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Phytonutrient Profile and Applications of Selected Edible Foliages in *Kashayams*

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INTRODUCTION

The term medicinal plants include various types of plants used in herbalism and some of these plants have medicinal activities. These medicinal plants are considered as a rich resource of ingredients which can be used in drug development and synthesis. Besides, these plants play a critical role in the development of human cultures around the whole world. Moreover, some plants are considered as important sources of nutrition and as a result of that these plants are recommended for their therapeutic values. Such plants include ginger, green tea, walnuts etc. Other plants and their derivatives are considered as important sources of active ingredients which are used in aspirin and toothpaste (Hassan, 2012).

The term phytonutrients/phytochemical refers to a classification system of botanical chemicals. Broadly stated, phytochemicals are chemicals that plants produce to perform metabolic functions. Phyonutrient, within the context of natural health and nutrition, has come to refer to bio- active plant chemicals that humans eat and have or may well have significant positive effects on human metabolism (Bradbury, 1988). The phytonutrients under the current study are:

Total Antioxidants

It is widely accepted that a plant-based diet with high intake of fruits, vegetables, and other nutrient-rich plant foods may reduce the risk of oxidative stress-related diseases. The large majority of the phytochemicals present in these plant foods are redox active molecules and therefore defined as antioxidants. Antioxidants can eliminate free radicals and other reactive oxygen and nitrogen species. It is hypothesized that antioxidants originating from foods may work as antioxidants in their own right in vivo, as well as bring about beneficial health effects through other mechanisms, including acting as inducers of mechanisms related to antioxidant defense, longevity , cell maintenance and DNA repair (Mohan, 2010).

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Ash

Ash is one of the components in the proximate analysis of biological materials, consisting mainly of non-organic, carbonates and bicarbonates and metals. It is the name given to all compounds that are not considered organic or water. It includes metal salts, which are important for processes requiring ions such as Na+ (Sodium), K+(Potassium), Ca2+ (Calcium). It also includes trace minerals, which are required for unique molecules, such as chlorophyll and hemoglobin. All foods digested in our bodies metabolize, or burn down to an ash residue. This ash residue can be neutral, acidic, or alkaline, depending mostly on the mineral content of the original food (Salunkhe, 1982).

Calcium

Calcium is a very important mineral in human metabolism, making up about 1-2 percent of an adult human's body weight. In addition to its widely known role in bone structure, calcium is used to help control muscle and nerve function, as well as to manage acid/base balance in our blood stream. Calcium in combination with phosphorus, is a component of bones and teeth, giving them strength and hardness (Titchenal, 2007).

Iron

A number of plant foods are also rich in iron. The best sources of iron are green leafy vegetables like amaranth, drumstick leaves, cauliflower greens, lotus stem and dates etc. All of the tissues in our body need a near constant supply of oxygen to maintain life. The principal role of iron is to deliver oxygen to body tissues. It is a component of hemoglobin, the coloring matter of red blood cells. Iron is utilized by enzymes that are involved in the making of aminoacids, hormones and neurotransmitters (Cooksey,1983).

Vitamin C

Ascorbic acid is well known for its antioxidant activity, acting as a reducing agent to reverse oxidation in liquids. When there are more free radicals (reactive oxygen species, ROS) in the human body than antioxidants, the condition is called oxidative stress, and has an impact on cardiovascular disease, hypertension, chronic inflammatory diseases, diabetes as well as on critically ill patients and individuals with severe burns. Individuals experiencing oxidative stress have ascorbate blood levels lower than 45 µmol/L, compared to healthy individuals ranging between 61-80 µmol/L (Milton, 2003).

METHODOLOGY

Sample Preparation

Fresh foliages namely papaya, guava, radish and cauliflower leaves were used for both recipe preparation and analysis. Another set of fresh leaves was washed and allowed to sundry. Then the semi dried foliages were spread on a tray and kept in an oven for five hours at 100^0c for further drying. The dried foliages were powdered in the mixer. Both the fresh and dried foliages were used for the preparation of *kashayam*.

Formulation and Acceptability of *Kashayam* Prepared with Fresh and Dried foliages

Kashayams are magical medicinal drinks conjured with a few simple kitchen ingredients. This singular drink takes less than five minutes to prepare and can cure nausea, common cold, indigestion, lack of appetite and even aches and pain.

Ten gram of the leaves were washed, shredded and boiled with 200ml of water along with the other ingredients namely, jaggery, ginger and cardamom. It was allowed to boil till the quantity reduced to half the volume, filtered and transferred to serving cups. The *kashayam* was served warm for organoleptic evaluation by a team of 10 panel members. The recipes were compared against *thulasi kashayam* prepared in the same way (as *thulasi* is a common leaf used for such preparations).The same procedure was followed for the dried powdered leaves using one gram of the powder (Plates 1and 2)

PLATE-1

Kashayams Made With Fresh Foliages

PLATE-2

Kashayams Made With Dried Foliages

The following phytonutrients present in the fresh leaves were determined in triplicates.

The total ash content was determined using muffle furnace, calcium by titrimetric method, iron by Wong's method, vitamin C using 2,6 dichloro phenol dye and total antioxidants by DPPH method.

