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Biochemical And Nutritional Assessment Of Unripe Papaya (*Carica Papaya*)

Dr. Jyoti D. Vora[1], Ms. Sneha Pednekar[2], Ms. Shruti Bendre[3], Ms. Snigdha Mathure[4]

[1] Guide
Head, Department of Biochemistry & Food Science and Quality Control
Ramnarain Ruia College, Matunga, Mumbai – 400019, India
[1] Assistant Professor
Head, Department of Biochemistry & Food Science and Quality Control
Ramnarain Ruia College, Matunga, Mumbai – 400019, India
[3,4]Students,
Department of Biochemistry & Food Science and Quality Control
Ramnarain Ruia College, Matunga, Mumbai – 400019, India
Corresponding Author: Dr. Jyoti D. Vora

Abstract: *For centuries, papaya, also known as the pawpaw (Carica papaya), has been a crucial ingredient in natural healing. It has also been part of the staple diet of many indigenous peoples. Papayas are known for their long list of health benefits. They have a variety of vitamins, minerals, and other nutrients. They are especially known for how they help with digestion. What is not commonly known is that unripe (or green) papayas also have health benefits. Unripe papayas are green in colour and are not pulpy. Moreover, the inside of the green papayas is sometimes white in colour. Unripe papayas are not that popular when compared to the ripe ones. This is because the ripe one's taste better and can be easily consumed raw. However, unripe papayas are difficult to eat raw. It needs to be cooked and the taste is also different. It would be interesting to know that green papayas also have health benefits which makes it a healthy fruit. Unripe papayas are rich in vitamins, enzymes and phytonutrients. Raw green papayas contain essential nutrients and minerals like potassium, magnesium, and vitamins like A, C, B and E. Green unripe papayas are rich in enzymes; papain and chymopapain which are very good for the stomach. Unripe papayas benefit the health in many ways. For example, green papayas aid digestion, converts proteins into essential amino acids, cleanses the colon, fights nausea and constipation to name a few. Moreover, unripe papayas are also good for women as it protects the urinary tract from infections. This led to a conclusion that the health benefits of unripe papaya are tremendous and comparatively the consumption is very less. To assess the complete papaya plant, samples of unripe papaya peel, fruit pulp as well as leaves were considered. Analysis of proximate principles was carried out and the nutritional profiles of unripe papaya pulp, peel and leaves was determined. The parameters considered for analysis were Carbohydrate Content, Total Protein Content, Iron, Calcium, Potassium, Sodium, Ascorbic Acid. Phytochemical assessment was carried out using Qualitative tests, and unripe papaya was found to be enriched with various samples such as alkaloids, phenols, phytosterols, flavonoids, terpenoids. These experiments led to the conclusion that Unripe Papaya has tremendous potential and has the capability of positively influencing various areas such as Biochemistry, Nutrition, Food Science, Product Development etc.*

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I. Introduction

The nutrients in the foods you eat support the activities of day-to-day living, protect your cells from environmental damage and repair any cellular damage that might occur. A nutritious, well-balanced diet – along with physical activity and refraining from smoking – is the foundation of good health. Healthy eating includes consuming high-quality proteins, carbohydrates, heart-healthy fats, vitamins, minerals and water in the foods you take in while minimizing processed foods, saturated fats and alcohol. Eating in this manner helps you maintain your body's everyday functions, promotes optimal body weight and can assist in disease prevention.

Once considered quite exotic, papayas can now be found in markets throughout the year. Although there is a slight seasonal peak in early summer and fall, papaya trees produce fruit year-round. This research aims to explore the unique biochemical and nutritional profile of the Unripe Papaya Plant. For this purpose, this research considered three valuable segments, i.e., Unripe Papaya Fruit Pulp, Unripe Papaya Fruit Peel, Papaya Plant Leaves.

Papaya:

Papaya is native to tropical America, from Southern Mexico through the Andes of South America. It was spread to the south by Indians, and throughout the Caribbean with Spanish exploration. The Spanish also carried it to Europe and the Pacific Islands. By the mid-17th century, papaya was distributed pantropically. Papaya was introduced to Hawaii in the 1800s, and Hawaii remains the only state in the USA to produce papaya commercially.

