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Comparative study of acidity status in some wild vegetables

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Abstract
The present research paper deals with the comparative study of acidity status in different wild vegetables like *Oxalis corniculata, Portulaca oleracea, Portulaca quadrifida, Rumex vesicarius and Hibiscus cannabinus* the result showed that *Hibiscus cannabinus* shows more acidity level than the others. When the leaves eaten in small quantities are perfectly alright but when eaten in large amount may create health problems, due to higher acidity status of it.

Keywords: wild vegetables, *Portulaca oleracea, Portulaca quadrifida*

1. Introduction

India represents an important and rich biodiversity of plants. Human diet mainly contains 55 different types of vegetables including potato, chili, tomato, cabbage etc. But the rural people have several another options of vegetables than urban peoples. Rural peoples eat wild and healthy vegetables in their regular diet. Wild vegetables are leafy green plants that grow in wild unattended places like in waste lands, fields, gardens, forest regions, along roadsides etc. all over the world in many different climatic zones. They are highly nutrition and medicinal too. The rural peoples traditionally use these vegetables regularly in their diet as a meal and salads. In India these wild vegetables are mainly available in the rainy season in local market. They are consumed not only in leafy form but also in the form of berries, seeds, rhizomes, flowers etc. as they are the rich source nutrition and medicine. There are some wild vegetables like Wood sorrel (*Oxalis corniculata* L.), Purslane (*Portulaca oleracea* L,), Chicken weed (*Portulaca quadrifida* L.), Bladder dock (*Rumex vesicarius* L.) and kenef (*Hibiscus cannabinus* L.)

Oxalis corniculata L. belonging to family oxalidaceae commonly known as wood sorrel. This species probably comes from south-eastern Asia. It is regarded as a weed in gardens, agricultural fields, and lawns. The leaves of wood sorrel are quite edible, with a tangy taste of lemons. A drink can be made by infusing the leaves in hot water for about 10 minutes, sweetening and then chilling. The entire plant is rich in vitamin C. Any wood sorrel is safe in low dosages, but if eaten in large quantities over a length of time can inhibit calcium absorption by the body.

Portulaca oleracea (common purslane) is an annual succulent in the family portulacaceae, which may reach 40cm (16 in) in height. *Portulaca* is a genus of succulent herbs distributed in the warmar parts of the world. It is an herbaceous weed. The herb is considered to possess refrigerant, vulnerary, antiscorbutic, aperients and diuretic properties. It has been reported to possess potent pharmacological actions such as hepatotprotective, analgesic and anti-unflammatory, wound healing, neuropharmacological, bronchiodilatory, antidiabetic, antioxidant, anti-hypertensive and many other reported biological actions. *Portulaca quadrifida* Linn. belongs to the family Portulacaceae. It is a small diffused, succulent, annual herb found throughout the tropical parts of India. *P. quadrifida* is used as a vegetable and also used for various curative purposes. It is said to be useful in asthma, cough, urinary discharges, inflammations and ulcers. A poultice of the plant is applied in abdominal complaints, erysipelas and haemorrhoids (Kirtikar and Basu, 2001).

Rumex vesicarius, also known as Ruby dock, or bladder dock, is a species of perennial flowering plant in the Polygonaceae family. *Rumex vesicarius* is native to tropical and temperate Asia, and Africa. It is an erect, succulent annual herb used as a vegetable. It is having sour taste due to content of higher amount of organic acids in it.

Hibiscus cannabinus, is a plant of the family Malvaceae also called Deccan hemp and Java jute. It is native to southern Asia. The name also applies to the fibre obtained from this plant. Kenaf is one of the allied fibres of jute and shows similar characteristics. It is an annual or biennial herbaceous plant

They all are sour in taste because in high content of organic acids present in them Organic acids mainly include oxalic acid, malic acid, citric acid, fumaric acid, tartaric acid and ascorbic acid etc. These organic acids can be regarded as link between the carbohydrate metabolism, respiratory process and nitrogen metabolism of the plant. Organic acid present in the food prevents or retard the growth of microorganism or in habits the germination of spores providing the proper environment for metal iron Chilation and also minimize lipid oxidation (Shelton, 2001) [19]. Organic acid present in the food naturally or produced after fermentation the importance of determining food acidity is to check the degree of maturity of fruits and vegetables or as indicator of maturity higher the maturity lower the acid content freshness of food quality of food like color, flavor and also to check fermentation process. But high amount of oxalic acid in food causes some problems because acid considered as anti-nutrient after consumption oxalic acid can bind the minerals to form compound including calcium oxalate and iron oxalate. High Oxalic acid diet has been linked to an increased risk of kidney stones and other health problems (Bown, D.1995) [1]. Free oxalic acid or oxalate bind with calcium ions in the body precipitated as insoluble calcium oxalate crystals and may lead to hypocalcaemia and

urolithiasis (Huges *et al*, 1992) [5].

