurement of individual polyphenolic compounds. Therefore, chromatographic techniques such as HPLC, GC-MS and HPTLC are use for the identification and quantification of particular phenolic compounds. The HPTLC has been used to determine individual antioxidant capacity of target compounds and might be of interest to the routine chemical or biological screening (Cimpoiu, 2006). In this TLC on silica gel plates is widely useful for the rapid and low cost separation and identification of the polyphenols. Densitometric quantification analysis of polyphenol extracts is usually performed by scanning the TLC plates with UV light at wavelength of 350-365 nm or 250-260 nm (Rastija and Medic-Saric, 2009). However, the antioxidant capacity is mainly evaluated through chemical methods such as DPPH free radical scavenging assay, ferric reducing antioxidant power (FRAP), ferric thiocyanate assay (FTC) and thiobarbituric acid assay (TBA).

The Cucurbitaceae or gourd family is a distinct family without any close relative. This family contains 121 genera and about 1760 species; most of the species are climbers or trailing herbs, usually with tendrils, and are rarely shrubs or trees (Schaefer et al., 2008). Cucurbitaceae are usually hairy climbers with simple or branched tendrils, yellow or whitish unisexual flowers, inferior ovary with parietal placenta and numerous relatively large seeds (Sahaefer and Renner, 2011). They are considered to be Asian origin and probably originated in the Late Cretaceous some 60 million years ago (Schaefer et al., 2009). These plants are cultivated in tropical and subtropical regions with hotspots in South Asia, West Africa, Madagascar and Mexico. The principal vegetable species into Gourd family are bitter gourd (Momordica charantia), bottle gourd
(Lagenaria siceraria), ridge gourd (Luffa acutangula), sponge gourd (Luffa cylindrica), pointed gourd (Trichosanthes dioica), pumpkin (Cucurbita maxima) and summer squash (Cucurbita pepo).

The gourd vegetables are considered as common men vegetables having traditional impotence in Indian Ayurveda since ancient times. The medicinal usefulness of these vegetables are due to the presence of bioactive constituents such as amino acids, alkaloids, flavonoids, sterols, terpenoids, saponins, cucurbitacins aglycones and phenyl amines (Jeffrey, 1990). Cucurbitaceae vegetables are unique in nature having composition of the entire essential constituents required for good health (Rahman, 2003). Among healthy plant foods, with health benefits crops from the family gourd (also known as Cucurbitaceae) have the focus of numerous epidemiological and clinical studies (Nagarani et al., 2014). Gourd vegetables, in particular those included into the order cucurbitals are good source of a variety of nutrients and heath promoting phytochemicals (Saha et al., 2010; Dhiman et al., 2012). Studies have revealed the presence of a wide range of secondary metabolites including flavonoids, triterpenoids, saponins and phenolic acids in gourd vegetables possessing distinct biological activities (Rizvi et al., 2009). Gourd vegetables such as L. siceraria, L. cylindrica, Luffa acutangula and Cucurbita pepo have been reported for the presence of secondary metabolites such as alkaloids, flavonoids, glycosides, steroids and saponins, which possess antioxidant activity (Irshad et al., 2010). The antioxidant activity of Mamordica charantia and Cucurbia maxima has been attributed mainly to their phenolic acids content (Ibrahim et al., 2011; Kubola & Siriamornpun, 2008). Seeds of fruit parts of some gourds are reported to possess purgative, emetics and anthelmintics properties due to the secondary metabolites (Rahman et al., 2007). Cucurbitacins mainly found in the cucurbitace family, having great interest because of the wide range of biological activities like antioxidants, anti-inflammatory and inhibit the proliferation of cancer cells (Tannin-Spitz et al., 2007). Some cucurbits have ribosome inactivation proteins (RIPs), which are well known for the selection of biological activities and possess antiviral, antitumor, and immunomodulatory activities (Puri et al., 2009).