The papaya plant is a large, single-stemmed herbaceous perennial, to 30 ft., <20 ft. in cultivation. Leaves are very large (up to 2 ½ ft. wide), palmately lobed or deeply incised, with entire margins, and petioles of 1-3.5 ft. in length. Stems appear as a trunk, are hollow, light green to tan brown, up to 8″ in diameter, and bear prominent leaf scars.

Papayas are largely utilized for fresh markets with small amounts pressed into juices and other processed fruits. Young leaves can be cooked and eaten as a green vegetable. Green or unripe papaya is used as a vegetable or salad garnish as well, but must be boiled first to denature the papain in the latex.

II. Materials And Methods

Analysis of Proximate Principles:This section of the research endeavour focused on identifying, characterizing and quantifying the various nutritional principles of Unripe Papaya.

i) Samples utilized:

Locally procured Unripe Papaya Plant was used for analysis. The Unripe Papaya Fruit was washed and dried. The peel was carefully removed. The Fruit Pulp was obtained using a knife, and was carefully cut into pieces. The Leaves of the plant were plucked, washed and dried before use.

ii) Processing of samples for Analysis:

The samples of unripe papaya fruit pulp, peel and leaves were processed to yield an aqueous extract and an ash solution. The steps involved in the preparation of these solutions is detailed as follows:

Preparation of Ash solution:

This involved the following distinct steps:

Drying of sample: A predetermined amount (usually in the range of 5-10g) of the sample was weighed and placed in a clean, dry, empty petri plate. The plate was then placed in a hot air oven set at 100-110°C for around 45 minutes to an hour until the sample was dry. The plate was placed in a desiccator and its weight was recorded. The sample was dried subsequently at 90°C for 10 minutes intervals under the same conditions until the constant weight was obtained.

Incineration of sample: The entire contents of the petri plate were transferred into a clean, dry, pre-weighed empty silica crucible. The crucible was then placed in the incinerator to allow ashing of the sample. The sample was incinerated until a white ash residue was left behind. The crucible was then cooled in a desiccator.

Extraction of ash: The ash residue in the crucible was extracted by dissolving it in approximately 1.0ml of 1:1 HCl and transferred into an appropriate volume of standard flask. Further, three washings of 0.5 ml of 1:1 HCl each to completely extract all ash. The extracted ash in the ash solution was diluted with distilled water up to the mark in the standard flask. This resultant ash solution was used for the analysis of minerals in the samples.

Preparation of Aqueous extract:A predetermined amount of the sample was taken in the mortar and pestle. Some amount of distilled water was added to the sample and it was macerated thoroughly. The aqueous phase was transferred into a standard flask after filtration through a muslin cloth. Subsequent extracts were collected in the same manner and the extract was diluted up to the mark with distilled water. This aqueous extract was used in the estimation of carbohydrates, proteins, and other nutrients in the sample.

Biochemical Parameters analysed:

The following proximate principles were analyzed from all the threesamples:

1. Estimation of Total carbohydrates by Anthrone method.
2. Estimation of Proteins by Folin Lowry method.
3. Estimation of Iron by Wong's Method
4. Estimation of Calcium by EDTA method.
5. Estimation of Vitamin C by 2,4,6-Dichlorophenol indophenol blue method.
6. Estimation of Crude Fibre by Ashing method.
7. Estimation of Sodium by flame photometry.
8. Estimation of Potassium by flame photometry
9. Determination of Moisture content.

In addition, Qualitative Analysis of Phytochemicals was carried out.