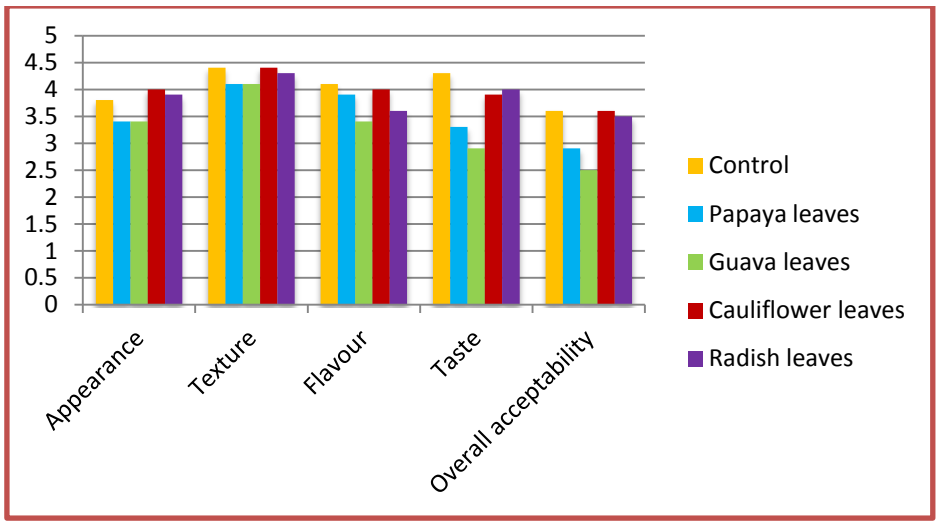
RESULTS AND DISCUSSION

1. **Results of Organoleptic Evaluation**

a. **Mean Organoleptic Scores of *Kashayam* made with Fresh Foliage**s

FIGURE 1

Mean Organoleptic Scores of *Kashayam* Made with Fresh Foliages

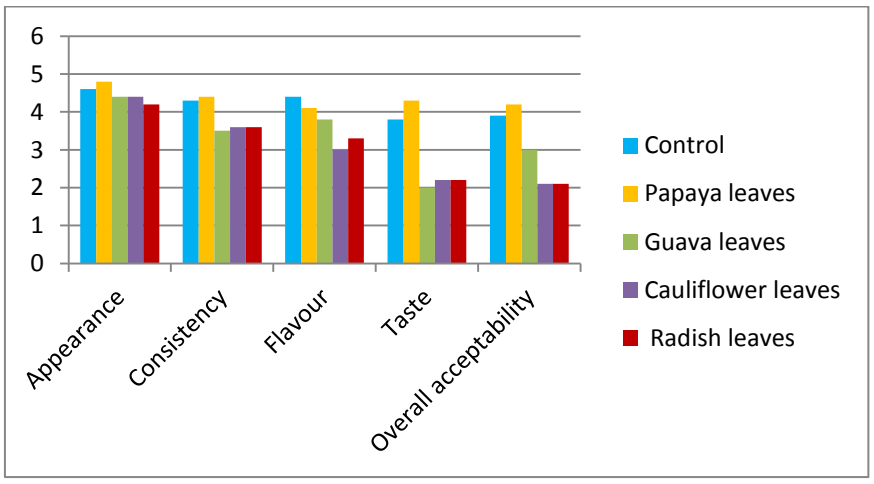


The mean scores of cauliflower leaves *kashayam* (Figure 1) for appearance, texture and overall acceptability were greater than that of control, papaya, guava and radish leaves. The mean scores obtained for taste was the maximum for *kashayams* made with thulasi leaves (control). *Kashayam* made with guava leaves had obtained low scores of 2.9 and 2.5 respectively for taste and overall acceptability. It is clear that the acceptability of control and cauliflower *kashayam*s was greater than the other leaves selected for the study. All the criteria of guava leaves *kashayam*s had obtained low scores. The panel members opined that the addition of ginger and cardamom would enhance the flavor of the *kashayam*s. Results of ANOVA showed no significant difference between the appearance and consistency of *kashayam* made with the selected fresh foliages, however it was significant for flavor, taste and overall acceptability.

b. Mean Organoleptic Scores of *Kashayam* made with Dried Foliages

FIGURE 2

Mean Organoleptic Scores of Kashayam Made with Dried Foliages



The mean organoleptic scores obtained by the control (Figure 2) was high (above 4.0) for all the criteria. This is because of the unique flavor and taste of thulasi leaves and ginger. The mean scores obtained by kashayam prepared with cauliflower and radish leaves was very low ranging between 2.0 and 2.2 for flavor, taste and overall acceptability. The judges also opined kashayams made with dried leaves were difficult to be consumed due to the bitter taste and unacceptable flavor. However, the judges also felt that most kashayams will have poor organoleptic

acceptability but high medicinal value. Results of ANOVA showed no significant difference between appearance, flavor, taste and overall acceptability of *kashayam* made with the selected dried foliages but were significant for consistency.

