COMPARATIVE ANALYSIS OF THE PHYTOCHEMICAL COMPOSITION OF MALE AND FEMALE *CARICA PAPAYA* (PAW PAW) LEAVES

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Abstract

Carica papaya, (pawpaw), belongs to the family of Caricaceae. Phytochemical screening of male and female Carica papaya (pawpaw) leaves were carried out. The phytochemicals tested for in the two species of pawpaw leaves are Alkaloids, Flavonoids, Glycosides, Reducing Sugar, Saponins, Steroids, and Tannin. The ethanoic, chloroform, and aqueous extracts of the male pawpaw leaves showed presence of all the tested phytochemicals except Glycosides and Reducing Sugar while in the Female pawpaw leaves, ethanoic and chloroform extracts show the presence of Alkaloids, Saponins, Steriods, and Tannins while Aqueous extract shows the presence of only Saponins and Tannins. The phytochemical screening shows that water is not the best extractant but ethanol and chloroform. The research also revealed that the male pawpaw leaves contain more phytochemicals than the female counterpart.

Keywords: *Carica papaya* leaves, phytochemical, extractant.

Introduction

Carica papaya Linnaeus, (pawpaw), belongs to the family of Caricaceae. Papaya is not a tree but a herbaceous succulent plants that possesses self-supporting stems. (Dick Gross, 2003). Papaya is a large perennial herb with a rapid growth rate. The plants are usually short-lived, but can produce fruit for more than 20years. The papaya has a rather complicated means of reproduction. The plants are male, hermaphrodite, or female (Bruce and Peter, 2008). The male trees are uncommon, but sometimes occur when homeowners collect their own seeds. Hermaphrodite trees (flowers with male and female parts) are the commercial standard, producing a pear-shaped fruit. These plants are selfpollinated (Jari, 2009). *Carica papaya* plants produce natural compounds (*Annonaceousacetogenins*) in leaf bark and twig tissues that possess both highly anti-tumour and pesticidal properties. It was suggested that a potentially lucrative industry based simply on production of plant biomass could develop for production of anti-cancer drugs, pending Food and Drug Agency approval, and natural (botanical) pesticides (Peter, 1991). The high level of natural self defence compounds in the tree makes it highly resistant to insect and disease infestation (Peter, 1991). *Carica papaya L.* leaf tea or extract has a reputation as a tumour-destroying agent. (Wilson Popenoe. 2000). Aside from its value as a remedy in dyspepsia and kindred ailments, it has been utilized for the clarification of beer.

The seed is used for intestinal worms when chewed. The root is chewed and the juice swallowed for cough, bronchitis, and other respiratory diseases. The unripe fruit is used as a remedy for ulcer and impotence, (Elizabeth, 1994). Fresh, green

pawpaw leaf is an antiseptic, whilst the brown, dried pawpaw leaf is the best as a tonic and blood purifier. (Atta, 1999). Chewing the seeds of ripe pawpaw fruit also helps to clear nasal congestion, (Elizabeth, 1994).

The green unripe pawpaw has a therapeutic value due to its antiseptic quality. It cleans the intestines from bacteria, more so that (only a healthy intestine is able to absorb vitamin and minerals, especially vitamin B12). The tea, prepared with the green papaya leaf, promotes digestion and aids in the treatment of ailments such as chronic indigestion, overweight and obesity, arteriosclerosis, high blood pressure and weakening of the heart (Mantok, 2005).

Phytochemicals in *Carica papaya*

Carica papaya contains some phytochemicals such as Alkaloids. This phytochemical shows quite diverse medicinal property. Many of them possess local anesthetic properties, but their practical use is limited for clinical purpose. Morphine is one of the most known alkaloids which had been used and still is for medical purposes (Atta, K. Bonsu, 1999). This alkaloid is a powerful narcotic which is used for the relief of pain, but its usefulness is limited because of addictive properties.

Methyl ether derivative of morphine—codeine—naturally occurring next to morphine in the opium poppy, possesses an excellent analgesic activity and is shown to be relatively non-addictive. These alkaloids act as respiratory or cardiac stimulants. Next, the alkaloid which is used as medication in many clinical applications is atropine. For example, injection with atropine is given to treat bradycardia (low heart rate).

Tubocurarine is an alkaloid which is an ingredient of poison cure, and is used as muscle relaxant. Alkaloids vincristine and vinblastine are used as chemotherapeutic agent in the treatment of many cancer types. Cocaine an alkaloid present in *Erythroxylum coca* is a potent local anesthetic. Ergonovine, an alkaloid from the fungus *Claviceps purpurea*, and the second alkaloid ephedrine isolated from *Ephedra* species both act as blood vessel constrictors.
Also, ephedrine is used in bronchial asthma and to relieve discomfort of hay fever, sinusitis, and common colds.

