



Research Article

EVALUATION OF MINERAL CONTENTS AND FTIR SPECTROSCOPIC ANALYSIS OF AQUEOUS EXTRACTS OF MALE AND FEMALE TREE LEAVES OF *CARICA PAPAYA* LINN.

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ABSTRACT

The current study is conducted to estimate mineral contents and FTIR profile of aqueous extracts of male and female tree leaves of *Carica papaya* Linn separately. Significant difference in minerals including sodium, calcium, potassium, iron, magnesium and manganese was observed in both male and female tree leaves ($p < 0.05$). FTIR Interferogram reflected distinct peaks indicating difference in functional groups exhibited by *Carica papaya* Linn male and female tree leaves. The data reflected that male and female tree leaves aqueous extracts showed differences in proportion of phyto-constituents. C=O, O-H and O=C-O-C groups are more dominating in female tree leaves indicating it as a hub of phytoconstituents as compared to male tree leaves. This current research redefines the kind of phytochemicals in male and female tree leaves of *Carica papaya* Linn that helps to establish the standards of quality for the plant in future researches.

Keywords: *Carica papaya*, mineral contents, FTIR Interferogram, phytochemicals, standards.

INTRODUCTION

Carica papaya Linn belongs to Caricaceae family of plant Kingdom. In English, the plant is named as Papaya, Papeeta in Urdu and Erandakarkati in Sanskrit^{1,2}. In tropical region of United States of America and Subcontinent, the plant has been cultivated since 16th century³. *Carica papaya* L. is extensively cultivated in some vicinity of Punjab and Sindh Province of Pakistan¹. The plant is familiar by its soft un-branched stem that produces milky latex at its apex. The growth pattern of plant is rapid, and it can be as tall as 20 m⁴. Traditionally, aqueous extracts of *Carica papaya* tree leaves are consumed in liver disease and dengue hemorrhagic fever⁵. In Asia, leaves of *Carica papaya* has shown significant beneficial effects and have also been consumed as medicine against malaria, pyrexia, wet and dry beriberi, asthmatic attacks and even in colic pain⁶⁻⁹. Antiviral and immunomodulatory properties are because of phytoconstituents of leaves^{10,11}. *Carica papaya* leaves exhibits abortifacient, hypoglycemic, anti-fertility, hepatoprotective and wound healing properties¹². *Carica papaya* Linn leaves are also the prime center of various minerals. Calcium, magnesium and potassium in significant amount has been reported. Sodium and iron have also been reported¹³. Lymphocyte proliferation can be boosted by calcium ions¹⁴. Erythrocyte hydration can be improved by magnesium ions. Hyponatremia and dengue can also be prevented by sodium¹⁵. Joint swelling and dengue pain can be cured by Mn of *Carica papaya* Linn leaves¹⁶. Hypokalaemic quadripareisis in acute dengue can be managed by potassium of *Carica papaya* Linn leaf⁷.

MATERIALS AND METHODS

Plant collection

Tall variety of *Carica papaya* Linn was cultivated in December 2016, at Memon Goath (Darshan Channa) near Malir, Karachi, Pakistan. The plant was cultivated at temperature range of 20-35°C with 22% to 60% humidity and was not pesticised. Samples were collected in May 2017 from the mid half of the plant during morning hours and transported in bags of polyethylene. Temperature during collection was 32°C and humidity was 44%. Prof. Dr. Shahnaz Dewar, Department of Botany, Karachi University, Pakistan taxonomically authenticated the leaf samples as tall variety. A voucher of specimen No.107 and 108 was deposited at Faculty of Pharmacy and Pharmaceutical Sciences, University of Karachi, Pakistan. Leaf samples were washed thrice with distilled water to remove dust. *Carica papaya* leaves were air-dried at 30 ± 2°C for two weeks in order to remove moisture and parts of the leaf were separated by using sterile blade to separate lamina part only in aseptic condition. By using mechanical blender, the plant material was grounded to coarse powder and kept separately in air tight jar for future use with appropriate tagging¹.