III. Results

Figure 1: Estimation of the Total Carbohydrate Content using Anthrone Method

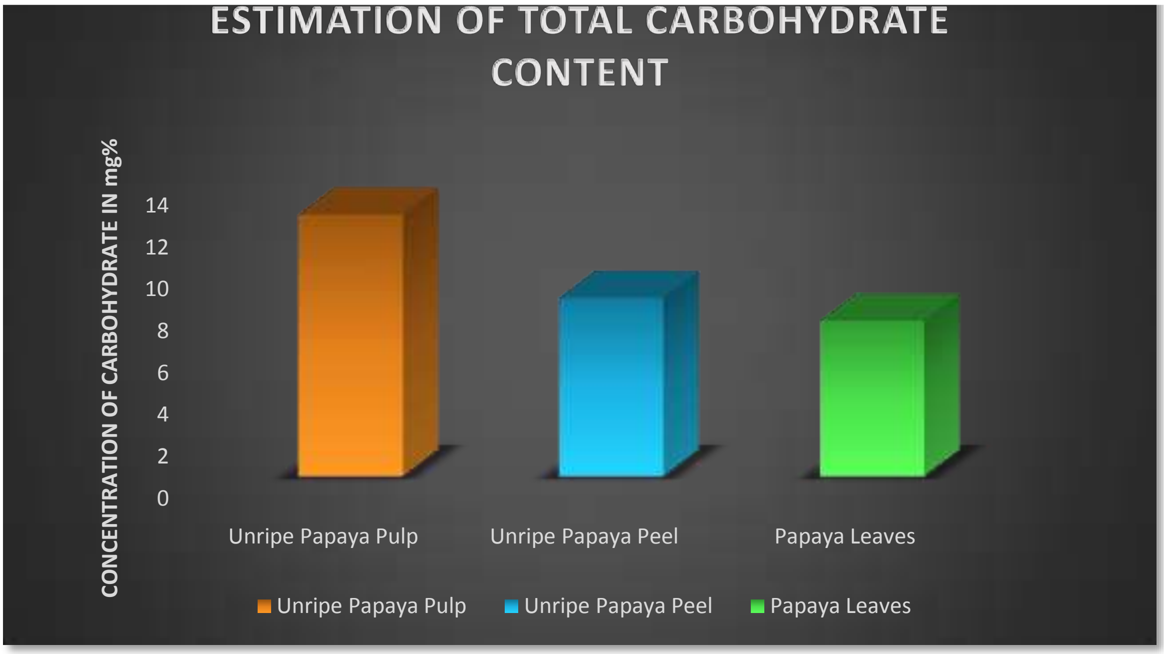


Figure 2: Estimation of the Total Protein Content using Folin- Lowry Method

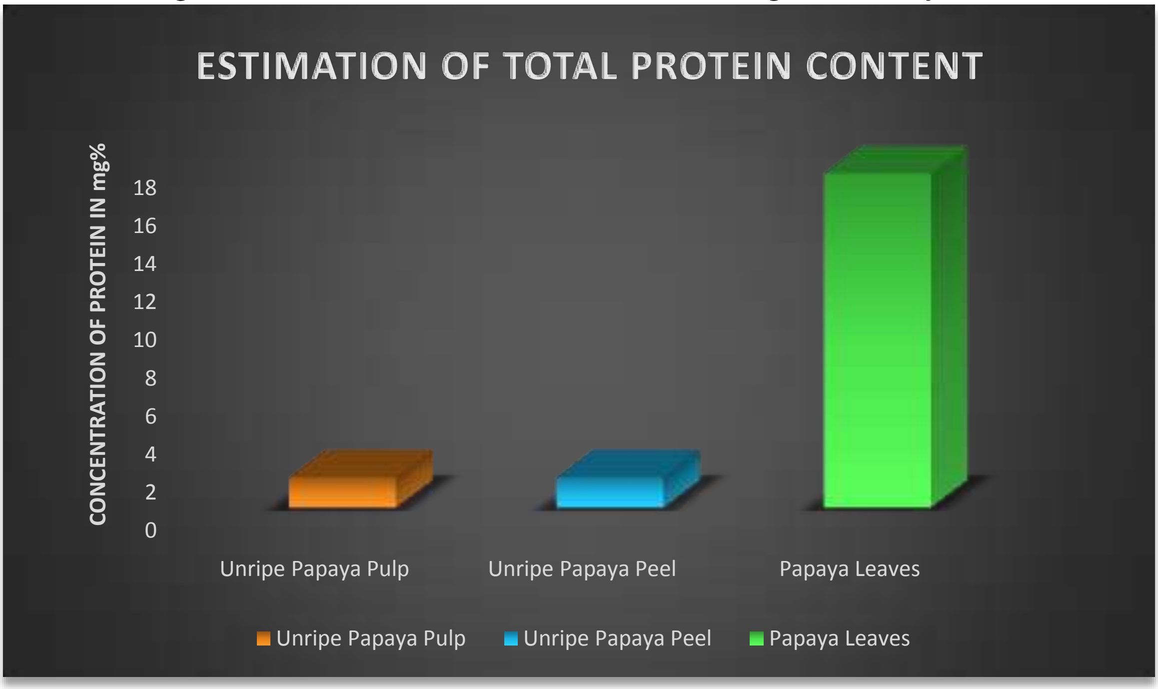


