Research Article

FTIR SPECTROSCOPIC ANALYSIS OF ETHANOLIC AND N-HEXANE EXTRACTS OF MALE AND FEMALE TREE LEAVES OF *CARICA PAPAYA* LINN

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ABSTRACT

The current study is executed to examine and investigate FTIR profile of ethanolic and n-hexane extracts of male and female tree leaves of *Carica papaya* Linn separately. Significant difference in FTIR Interferogram was observed that revealed distinct peaks indicating difference in functional groups showed by *Carica papaya* Linn female and male tree leaves in both polar and non-polar extracts. N-H, C=O, O-H are dominating in ethanolic female tree leaves extract while C-O, N-H₂ and O=C-O-C groups are dominating in male tree leaves ethanolic extract. C-O, C=O, O-H and NH are dominating in female tree leaves hexane extract while C-O, NH₂ and O-H are dominating in male tree leaves hexane extract. Data reflecting female tree leaves as a hub of major phytoconstituents in both polar and non-polar extracts. This present research reveals the difference of phytochemicals constituent in male and female tree leaves of *Carica papaya* Linn separately that improve the already established quality standard of *Carica papaya* Linn tree leaves in forthcoming studies.

Keywords: Functional groups, dominating, *Carica papaya*, FTIR Interferogram, constituents, quality standard.

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 United States of America and Subcontinent's tropical region, the plant has been cultivated since 16th century³. *Carica papaya* L. is extensively cultivated in some localities of Punjab and Sindh Province of Pakistan¹. The plant is well known by its unbranched soft stem which at its apex secretes milky latex. The plant shows rapid growth and can reach to a maximum height of 20 m⁴. Traditionally, various extracts of *Carica papaya* Linn tree leaves are consumed in various ailments including dengue hemorrhagic fever^{1,5}. Leaves of *Carica papaya* L. exhibit beneficial effects and in Asia leaves of the plant are widely used as medicine⁶⁻⁹. Phytoconstituents of leaves shows hepatoprotective, hypoglycemic, anti-fertility, immunomodulatory, wound healing as well as antiviral properties¹⁰⁻¹².

MATERIALS AND METHOD

Plant collection

Carica papaya Linn tree's tall variety was cultivated in month of December 2016, at Memon Goath located near Malir Town, Karachi. The plants were not pesticised and cultivated at 22% to 60% humidity, having temperature range of 20-35°C. In May 2017, leaf samples were collected in early morning hours and packed in polyethylene bags before transport. Plant leaves were taxonomically authenticated from Department of Botany, Karachi University, Pakistan by Prof. Dr. Shahnaz Dewar. Voucher specimen No.107 and 108 was assigned and deposited at

Department of Pharmacognosy, Faculty of Pharmacy and Pharmaceutical Sciences, University of Karachi, Pakistan. Washing of both male and female tree leaves was done thrice with distilled water and air-dried at 30 ± 2°C for two weeks to remove moisture. Leaf sample were cut by using sterile blade under aseptic condition and only lamina part was separated. The plant material was grounded by mechanical blender to convert into coarse powder. Finally, the powdered samples were kept separately with appropriate tagging in airtight jar for future usage¹.

Preparation of the plant extracts

Preparation of ethanolic and n-hexane extracts

Female and male tree leaves (500 g each) of *Carica papaya* L. were macerated in 1000 ml of ethanol and n-hexane separately with proper labelling and kept for 2 weeks in separate wide mouth jars and shaken 10-15 times every day for 10 min. Leaves were extracted separately with ethanol and n-hexane for wide-ranging extraction. The extracts were filtered by using Whatman filter paper No. 42 and kept at 4°C in airtight container. The solvent filtrates were concentrated in vacuum using Marshall Scientific™ Büchi Rotavapor® R-200 which were then freeze dried by using KESU-4F® Union Microwave freeze dryer (Zhengzhou) Co., Ltd. Dried extracts were stored with labelling in separate containers at temperature range of 4° to 8°C.¹³

Fourier transform infrared (FTIR) spectroscopic analysis

FTIR is known to be the principal tool for identification of distinctive functional groups of phytoconstituents. Chemical

bonds in a molecule can be determined by the use of infrared absorption spectrum. Male and female tree leaves dried ethanolic and n-hexane extracts were sampled for analysis. For the study, neat technique was used. Smear of dried extract on KBr pellet were made separately for all extracts. FTIR spectrophotometer Bruker Vector 22 having range 400 to 4000 cm^{-1} was used for analysis¹⁴.