Most dietary vegetables are consumed in cooked form according to the recipes and the culinary traditions of the various countries. In Asian countries including India, vegetables are usually consumed after cooking by various means such as boiling, frying, steaming, baking, roasting and microwaving. These thermal treatments of foods include
several biological, physical and chemical modifications leading to sensory, nutritional and textural changes. Cooking increases food safety as a result the destruction of microorganisms and the inactivation of anti-nutritional factors. A second beneficial effect of cooking is the enhancement of the digestibility of the food and the bioavailability of nutrients. Cooking is also involved in the formation of desired compounds such as flavour compounds, antioxidants and colouring agents. When vegetables are submitted to cooking process variation appears in their antioxidant activity or scavenger capacity. These variations depends on the vegetable themselves (bioactive structure), the cooking method, the bioavailability of phenolics (Sultana et al., 2008), temperature, cutting, chopping (Makris and Rossiter, 2001), stability of structure to heat (Pedraza-Chaverri et al., 2006). Previous studies conducted on various vegetables including gourd vegetables showed that after cooking, total polyphenols content and antioxidant activity of the vegetable samples can be higher or lower compared to fresh vegetables. Boiling and stir frying have been reported to show a reduction in the total phenolic content but an increase in the free radical scavenging activity of the cooked samples of pumpkin (C. moschata) (Azizah et al., 2009). Saikia & Mahanta (2013) have reported both positive and negative impact of cooking on the phytochemicals and antioxidative activity of bottle gourd and teakle gourd. Jimenez-Monreal et al. (2009) have reported that free radical scavenging activity of boiled and fried C. pepo reduced considerably over its raw counterparts. Total antioxidant activity has been reported to increase in the cooked bitter gourd (Ng et al., 2011). Turkmen et al. (2005) showed that there is no significant loss in antioxidant activity, with the exception of some losses of phenolics in squash and peas. Variable effects of different cooking treatments have been reported by Sengul et al. (2014) on various vegetables including beet root, turnip, cabbage and broccoli. Alteration in the total antioxidant content and activities due to different heat processing methods is of scientific importance, especially its impact on dietary nutrition. The increase in antioxidant activity of vegetables after cooking could be due to (1) the liberation of high amounts of antioxidant components due to the thermal destruction of cell walls and subcellular compartments; (2) the production of stronger radical-scavenging antioxidants by thermal chemical reaction; (3) suppression of the oxidation capacity of antioxidants by thermal inactivation of oxidative enzymes; (4) production of new non nutrient antioxidants or the formation of novel compounds such as maillard reaction products with antioxidant activity (Morales and Babel, 2002). However, it is not clear to what extent each possible factor contributes to the increase in activity (Yamaguchi et al., 2003). On
the other hand the possibility for decrease in antioxidant activity may be due to the thermal destruction and breakdown of some heat labile polyphenolic compounds (Hunter and Fletcher, 2002; Ismail et al., 2004). Maceration, heating and various preparation steps can result in oxidation, thermal degradation, leaching and other events that lead to lower levels of antioxidants in processed foods (Shi and Le Maguer, 2000).

The antioxidant bioactive phytochemicals are embedded in the food matrix and their distribution, associations as well as organization in food matrix obviously depend upon a particular food matrix. The varied chemical composition and structure of the phytochemicals add more complexity and variation to their antioxidative activity. Therefore, inconsistent effects of different heat processing treatments are expected on the antioxidant activity of the extracts of heat processed vegetables. Therefore, in light of the above facts it becomes imperative to explore the crop specific effects of different heat processing treatments on the antioxidant compounds and their activity. Therefore, the present study was pursued with the following specific objectives.

1. Qualitative and quantitative testing for the presence of various phytochemicals present in traditional vegetables of gourd family i.e. bitter gourd (Momordica charantia), bottle gourd (Lagenaria siceraria), ridge gourd (Luffa acutangula), sponge gourd (Luffa cylindrica), pointed gourd (Trichosanthes dioica), pumpkin (Cucurbita maxima) and summer squash (Cucurbita pepo).

2. Assessment of the antioxidant potential of raw fruits of bitter gourd (Momordica charantia), bottle gourd (Lagenaria siceraria), ridge gourd (Luffa acutangula), sponge gourd (Luffa cylindrica), pointed gourd (Trichosanthes dioica), pumpkin (Cucurbita maxima) and summer squash (Cucurbita pepo).

3. Assessment of the antioxidant potential thermally processed fruits of bitter gourd (Momordica charantia), bottle gourd (Lagenaria siceraria), ridge gourd (Luffa acutangula), sponge gourd (Luffa cylindrica), pointed gourd (Trichosanthes dioica), pumpkin (Cucurbita maxima) and summer squash (Cucurbita pepo).

4. To assess the free radical scavenging properties of raw and thermally processed fruits of bitter gourd (Momordica charantia), bottle gourd (Lagenaria siceraria), ridge gourd (Luffa acutangula), sponge gourd (Luffa cylindrica), pointed gourd (Trichosanthes dioica), pumpkin (Cucurbita maxima) and summer squash (Cucurbita pepo).