Preparation of the plant extracts

Aqueous extract

500 grams of grounded male and female tree leaves in 1000 ml of distilled water were macerated separately in wide mouth jars. Samples were soaked for 12 hours at 25-30°C with continuous shaking for 10-15 min after every hour. Using Whatman filter paper No 42, extracts were filtered and kept at 4°C in airtight container. The solvent was filtrated, made concentrated by using

Büchi Rotavapor® R-200 Marshall Scientific TM, Switzerland¹⁸ and then freeze dried by using Union Microwave freeze dryer KESU-4F® (Zhengzhou) Co., Ltd. Dried aqueous extract was stored in near 4° to 8°C for their future use.

Quantitative mineral analysis

Leaves of *Carica papaya* Linn contain various minerals. Detection of mineral contents was done by digesting the obtained ash with HCl (3M) which was then filtered. Ca, Mg, Mn and Fe detection was done by AA-6200 atomic absorption spectrophotometer. Flame photometer FP8800 KRÜSS Optronic was used for detection of Na and K¹⁹.

Fourier transform infrared (FTIR) spectroscopic analysis

FTIR is the most leading tool for identification of distinguishing functional groups found in the phyto constituents. In a molecule, chemical bonds can be determined by infrared absorption spectrum. Male and female tree leaves dried aqueous powder was sampled for analysis. For FTIR study, neat technique was used by

forming smear of dried extract on KBr pellet, using Bruker Vector 22 FTIR spectrophotometer having range 400 to 4000 cm⁻¹²⁰.

RESULTS

Quantitative mineral analysis

Mineral composition data of male and female tree leaves of *Carica papaya* Linn is provided in Table 1 which revealed clearly that both types of leaves are rich source of minerals. The result delineated the quantity of Na, Ca, K, Mg, Fe and Mn. Female tree leaves dominated the minerals most (p < 0.05) indicating their more value in disease like malaria and dengue.

Fourier transform infrared (FTIR) spectroscopic analysis

Interferogram of female and male tree leaves aqueous extracts are provided in figure 1 and 2 respectively. Peak values data and probable functional groups from FTIR analysis in both extracts of leaf is provided in Tables 2.

Table 1: Mineral contents of *Carica papaya* male tree leaf extract

Minerals	Male tree leaf extract <i>Carica papaya</i>	Female tree leaf extract <i>Carica papaya</i>	p-value
	Quantity mg/100 g	Quantity mg/100 g	
Na	24.4 ± 0.965	78.7 ± 1.321	< 0.01*
Ca	801.1 ± 0.667	767.8 ± 0.967	< 0.01*
Mg	612.9 ± 1.221	734.9 ± 0.998	< 0.01*
Mn	12.5 ± 0.983	19.6 ± 0.763	< 0.01*
P	3666.2 ± 0.649	4352.7 ± 0.873	< 0.01*
Fe	33.7 ± 0.876	20.9 ± 0.771	< 0.01*
K	398.4 ± 0.932	429.5 ± 1.211	< 0.01*