Figure 3: Estimation of the Iron Content using Wong's Method

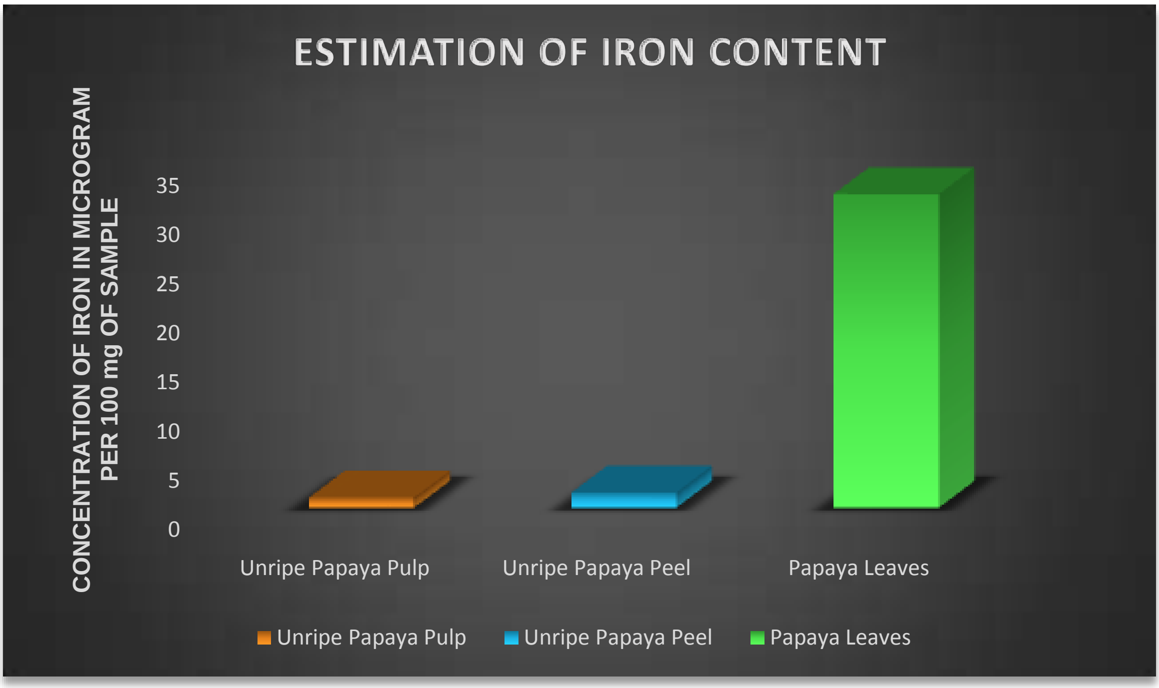


Figure 4: Estimation of the Calcium Content by Titration using EDTA

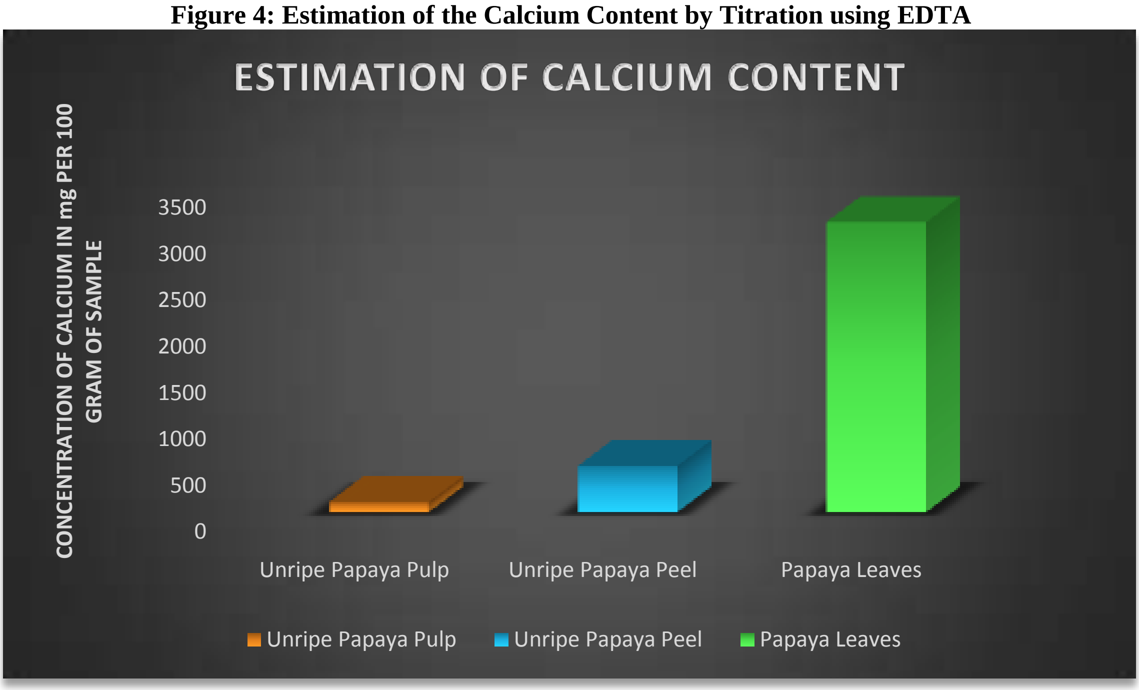


Figure 5. Estimation of the Vitamin C Content by Titration using Chlorophenol Indophenol Dye

