NUTRIENT AND NON-NUTRITIVE BIOACTIVE COMPOUNDS OF ORGANICALLY AND CONVENTIONALLY GROWN LEAFY VEGETABLES

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Introduction

Organic food sector is one of the fastest growing food sectors in developed countries (Crinnion, 2010). Organic foods are foods that are produced using methods that do not involve modem synthetic inputs such as synthetic pesticides and chemical fertilizers, do not contain genetically modified organisms, and are not processed using irradiation, industrial solvents, or chemical food additives (Allen et al., 2007). Organic farming practices also improve soil quality, enhance biodiversity and reduce the effect of global warming. These changes in farming practices can affect the overall quality of the crop which includes nutritional quality, bioactive compounds, sensory attributes and level of contaminants

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Materials and Methodology:

Research is a systematic and refined technique of thinking, employing specialized tools, instruments and procedures in order to obtain a more adequate solution of a problem than would be possible under ordinary means. It starts with a problem, collects data or facts, analyze them critically and reaches to a decision based on the actual evidence. The purpose of any research work is to discover the answer to the question through the application of a scientific procedure

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The present study entitled 'A comparative study on consumer perception, sensory attributes, nutrients and pesticide residue level among organic foods and conventional foods' is an attempt to find out whether organically grown foods differ from conventionally grown foods. To fulfill the objectives specified in the study, six different research activities were carried out which are as follow: As discussed in the review, some studies were in favour of organic foods and some studies did not find any difference in various qualitative attributes of organic and conventional foods. Besides this, a very few studies were carried out on comparison of various aspects of organic and conventional foods. Hence, the present study was planned with the following objectives.

All the organically grown foods selected for the study were procured from certified organic farm/store. Similar varieties of the food commodities from conventional origin were procured from local farms and market of Anand or Ahmedabad, Central Gujarat, India. 1 Kilogram of each commodity was purchased and directly brought to the analytical laboratory. The analytical research activities were carried out in the laboratory of Foods and Nutrition at P.G. Department of Home Science, Sardar Patel University, Vallabh Vidyanagar, Gujarat, India. All these samples were studied for various nutrient parameters and bioactive compounds are as listed in table -3.1.1 All the food commodities were cleaned and the edible portion of fresh samples (Fruits and Vegetables) were pulped without addition of water or other solvent using a blender (Philips Ltd.) while dried samples (Cereals, Pulses, Split Pulses, Spices, Oilseeds) were powdered using a grinder (Philips Ltd). The pulp/powder of thesample was mixed thoroughly and used for the analysis of the following parameters

Nutrient parameters:

1. Calcium (Clark and Collip,1925)
2. Iron (Ramsay, 1969)
2. Phosphorus (Fiske and Subbarao, 1925)

Nutrient and non-nutritive bioactive compounds of organically and conventionally grown leafy vegetables:

Plant foods are excellent source of many nutrients which are essential to maintain good health. Macro-nutrients like carbohydrates, protein, fat and micro-nutrients like vitamins and minerals play a specific role in various

metabolisms for the growth and maintenance for positive health. Many epidemiological studies reported interrelationship between fruits and vegetables (Rissanen et al., 2003; Hung et al., 2004; Subhashree et al.,2009), cereals (Sarwar et al., 2013), pulses and split pulses (Villegas et al., 2008), spices and condiments (Krishnaswamy, 2008; Iyer et al., 2009) intake and prevention of degenerative diseases like cancer, cardiovascular diseases and hypertension. Apart from nutrients, all the plant foods also contain non nutrient bioactive compounds which comprises of antioxidants that scavenge the free radicals and prevent the damage caused by them. Different plant contains different types of phenolic compounds such as phenolic acids (hydrobenzoic acid, hydroxycinnamic acid, chlorogenic acid, caffeic acid), flavonoids, flavanols, falvonols,flavones, flavanones, isoflavones and lignanes. During cultivation period of various plant foods, these nutrients and phenolic compounds get affected by different farming practices, geographical location, genotypes, season etc.

This section discusses the results obtained for the proximate composition and nonnutritive bioactive compounds of organically and conventionally grown foods. Moisture, ash, fat, protein, calcium, iron, phosphorus, total phenol, flavonoid and total antioxidant capacity (DPPHRSA) were analyzed from the studied food commodities, p-carotene and ascorbic acid were analyzed from vegetables and fruits. Fat and protein were analyzed for cereals, pulses, split pulses and nuts. Spices and condiments were studied for antioxidant profile. All the parameters were analyzed using standard methods. The results of moisture and ash (calcium, iron and phosphorus) content of organically andconventionally grown leafy vegetables are presented in table.