RESULTS AND DISCUSSION

Fourier transform infrared (FTIR) spectroscopic analysis

Interferogram of female and male tree leaves dried ethanolic extracts are provided in Figure 1 and 2 respectively and interferogram of n-hexane extracts of female and male tree leaves are given in Figure 3 and 4 respectively. Peak values data and possible functional groups of ethanolic and n-hexane leaves extracts are provided in Tables 1 and 2 respectively.

Carica papaya possesses valuable constituents that play key role in prevention and treatment of health conditions¹⁵. *Carica papaya* Linn leaves are the hub of numerous phyto-constituents used in various herbal formulation of the recent era¹⁶. FTIR spectroscopic analysis was performed to evaluate and identify functional groups

separately for both types of leaf extracts of male and female tree leaves of *Carica papaya*. In a study, phytoconstituents from two different varieties of *Carica papaya* were found to be similar in ethanolic and n-hexane extracts¹⁷ but the interferogram from the current study revealed significant difference in functional groups of phytoconstituents in both types of plant leaves. More functional group peaks are observed in both ethanolic and n-hexane extracts of female tree leaves. N-H (3010.6 to 3491.2 cm^{-1}), C=O (1738.3 cm^{-1}), O-H (3512.9 cm^{-1}) are dominating in ethanolic extracts of female tree leaves while C-O (995.8 to 1054.4 cm^{-1}), N-H₂ (1609.5 cm^{-1}) and O=C-O-C (1267.8 cm^{-1}) groups are dominating in ethanolic extract of male tree leaves. O-H group above 3500 cm^{-1} indicating presence of more acidic contents or phenolic compounds which are variable in both extracts of female and male tree leaves of *Carica papaya*. In aqueous extracts of *Carica papaya* female tree leaves O-H group in the region of 3661.4 and 3699.8 cm^{-1} indicated presence of more phenolic or acidic contents. C=O in the region of 1760.7, 1815.1 and 1865.7 reflected strong carbonyl groups in female tree leaves aqueous extracts that were absent in male¹⁸. Data reflecting female tree leaves of *Carica papaya* as a hub of major phytoconstituents in both polar and non-polar extracts.

Table 1: Peak values and functional groups of ethanolic extracts of *Carica papaya* L. female and male tree leaves

S. No.	EFLEPV cm^{-1}	FG	I	EMLEPV cm^{-1}	FG	I
1.	635.2	$\equiv\text{C-Br}$ Bending broad	s	601.1	C-Br Stretching	s
2.	718.8	OH Bend (out of plane)	m	---	-----	---
3.	776.6	C-Cl Stretch	s	777.3	C-Cl Stretch	s
4.	821.5	= C-H Bending	s	824.3	= C-H Bending and = CH ₂	s
5.	866.6	= C-H Bending (out of plane)	s	---	-----	---
6.	922.9	= CH-H Bending	s	925.2	= C-H Bending and = CH ₂	s
7.	---	-----	---	995.8	C-O Stretching	m-s
8.	1073.1	C-O Stretching	m-s	1054.5	C-O Stretching	m-s
9.	1245.2	C-O Stretching	m-s	1267.8	O=C-O-C aromatic Stretch	s-vs
10.	1380.5	CH ₃ -CH Bend	s	---	-----	---
11.	---	-----	---	1410.4	C-H ₂ Bending broad	s
12.	1461.1	C-H Bending	s	---	-----	---
13.	---	-----	---	1609.5	N-H ₂ Scissoring	m-s
14.	1642.1	C=C Stretch	vw-m	---	-----	---
15.	1738.3	C=O Stretch	s	---	-----	---
16.	2108.8	C $\equiv$ C	m	---	-----	---
17.	2855.2	C-H Stretch	s	---	-----	---
18.	2926.6	C-H Stretch broad	s	2929.0	C-H Stretch	s
19.	3010.6	N-H Stretch	w	---	-----	---
20.	3335.2	N-H Stretch	w	3385.8	N-H Stretch	---
21.	3407.2	N-H Stretch	w	---	-----	---
22.	3491.2	N-H Stretch	w-m	---	-----	v
23.	---	-----	-----	---	-----	---
24.	3512.9	O-H	s	---	-----	---