*p < 0.05 was considered significant using independent sample t-test

Table 2: Peak values and functional groups

S. No.	AFLEPV cm ⁻¹	FG	I	AMLEPV cm ⁻¹	FG	I
1.	536.5	C-Br Stretching	s	535.2	C-Br Stretching	s
2.	669.8	= C-H Bending broad	m-s	670.0	= C-H Bending broad	m-s
3.	770.6	C-H Bending	m	773.4	C-H Bending	m
4.	---	-----	---	847.5	C-Cl Stretch	s
5.	870.2	C-H Bending	s-m	---	-----	---
6.	1045.7	C-O Stretching	m	---	-----	---
7.	---	-----	---	1121.7	C-O Stretch	m-s
8.	1278.6	O=C-O-C aromatic Stretch	s-vs	---	-----	---
9.	1321.4	C-H Bending	m	---	-----	---
10.	1408.7	C-H Bending	s	1408.3	CH Bending	s
11.	---	-----	---	1518.6	N-H Amine	s
12.	1588.0	N-H Bending	w-m	1585.9	NH ₂ Scissoring	m-s
13.	1760.7	C=O Carbonyl group Stretching	s	---	-----	---
14.	1815.1	C=O Carbonyl group Stretching	s	---	-----	---
15.	1856.7	C=O Carbonyl group Stretching	s	---	-----	---
16.	2962.0	C-H Stretch	m	2962.4	C-H Stretch	m/s
17.	3062.6	C-H Stretch	m	3065.1	C-H Stretch	m
18.	3661.4	O-H Phenol / Acid	v	3660.7	O-H Phenol / Acid	v
19.	3699.8	O-H Phenol / Acid	v	---	-----	---

Note: (v; variable, s; strong, m; medium, AFLEPV; aqueous female leaf extracts peak values, AMLEPV; aqueous male leaf extracts peak values, FG; functional groups, I; intensity)

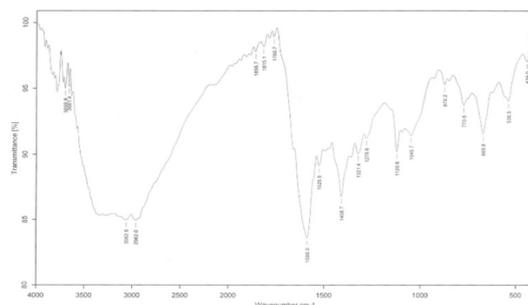


Figure 1: Interferogram of female tree leaf aqueous extract

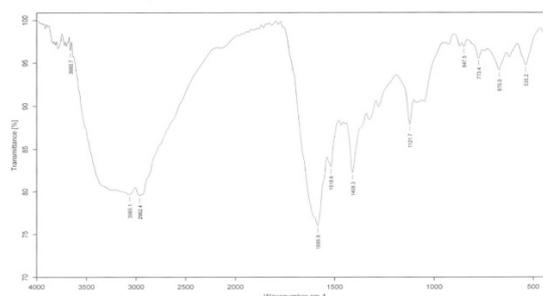


Figure 2: Interferogram of male tree leaf aqueous extracts

DISCUSSION

Carica papaya Linn leaves are promising in providing wide variety of phyto-constituents and minerals for various herbal formulation of the current era²¹. The plant is the richest source of phytochemicals, essential vitamins and minerals.

Magnesium, sodium and potassium ions of *Carica papaya* Linn leaf have significant importance in curing symptoms of dengue^{16,17}. The present study showed that female tree leaves are rich in various minerals as compared to male tree leaves ($p < 0.05$) using independent sample t-test, given in Table 1 indicating its key role in dengue and other blood manifestations. FTIR analysis was carried out to evaluate functional groups separately for both types of leaf extracts. The interferogram reflected significant difference in functional groups of phyto-constituents for both types of plant leaves. More functional group peaks are observed in female tree leaves aqueous extracts. O-H group in the region of 3661.4 and 3699.8 cm^{-1} indicated presence of more phenolic or acidic contents in female tree leaves while in male it is found only in 3660.7 cm^{-1} . C=O in the region of 1760.7, 1815.1 and 1865.7 reflected strong carbonyl groups that are absent in male tree leaf extracts in this region. O=C-O-C aromatic stretch is found only in female tree leaves extracts only. C-H bending is also dominating in female tree leaf extracts as compared to male as provided in Table 2.

CONCLUSION

The present established data on *Carica papaya* L. leaves will be improved from current research which was conducted separately on male and female tree leaves that helps to enhance the standards of quality control of herbal products holding leaves as main formulation ingredients against dengue and other diseases. The present research reflected variations in phyto-constituents and minerals in female and male tree leaf extracts. This research redefines and refines the kind of phytochemicals in male and female tree leaves of *Carica papaya* L. for future researches.

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