Leafy Vegetable	Farming Practice	Calcium (mg%)	Iron (mg%)	Phosphorus (mg%)
Fenugreek leaves	Organic	423.29	1.70	44.35
	Conventional	253.09	10.92	73.02
Spinach	Organic	369.28	1.75	35.11
	Conventional	378.86	1.44	22.47
Amaranth leaves	Organic	507.14	11.13	73.11
	Conventional	263.09	10.92	73.02
Coriander leaves	Organic	109.26	0.89	52.23
	Conventional	73.68	0.62	42.63
Mint leaves	Organic	201.95	18.19	50.59
	Conventional	109.06	10.62	50.25
Radish leaves	Organic	114.54	0.20	58.97
	Conventional	66.45	0.13	75.74

Ash content of organically and conventionally grown leafy vegetables, the lowest ash content was found in colocasia leaves while the highest ash was found in amaranth leaves in both the cultivation systems. Except spinach, all the organically grown leafy vegetables contained higher levels of ash as compared to conventionally grown leafy vegetables. Calcium content of organically grown leafy vegetables ranged from 109.26 mg%(coriander leaves) to 507.14mg% (amaranth leaves) while in conventionally grown leafyvegetable samples, it ranged from 73.68 mg% (coriander leaves) to 505.78 mg% (fenugreek leaves). Except fenugreek leaves and spinach all the organically grown leafy vegetables contained significantly ($p<0.01$) higher calcium content than their conventional counterparts.

The highest iron content was observed in mint leaves among organic (18.19 mg%) which was followed by >amaranth leaves (11.13 mg%) > spinach (1.75mg%) > fenugreek leaves (1.70mg%) > coriander leaves (0.89 mg%) > radish leaves (0.20 mg%). Among conventional leafy vegetables, the descending sequence of iron content was colocasia leaves (12.62 mg%) > amaranth leaves (10.92 mg%) > mint leaves (10.62mg%) > fenugreek leaves (1.50 mg%) > spinach (1.44 mg%) > coriander leaves (0.62mg%) > radish leaves (0.13 mg%). Organic colocasia leaves, amaranth leaves and spinach showed significantly ($p<0.01$) higher iron content than their conventional counterparts.

Phosphorus content of organically grown amaranth leaves (73.1 lmg %), spinach (35.11 mg%), coriander leaves (52.23 mg%),and mint leaves (50.59mg%) was found higher than their conventional counterparts. While conventionally grown fenugreek leaves (44.43mg %) and radish leaves (75.74mg%) contained higher phosphorus content than their organic counter parts. When the agricultural systems were compared, a significant ($p<0.01$) difference was observed for spinach, coriander leaves and colocasia leaves. In the present study, calcium, iron and phosphorus content were found higher in majority of the leafy vegetables. It is supported by the various researchers who have mentioned that organic foods have higher mineral content. Citak and Sonmez (2010) have reported that season and type of fertilizers used in organic farming may affect the mineral content

of the organically grown leafy vegetables. They concluded that the type of bio-fertilizer, its combination and season affect the mineral content of leafy vegetables. Ruuml (2011) observed that plant grown in soil treated with sodium chloride (NaCl) salt has higher mineral content. The author mentioned that the nutrient concentrations in plant tissues like leaves, roots, shoots and pods of fenugreek was strongly affected by all salt treatments. Phosphorus, iron, manganese and zinc increases while calcium and potassium were reduced after the treatment.

Herencia et al. (2011) have agreed with the findings of the present study pertaining to phosphorus content of vegetables. They have also found that organically grown vegetables contained higher phosphorus content as compared to the conventional ones. The similar values for various minerals of conventional leafy vegetables were observed by Uusiku et al. (2010). They mentioned that calcium content of amaranth leaves ranged from 253^425 mg% which support the calcium content of conventional amaranth leaves in the present study (263.09 mg%). Organic amaranth leaves contained higher value for calcium as compared to this range. In the present study, the iron content of amaranth leaves was found below the iron content of mint leaves. Unlike, Singh et al (2001) have reported higher iron content for mint leaves and spinach as compared to amaranth leaves. However discrepancy was noticed for spinach as it contained less iron content than amaranth leaves.

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