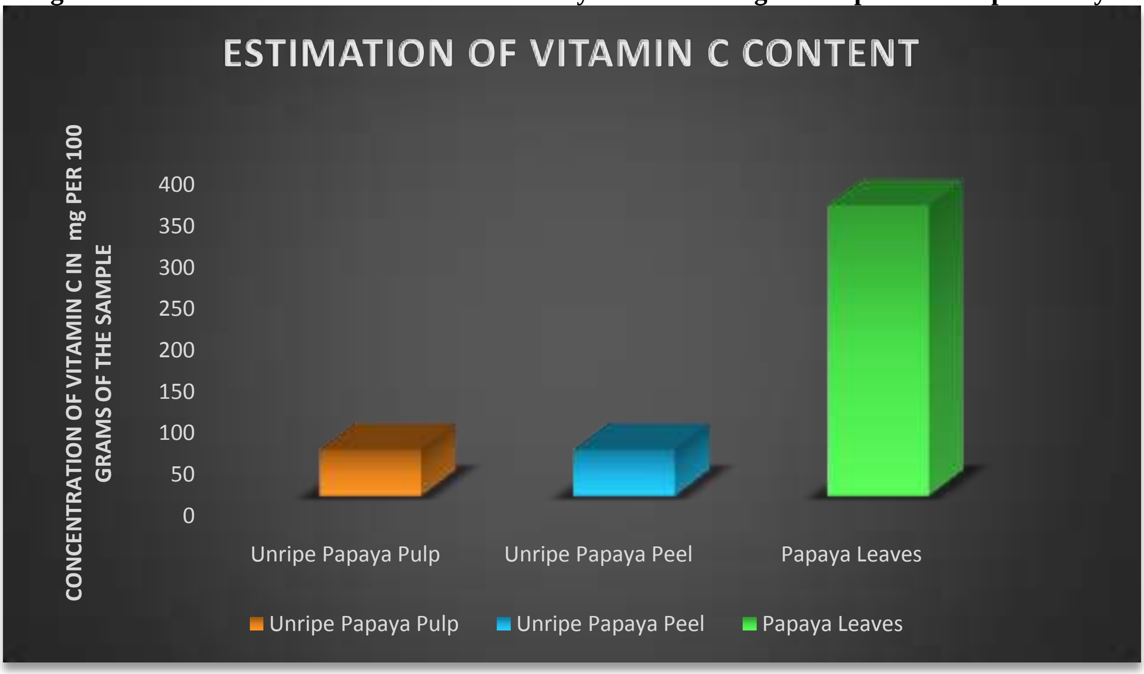


Figure 6: Estimation of the Crude Fibre Content

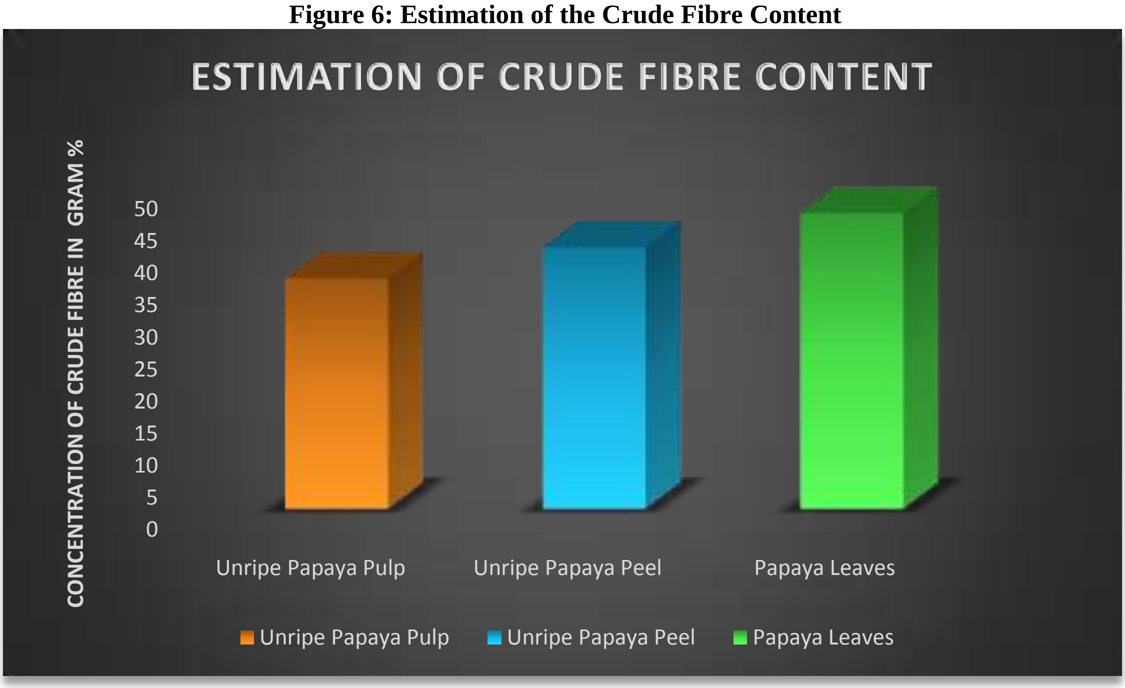