Quinine is a powerful antimalarial agent and more often is replaced by synthetic drugs, which are more effective and less toxic (Bruce, S. and Peter, C. A, 2008). Another alkaloid from *Cinchona* species is quinidine which has medical application as treatment of irregular rhythms of the heartbeat or arrhythmias.

Colchicine is another alkaloid, present in plants of Liliaceae family, known for ages to treat acute gout attacks. Another clinically used alkaloid is lobeline isolated from *Lobelia inflata*, which has multiple mechanisms of action.

Health Benefits of Flavonoids

Flavonoids are a widely distributed group of polyphenols and comprise the most studied bioactive compounds for about 50 years due to their potential health benefits; they have a complex and unknown biologic function, which are based on their antioxidant activity (Gbolahan, D. 2001). Furthermore, because of their remarkable activities and potential health benefits, they are used in the food and cosmetics industries.

Medicinal Importance of Saponins

Saponins affect the immune system in ways that help to protect the human body against cancers, and also lower cholesterol levels. Saponins decrease blood lipids, lower cancer risks, and lower blood glucose response. A high saponin diet can be used in the inhibition of dental cares and platelet aggregation, in the treatment of hypercalciuria in humans, and as an antidote against acute lead poisoning. In epidemiological studies, saponins have been shown to have an inverse relationship with the incidence of renal stones.

Main Uses and Potential Benefits of Steroids

When one thinks of steroids, the first thing that may come to mind is their use in bodybuilding to promote muscle gain (Mantok, C. 2005). The main potential benefits associated with anabolic steroids are the following:

- increases muscle tissue due to enhanced protein synthesis
- decreases body fat percentage
- increases muscle strength and power
- enhances recovery from workouts and injury
- improves bone mineral density
- promotes better muscle endurance
- increases the production of red blood cell

Benefits of Tannins

The anticarcinogenic and antimutagenic potentials of tannins may be related to their antioxidative property, which is important in protecting cellular oxidative damage, including lipid peroxidation. The generation of superoxide radicals was reported to be inhibited by tannins and related compounds. The antimicrobial

activities of tannins are well documented. The growth of many fungi, yeasts, bacteria, and viruses was inhibited by tannins. The antimicrobial property of tannic acid can also be used in food processing to increase the shelflife of certain foods, such as catfish fillets. Tannins have also been reported to exert other physiological effects, such as to accelerate blood clotting, reduce blood pressure, decrease the serum lipid level, produce liver necrosis, and modulate immune-responses. The dosage and kind of tannins are critical to these effects.

Medicinal Properties of Papaya

Papaya has been known as a food or as a quasi-drug. It has wide consumption owing to its pharmacological properties and can be used as a folk remedy for various disorders. It contains different kinds of immuno-stimulating agents and antioxidants. Its pulp is utilized in hospitals of Africa for wounds healing as well as curing burns because management of chronic non-healing ulcers poses difficulty and many clinical problems. An amalgamation of papain-urea has been proven effective in conducting enzymatic wound debridement. According to Reed, papaya latex is very useful for curing dyspepsia and is externally applied to burns and scalds; it also cures diarrhoea, bleeding haemorrhoids, and whooping cough. Papaya juice helps in alleviating infections of the colon by clearing away infection, pus, and mucus (Hunt, S, 2001). Its ripe fruit is a carminative, diuretic, expectorant, sedative, and has preventive action against dysentery, skin diseases, psoriasis, and ringworm. Papaya also exhibits therapeutic assets against various pathological disorders. The unripe fruit is used as a remedy for ulcers and impotence; it has the ability to exhibit bacteriostatic

activity against human enteric pathogens; and it aids in reducing menstrual irregularities and promotes natural menstruation flow in women. It has been recommended for controlling the most ubiquitous problem of hair dandruff. The green leaf presents an imitable source of vital and essential nutrients while the yellow one provides iron (Ayoola, P. 2010). It has a synergistic action to reduce enlarged spleen and liver and it is used in snakebite to remove poison. Papaya fruit is thought to contain some immunostimulating and antioxidant agents; its juice is prescribed to cure gastrointestinal maladies.

The objective of this study is to screen the male and female leaves of *Caricapapaya* for phytochemicals, as a basis to advising the traditional medicine practitioners, herb users, herb sellers, health institutions and farmers on the health and economic importance of male and female Carica *papaya* leaves.

Materials and Method Collection and Identification of plant materials

The male and female leaves of *Carica papaya* were plucked from Mr. Odenigbo's farm at Ugwuaji Enugu South LGA of Enugu State, Nigeria and were identified and authenticated by a taxonomist of University of Nigeria, Nsukka. The leaves were washed, air-dried and ground into fine powder using mortar and pestle in the laboratory as described by Stray, F. 1998).