There are two interrelated concepts in food analysis that deals with acidity: i. e. pH and Titratable acidity. Each of these quantities is analytically determined in separate ways and each has its own particular impact on food quality. Titratable acidity deals with measurement of the total acid concentration contained within a food (also called total acidity). This quantity is determined by exhaustive titration of intrinsic acids with a standard base. It is expressed as grams/liter (g/L) and is obtained by multiplying to percent TA by 10. So, a TA of 0.60% is expressed as 6g/L. pH is defined as the measure of the strength of acid in a solution. On a pH scale, 7 is considered neutral. The lower number on the pH scale indicates more acidity. Conversely, the higher the reading on the pH scale, the more alkalinity. pH is a logarithmic scale. So, for each increment there is a factor of 10. So, a reading of 5 is 10 times more acid than a reading of 6. Titratable acidity is a better predictor of acid's impact on flavor than pH. The pH value of the solution may not be directly related to its Titratable acidity as pH is only a measurement of free hydrogen ion activity while Titratable acidity measures the total acid concentration (Sadler and Murphy, 2010). Keeping all these views in mind an attempt has been made to study the acidity status in these wild vegetables.

Material and Methods

Titrable acidity represents the acidity status of the plant tissue it also represents the amount of various organic acids present in the plant tissue. Titrable acidity provide a simple estimation of acids present in the plant tissue by routine titration method it cannot differentiate between individual acids therefore Titrable acidity is usually stated in terms of predominant acid e.g. milk rich in lactic acid tamarind rich in tartaric acid and citrus rich in citric acid etc. There are two ways to express acidity status of plant tissue

1. Total Titrable acidity is simple to estimate the total acid content of food
2. Determination of pH i e. hydrogen ion concentration

Total Titrable acidity of fresh plant material was determined by method of (Thomas and beavers, 1949). The fresh plant material for analysis was collected from the field. Mature and fully developed leaves were selected from Wood sorrel, Purslane, Chicken weed, Bladder dock and Roselle separately. Each plant material was washed thoroughly with distilled water to remove any dirt or dust particles on the leaf surface and blotted to dry then the plant material was cut into small pieces. After that the material was accurately weighed then it was immersed in boiling water and boiled for half an hour then it was cooled and the aliquot was titrated against standardized N/40 NAOH using phenolphthalein as an indicator till permanent pink color is obtained and the reading was recorded. Standardization of NAOH was done by N/40 oxalic acid using the same indicator. Titrable acidity represents the number of ml of decinormal NAOH required to neutralize the acid content in 100 grams of fresh tissue. The same samples were used for determination of pH using pH meter. 5 different species of wild vegetables namely *Oxalis corniculata, Portulaca oleracea, Portulaca quadrifida Rumex vesicarius, and Hibiscus cannabinus* were analysed both for Titrable acidity and pH. Each species showed a specific organic acid fingerprint but the Titrable acidity value represents a combination of several organic acids. Total Titrable acidity was calculated using following formula:

$$\text{Total Titrable acidity (\%)} = \frac{\text{Vol. of oxalic acid Taken for Titration (ml)}}{\text{Titration Reading (ml)}} \times \frac{\text{Total volume of extract (ml)}}{\text{Wt. of plant Material (g)}} \times \frac{\text{Plant extract reading (ml)}}{\text{Vol. of extract taken for titration}} \times \frac{100}{4}$$

Result and Discussion

The following table represents the values of Total Titrable acidity % and pH of 5 different wild vegetables namely *Oxalis corniculata, Portulaca oleracea, Portulaca quadrifida, Rumex vesicarius and Hibiscus sabdariffa*. From the table values it is observed that *Hibiscus sabdariffa* showed maximum amount of total Titrable acidity % while *Oxalis corniculata* with minimum total Titrable acidity % among all other tested plants. But all these vegetables showed high levels of oxalic acid therefore they became sour lemony for taste. The Relationship between total acidity % and pH values is somewhat similar.

Table 1

Sr. No.	Name of The Plant Species	Total Titrable Acidity % g/100g fresh wt.	pH Value
1	*Oxalis corniculata*	0.13	6.4
2	*Portulaca oleracea*	0.21	5.4
3	*Portulaca quadrifida*	0.17	5.8
4	*Rumex vesicarius*	0.42	4.6
5	*Hibiscus cannabinus*	0.49	4.4

Hanan *et. al.* (2014) [16]. estimated previously Total acidity and ph value of Purslane (Portulaca oleracea) plant. Jamkhandi *et. al.* (2011) [15]. determined acid value previously by potentiometric method in *oxalis corniculata* at different geographical conditions. When we compare the observed results with the above research work the Total acidity % and ph values are somewhat similar to those findings. Similar types of work were also done by different workers in different plants Popp and Kinzel, (1971) [17]. investigated inorganic and organic content in young and old leaves from 22 mangrove species of Australia. Boulton (1980) [2]. in grapes, Jin chen *et al*. (1999) [3]. in wild edible fruits of southern Yunnan, Lobit *et al*. (2002) [6]. in peach, Magaia, *et al*. (2013) [7]. in wild edible fruits of Mozambique. Hew and Wong (1974) [4]. recorded the Titrable acidity decrease in the light and increases at night that is diurnal changes in Titrable acidity of *drymoglossum*, *pyrrosia* and *kalanchoe.*

Conclusion

All the plants *Oxalis corniculata, Portulaca oleracea, Portulaca quadrifida, Rumex vesicarius, and Hibiscus cannabinus* selected for study purpose contains high levels of oxalic acid. When the leaves eaten in small quantities are perfectly alright but when eaten in large amount may create health problems. People with tendency to rheumatism, arthritis, gout, kidney stones or hyperacidity should take special caution. (Bown, D., 1995) [1].

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