Figure 7: Estimation of the Potassium Content using Flame Photometry Analysis

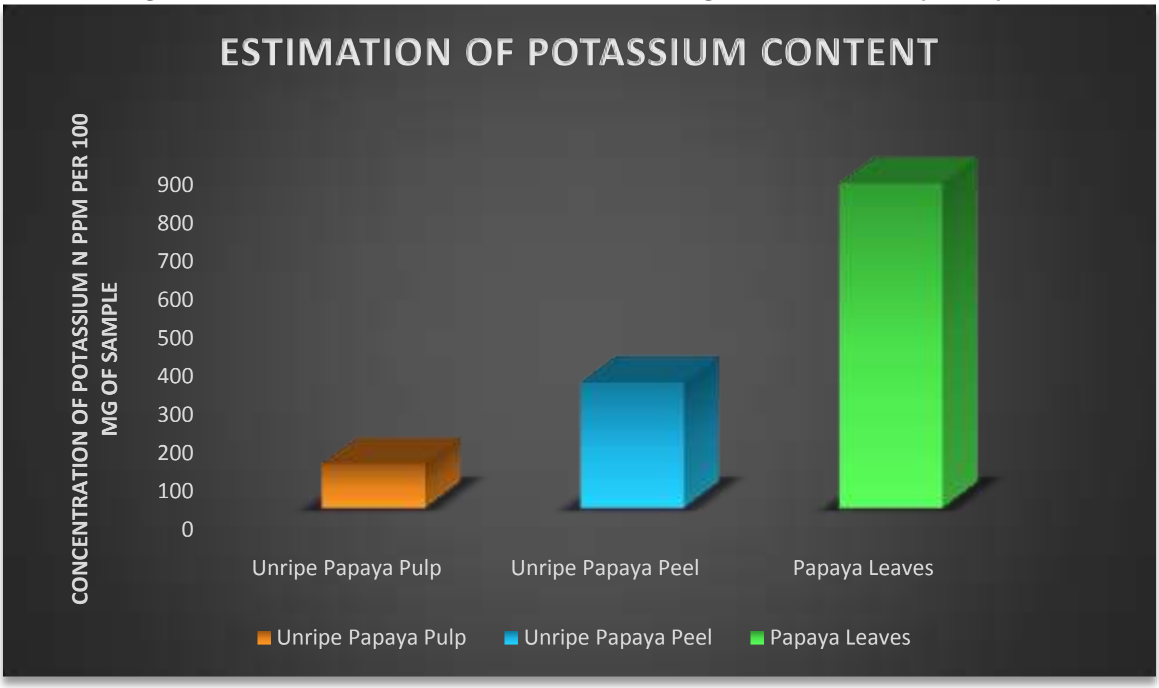


Figure 8: Estimation