2. Nutrient Content

a. Ash Content

TABLE-I

Total Ash Content of the Selected Foliages

Foliages	Ash Content(g/100g)
Papaya leaves	5
Guava leaves	5
Cauliflower leaves	4.5
Radish leaves	4

The total ash content of papaya and guava leaves was higher (5.0mg%) (Table I) than radish and cauliflower leaves which had obtained 4.5 and 4.0 mg% respectively. This amount may be reflected in the individual mineral content also. Gupta (2014) stated in his study on "Nutritional composition of value added products prepared from the underutilized indian sorrel leaves" that the ash content of the developed products varied from 0.39 to 44.25g/100g.

b. Mineral Content

TABLE-II

Mineral Content of the Selected Foliages

Foliages	Calcium Content(mg)/100g	Iron Content(mg)/100g
Papaya leaves	1000	20.4
Guava leaves	450	25.2
Cauliflower leaves	1350	22.8
Radish leaves	2250	18

The calcium level (Table II) was quite high in radish leaves (2250mg/100g) followed by cauliflower leaves(1350mg/100g). The calcium content of guava leaves was the least (450mg%). to correct osteoporosis. Sharma (2013) has reported that the yellow papaya leaves collected from the plains contained the least amount of Calcium (Ca), while green, brown and yellow leaves from hills had almost equal and an appreciable amount of calcium. Joseph (2011) has found the calcium level of guava fruit to be 17.8-30mg while that of guava leaves to be 450mg/100g. Hence the incorporation of guava leaves in human diet will help

As per Gopalan et al.(2010) cauliflower leaves are the richest source of iron, however in the present study it was found that guava leaves had the maximum amount of iron (25.2mg%). Sharma (2013) showed in his study that papaya leaves had 32mg of iron per 100g while the same in the present study was 20.4mg%. The study by Vasanthamani (2012) on the "Effect of cauliflower greens supplementation on blood haemoglobin levels on anaemic adolescent girls" showed that blood haemoglobin level of the selected subjects was increased at five percent level within the period of 90 days.

c. Vitamin C Content

TABLE-III

Vitamin C Content of the Selected Foliages

Foliages	Vitamin C Content (mg/100g)
Papaya leaves	23.04
Guava leaves	7.68
Cauliflower leaves	12.8
Radish leaves	10.24

From Table III, it is clear that papaya leaves had the highest amount (23.04mg%) of vitamin C than the other leaves taken for the study and guava leaves the minimum (7.68mg%.). Goldberg (1994) reported a vitamin C level of 28mg % in papaya leaves. . Ramaswamy and Gayathri (2012) have given a vitamin C value of 2.8%, 3.5%, 4.0% and 3.2% in curry leaves, manathakkali leaves, fenugreek leaves and tulsi leaves respectively. Sunmola et al. (2012) have reported a vitamin C content of 60.6mg% in chenopodium cultivators bathua local followed by pusa bathua-1(23.0mg%) and spinach cultivators 51mg%.

According to Fuglie (1999), Moringa leaves contain more vitamin C than oranges and more potassium than bananas. However, the dried leaf extract contains higher concentrations compared to the fresh leaves and the outcome is dependent of the method of handling the samples. Gupta (2009) has reported the ascorbic acid content of Indian GLV to range between 15.18 and 101.36 mg%.

Table III shows that papaya leaves are good sources of vitamin C (23.04mg%). Due to the ascorbic content papaya leaf extracts were found to exhibit positive effects on the immune system by a mechanism called immunomodulation. A study showed that there was an increase in production of Th2 type cytokines with papaya leaf

extracts. Th2 type cytokines are a group of lymphocytes produced to boost the immune response of the body (Obaineh, 2013).

d. Total Antioxidant Content

Green leafy vegetables represent a class of underexploited plants that are stipulated to be rich sources of natural antioxidants. Because of their high content of antioxidants, green leafy vegetables may be one of the best cancer- preventing foods.

TABLE-IV

Total Antioxidant Content of the Selected Foliages

Concentration Of Solution (mg)	% of Radical Scavenging Activity			
	Papaya Leaves	Guava Leaves	Cauliflower Leaves	Radish Leaves
Blank	0.00	0.00	0.00	0.00
Control	0.62	0.62	0.62	0.62
50	3.23	24.19	56.45	35.48
100	6.45	29.03	64.52	64.52
200	17.74	35.48	66.13	67.74
300	48.39	58.06	70.97	69.35
400	62.90	64.52	74.19	70.97

The total antioxidant content (Table IV) in terms of % of free radical scavenging capacity was found to be maximum in cauliflower leaves followed by radish leaves, while it was least in papaya leaves. The maximum DPPH scavenging activity and reducing power was exhibited by *Muiraya Koenigii* and least in *Centella asiatica* (Gupta and Prakash, 2009). Sunmola et al. (2012) have reported the antioxidant capacity of leafy vegetable to be in the following order: Amaranth-> Chenopod-> Spinach-> Palak-> Fenugreek-> Sarson sag. Rani (2012) has said that the radical scavenging activity by hydrogen or electron donation is a marker of antioxidant activity.

Conclusion

Kashatams can be prepared with underutilized foliages as they are rich in nutrients. These foliages have medicinal components which are responsible for their action against various diseases.

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