Note: (v; variable, s; strong, m; medium, vs; very strong, vw; very weak, EFLEPV; ethanolic female leaf extracts peak values, EMLEPV; ethanolic male leaf extracts peak values, FG; functional groups, I; intensity)

Table 2: Peak values and functional groups hexane extracts of CARICA PAPAYA L. female and male tree leaves

S. No.	HFLEPV cm ⁻¹	FG	I	HMLEPV cm ⁻¹	FG	I
1.	598.4	C-Br Stretching	s	538.8	C-Br Stretching	s
2.	725.2	-(CH ₂) _n Bending	w	723.0	CH ₂ Rocking	w
3.	837.0	= C-H Bending	s	844.0	= C-H Bending &= CH ₂	s
4.	972.6	= CH-H Bending	m	---	-----	---
5.	1035.0	C-O Stretching	m-s	1037.2	C-O Stretching	m-s
6.	1096.9	C-O Stretching	m-s	1174.3	C-O Stretching	m-s
7.	1173.2	C-O Stretching	m-s	1245.7	C-O Stretching	m-s
8.	1244.1	C-O Stretching	m-s	---	-----	---
9.	1377.2	CH ₃ -CH Bend	m	---	-----	---
10.	1453.4	C-H Bending	s	1411.4	C-H ₂ Bending	s
11.	---	-----	---	1516.5	N-H Bending	m
12.	---	-----	---	1585.7	N-H ₂ Scissoring	m-s
13.	1657.7	C=O Stretch broad	s	---	-----	---
14.	1735.2	C=O Stretch	s	1738.0	C=O Stretch	s
15.	2731.7	H-C=O Stretch	m	---	-----	---
16.	2856.2	C-H Stretch	s	2854.2	C-H Stretch	s
17.	---	-----	---	2930.6	C-H Stretch	s
18.	3190.7	OH Bounded	s	---	-----	---
19.	3238.1	OH Free broad	s	---	-----	---
20.	3371.1	N-H Stretch	w-m	---	-----	---
21.	3416.0	N-H Stretch	w-m	---	-----	---
22.	3461.1	N-H Stretch	w-m	---	-----	---
23.	3550.1	O-H Stretch Acid /Phenol	v	3559.3	O-H Stretch Acid /Phenol	v
24.	---	-----	---	3583.6	O-H Stretch Acid /Phenol	v

Note: (v; variable, s; strong, m; medium, HFLEPV; hexane female leaf extracts peak values, HMLEPV; hexane male leaf extracts peak values, FG; functional groups, I; intensity)

Figure 1: Interferogram of female leaf ethanolic plant extract

Figure 2: Interferogram of male leaf ethanolic plant extracts

Figure 3: Interferogram of female leaf hexane plant extract

Figure 4: Interferogram of male leaf hexane plant extract

CONCLUSION

The data on quality standards of *Carica papaya* L. leaves will be improved from present research conducted separately on female and male tree leaves which helps to improve the quality control standards of herbal formulations having leaves as main ingredients of the product against notorious diseases including dengue. Results from this research indicated variations in phyto-constituents of female and male tree leaves in polar and non-polar solvent extracts. This research redefines the abundance of phytochemicals in female and male tree leaves of *Carica papaya* L. for forthcoming studies.