of the Sodium Content using Flame Photometry Analysis

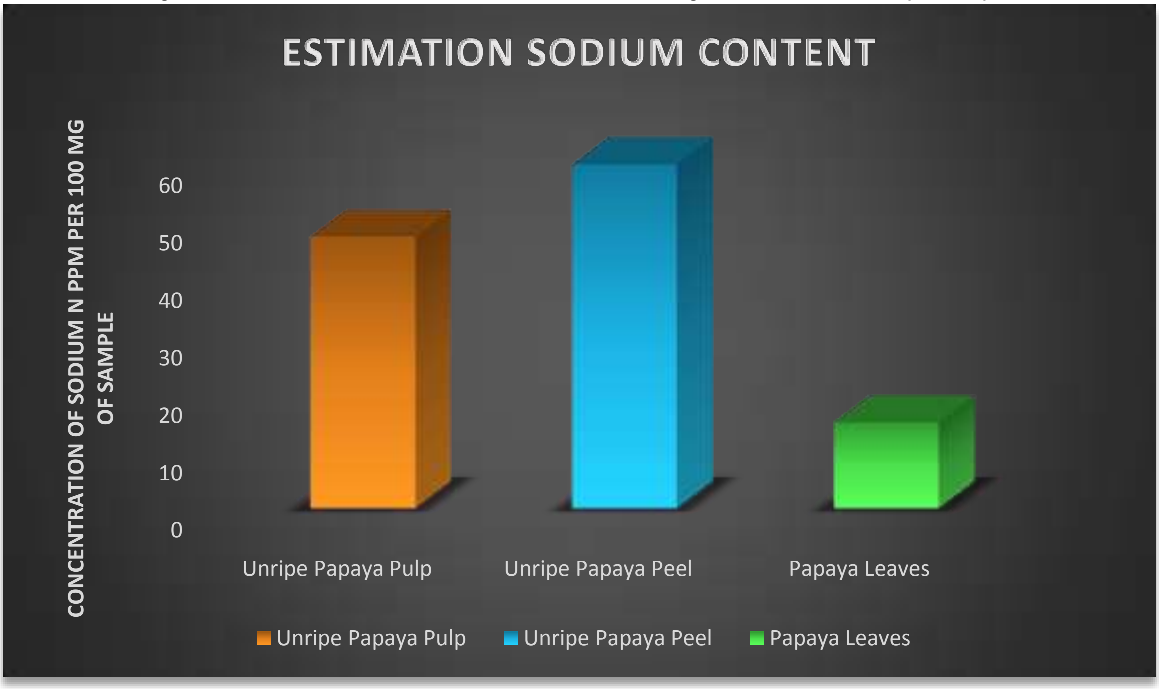
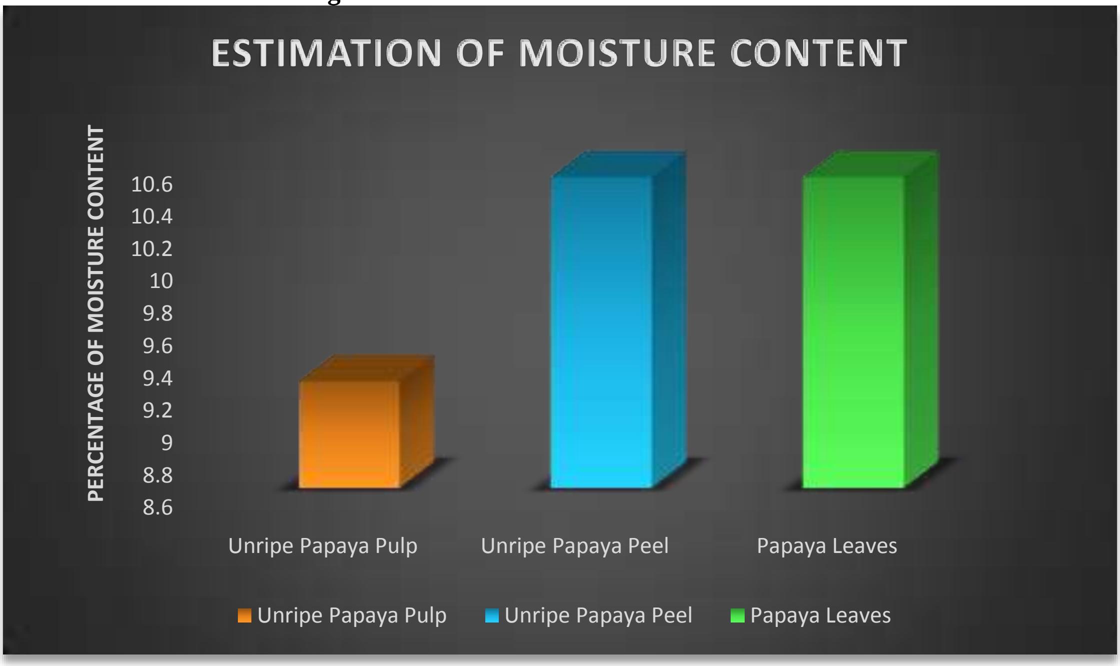