Extraction method

Powdered pawpaw plant leaves (80.0g) was dispersed into a volumetric cylinder of 1000ml capacity containing 800ml of ethanol. The mixture was kept for fourteen (14) days with shaking at regular intervals after which the content was

filtered and the filtrate was evaporated at 30^{o}C. The crude extract (4.0g) was partitioned in a mixture of 20ml chloroform and 20ml water (1:1). The mixture was shaken properly, placed in a separatory funnel and allowed to separate before collection into separate beakers. Both the water and chloroform extracts were allowed to evaporate at room temperature (Egan, H. 2019).

Test for alkaloids

To 0.1ml of the extract and fractions in a test tube, 2 –3 drops of Dragendoff's reagent was added. An orange red precipitate with turbidity showed the presence of alkaloids (Egan, H. 2019).

Test for flavonoids

To 4mg/ml of the extracts and fractions, a piece of magnesium ribbon was added followed by drop-wise addition of concentrated HCl. A colour change from orange to red indicated the presence of flavones; red to crimson indicated the presence of flavonoids (AOAC. 2018).

Test for glycosides

Approximately 10ml of 50% H_2SO_4 was added to 1ml of the filtrate in separate test tubes and the mixtures heated for 15mins followed by addition of 10ml of Fehling's solution and boiled. A brick red precipitate indicated presence of glycosides (AOAC. 2018).

Test for Reducing Sugars

To 1ml of extract and fractions in separate test tubes, 2.0mls of distilled water were added followed by addition of Fehling's solution (A + B) and the mixtures

were warmed at 40^{o}C. Appearance of brick red precipitate at the bottom of the test tube indicated the presence of reducing sugar (Egan, H. 2019).

Test for Saponins

Each powdered pawpaw leaf (0.5g) was dispensed in a test-tube and 5.0ml of distilled water was added and shaken vigorously. A persistent froth that lasted for about 15 minutes indicated the presence of saponins (Egan, H. 2019).

Test for Steroids

About 2ml of the extracts were evaporated to dryness in separate test tubes and the residues dissolved in acetic anhydride followed by addition of chloroform. Concentrated sulphuric acid was added by means of a pipette via the side of the test tubes. Formation of brown ring at the interface of the two liquids and violet colour in the supernatant layer showed the presence of steroids (Egan, H. 2019).

Test for Tannins

About 2ml of the extract/fraction was diluted with distilled water in separate test tubes; 2 to 3 drops of 5% ferric chloride ($FeCl_3$) solution were added. A green – black or blue colouration indicated the presence of tannin (Egan, H. 2019).

Results Table 1.1 Phytochemical Constituents of Female *Carica papaya* leaf Extract/fractions

Extractant	Alkaloids	Flavonoids	Glycosides	Reducing Sugar	Saponins	Steroids	Tannins
EE	+	+	-	-	-	+	+

CE	+	+	-	-	-	+	+
AE	-	-	-	-	+	-	+

Key: *EE = Ethanolic Extract, CE = Chloroform Extract, AE = Aqueous Extract, + = Present, - = Absent*

Table 1.2 Phytochemical Constituents of Male *Carica papaya* leaf Extract/fractions

Extractant	Alkaloids	Flavonoids	Glycosides	Reducing Sugar	Saponins	Steroids	Tannins
EE	+	+	-	-	+	+	+
CE	+	+	-	-	+	+	+
AE	+	+	-	-	+	+	+

Key: EE = Ethanolic Extract, CE = Chloroform Extract, AE = Aqueous Extract, + = Present, - = Absent

Discussion

The ethanolic, chloroform, and aqueous extracts of the male pawpaw leaves show presence of all the tested phytochemicals except Glycosides and Reducing Sugar while in the female pawpaw leaves, ethanolic and chloroform extracts show the presence of Alkaloids, Saponins, Steriods, and Tannins while Aqueous extract shows the presence of only Saponins and Tannins. The phytochemical screening shows that water is not the best extractant but ethanol and chloroform.

The research also revealed that the male pawpaw leaves contains more phytochemicals than the female ones.

Conclusion

The Phytochemicals of the male and female pawpaw leaves were comparatively evaluated and it was observed that the male pawpaw leaves have more phytochemicals than the female ones and also, out of the extractants used, it is discovered that water is not the best but ethanol and chloroform.

Recommendations

It is recommended that more research be carried out in the male leaves of *Carica papaya* since it contains more phytochemicals than the female ones and also because literature has shown that it is mainly the female leaves that many works have been done on. It is also good that government increase the planting rate of this *Carica papaya* since the medicinal importance of the plant cannot be over-emphasized.

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