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REFERENCES

1. Zohaib SH, Nighat R, Imran A, Farid H. Development of quality standard and phytochemical analysis of *Carica papaya* Linn leaves. Pak. J. Pharm. Sci 2018; 31 Suppl 5: 2169-2177.
2. Anjum V, Ansari SH, Naquvi KJ, Arora P, Ahmad A. Development of quality standards of *Carica papaya* Linn leaves. Sch. Res. Lib 2013; 5(2): 370-376.
3. Milind P, Gurditta. Basketful benefits of Papaya. Int Res J Pharm 2011; 2(7): 6-12.
4. Owoyele BV, Adebukola OM, Funmilayo AA, Soladoye AO. Anti-inflammatory activities of ethanolic extract of *Carica papaya* leaves. Inflammopharmacol 2008; 16: 168-173.
5. Ahmad N, Fazal M, Ayaz M, Abbasi BH, Mohammad I, Fazal H. Dengue fever treatment with *Carica papaya* leaves extracts. Asian Pac. J. Trop. Bio Med 2011; 1: 330-33.
6. Anuar NS, Zahari SS, Taib IA, Rahman MT. Effect of green and ripe *Carica papaya* epicarp extracts on wound healing and during pregnancy. Food and Chem. Toxicol 2008; 46 (7): 2384-2389.
7. Personal author: Lim TK. *Carica papaya*. In: Lim TK, editor. Edible Medicinal and Non-Medicinal. Plantas Volume 1, Fruits. 1. First ed. New York, USA: Springer; 2012. p. 693-717.
8. Otsuki N, Dang NH, Kumagai E, Kondo A, Iwata S, Morimoto C. Aqueous extract of *Carica papaya* leaves exhibits anti-tumor activity and immune-modulatory effects. J. Ethnopharmacol 2010; 127(3): 760-767.
9. Nguyen TT, Parat MO, Shaw PN, Hewavitharana AK, Hodson MP. Traditional aboriginal preparation alters the chemical profile of *Carica papaya* leaves and impacts on cytotoxicity towards human squamous cell carcinoma. PLoS One 2016; 11(2): e0147956.
10. Adeneyea AA, Olangunju JA. Pharmacognostic evaluation of *Carica papaya* L. leaves with reference to sexual dimorphism, Biol and Med 2009; 1(1): 1-10
11. Yogiraj V, Pradeep KG, Chetan SC, Anju G, Bhupendra V. *Carica papaya* Linn: An Overview. Int. J. of Herb Med 2014; 2(5): 01-08.
12. Suresh K, Deepa K, Harisaranraj R, Vaira, Achudhan V. Antimicrobial and phytochemical investigation of the leaves of *Carica papaya* L., *Cynodon dactylon* (L.) Pers., *Euphorbia hirta* L., *Melia azedarach* L. and *Psidium guajava* L. Ethnobot. Leaflets 2008; 12: 1184-1191.
13. Omojola PF, Awe S. The antibacterial activity of the leaf extract of *Anacardium occidentale* and *Gossypium hirsutum* against some selected microorganisms. Biosci. Res. Communication 2004; 16(1): 24-30.
14. Lohar DR. Protocol for testing of Ayurveda, Siddha and Unani medicines. Government of India. Department of AYUSH. Ministry of Health and Family Welfare. Pharmacopoeial Laboratory for Indian Medicines. Ghaziabad; 2007. p. 47-52.
15. Marfo EK, Oke OL, Afolabi OA. Chemical composition of papaya (*Carica papaya*) seeds. Food Chem 1986; 22: 259-66.
16. Zunjar V. Pharmacognostic physiochemical and phytochemical studies *Carica papaya* Linn leaves. Pharmacog J 2011; 3: 214-217.
17. Njoku V, Obi C, Onyema OM. Phytochemical constituents of plants. Afr. J. Biotech 2011; 10(66): 15020-15024.
18. Zohaib SH, Bilal M, Imran A, Asif A. Evaluation of mineral contents and FTIR Spectroscopic analysis of aqueous extracts of male and female tree leaves of *Carica papaya* Linn. Int. Res. J. Pharm 2019; 10(8): 14-17.

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