Figure 9: Estimation of the Moisture Content



Qualitative Analysis of Phytochemicals:

Phytochemicals	**Unripe Fruit Pulp**	**Unripe Peel**	**Leaves**
Alkaloids	+	+	+
Carbohydrates	+	+	+
Reducing sugars	+	+	+
Saponins	-	-	-
Phenols	+	+	+
Phytosterols	+	+	+
Tannins			
Flavonoids	+	+	+
Cardiac glycosides	-	-	-
Proteins & Amino acids	+	+	+
Terpenoids	+	+	+
Fixed oils & Fats	+	+	+
Cardiac glycosides	+	-	+
Deoxy sugar	-	+	-

Quantitative Analysis of Proximate Principles:

SR. NO.	NUTRIENT	UNRIPE PAPAYA PULP	UNRIPE PAPAYA PEEL	PAPAYA LEAVES
1	Carbohydrate Content (mg %)	12.56mg%	8.57mg %	7.46 mg%
2	Total Protein Content (mg%)	1.6 mg %	1.6 mg %	17.6 mg %
3	Iron Content (µg/ 100 mg)	1.0466µg	1.5607µg	31.99µg
4	Calcium Content (mg/ 100 g)	112.2 mg	501 mg	3126 mg
5	Ascorbic Acid (mg/ 100 g)	56.14 mg	56.14 mg	350.8 mg
6	Crude Fibre (g / 100g)	35.9 g	40.8 g	46.1 g
7	Potassium Content (ppm/ 100 mg)	115.24 ppm	328.545 ppm	849.312 ppm

8	Sodium Content (ppm/ 100 mg)	47.7 ppm	60 ppm	15 ppm
9	Moisture Content (%)	9.26 %	10.52 %	10.52 %

IV. Conclusion

This research work suggested that the unripe papaya pulp, peel as well as leaves are a potent source of nutrients. A comparative study suggests that most of the nutrients are present in a greater concentration in the papaya leaves. This makes papaya leaves a strong contender for future research. The qualitative analysis of phytochemicals advocates that unripe papaya leaves are a dominant source of anti-oxidants and phytochemicals, along with unripe papaya pulp and peel which are more than moderate sources.

FUTURE PORSPECTS

Unripe Papaya has tremendous potential and has the capability of positively influencing various areas such as Biochemistry, Nutrition, Food Science, Product Development etc.Following are some of the future prospects of research in this area; Study of the changes in the bio molecular composition and nutritional profile during the ripening of the Papaya Fruit.

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