



Proximate Composition and Phytochemical Constituents of Matured *Carica papaya* Seed Extracts

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Authors' contributions

This work was carried out in collaboration among all authors. Author KMA designed the study, performed the statistical analyses, wrote the protocol and wrote the first draft of the manuscript. Authors YR and IMP managed the analyses of the study. Authors YAI and NA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aim: To investigate the proximate composition and phytochemical constituents of matured *Carica papaya* seed.

Study Design: Proximate composition was determined on *Carica papaya* seed powder while extracts for phytochemical analysis were obtained, in turn using five different solvents of varying polarity, namely n-hexane, chloroform, ethyl acetate, methanol and water.

Place and Duration of Study: Department of Biochemistry, Faculty of Basic Medical sciences, Bayero University Kano, Nigeria. The study was carried out between March- April, 2019.

Results: The proximate composition of matured *Carica papaya* seed showed it contained crude fat (27.72%), carbohydrate (23.34%), crude fibre (21.25%), ash (10.25%), crude protein (9.65%) and moisture (7.34%). Qualitative phytochemical screening of *Carica papaya* seed extracts detected major phytochemicals except anthraquinones and quantitative analyses of these phytochemicals in

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all the five extracts showed that flavonoids was the most abundant phytochemical with 38.68%, 35.85%, 36.76%, 34.04% and 23.50% for methanol, aqueous, chloroform, n-hexane and ethyl acetate fractions respectively while tannins was the least abundant phytochemical with 0.03% for methanol extract, 0.04% for n-hexane extract, 0.09% for aqueous and ethyl acetate extracts, and 0.14% for the chloroform extract.

Conclusion: Seeds of matured *Carica papaya* contain major nutrients that may be useful in nutrition. The presence of phytochemicals such as flavonoids, alkaloids and saponins in considerable quantities explained the medicinal activity of the plant material as encountered in its therapeutic uses.

Keywords: Proximate composition; phytochemical constituents; *Carica papaya* seed; extract; extraction solvent.

1. INTRODUCTION

Nutritional and pharmaceutical sciences have in recent years seen an increased in scientific literature due to the renewed interest on food plants with several health benefits and medicinal potential [1]. Plants are generally considered safe, nutritious and proven to be effective against many human ailments [2]. To this end, several plant parts are being screened for their nutraceutical benefits. One of such plants whose fruits, leaves, stem and seeds are being screened by researchers for food and medicinal activities is *Carica papaya*. This is important in order to determine the scientific basis for the several-century of usage of these plant parts as food and in traditional medical practice [3]. *C. papaya* is a fast growing tree-like herbaceous plant belonging to the family *Caricaceae* and is widely grown globally in both tropic and sub-tropical regions of the world including Nigeria [4].

The Food and Agricultural Organization (FAO) of the United Nations has reported that Nigeria is the largest producer of *C. papaya* globally [5]. The fruit contains papain, a proteolytic enzyme that is also used in the treatment of trauma, allergies and spot injuries [3]. Several vitamins including Vitamin A, Vitamin C and Vitamin E are predominantly found in the fruit. These substances are useful in nutrition and also have documented antioxidant activities [6]. The seeds of *C. papaya* have been reported to possess several health benefits including antimicrobial and antifungal activities [7]. Recent report has shown that *C. papaya* seed possesses preventive effect against potassium bromate-induced renal toxicity in rats [8]. The objective of the present study is to carry out a preliminary investigation on matured *C. papaya* seed to determine its proximate composition and phytochemical constituents. This is important because awareness on the nutritive value and

health benefits of *C. papaya* seed is of utmost importance in order to enhance its nutritional and medicinal use.

2. MATERIALS AND METHODS

2.1 Plant Sample and Preparation

25 matured unripe *C. papaya* was bought from Na'ibawa market Kano, Nigeria and identified by the Department of Plant Biology, Bayero University Kano, Nigeria with an accession number, BUKHAN 0012. Each of the plant samples was cut into two to remove the seeds which was washed with tap water, shade-dried and ground into fine powder using an electric blender.

2.2 Preparation of Extract for Phytochemical Screening

500g of the pulverized *C. papaya* seed was suspended in 1500 ml of each of the five extraction solvents namely n-hexane, chloroform, ethyl acetate, methanol and water for 24 hours and shaken at regular intervals [9]. Each of the extract was then sieved first with cheese cloth and then with Whatman filter paper No 1. The filtrate in each case was concentrated to dryness in a water bath preset at 45°C and was kept in the refrigerator at 4°C until required (Result not shown).

2.3 Proximate Analysis

Proximate composition constitutes the class of food present in samples and it includes carbohydrate, protein, fat, fibre, ash and moisture content. The proximate analysis of matured *C. papaya* seed was carried out according to the procedures of the Association of Official Analytical Chemists [10].

2.4 Phytochemical Analyses

Qualitative phytochemical screening of aqueous, methanol, ethyl acetate, chloroform and n-hexane extracts of *C. papaya* seed were carried out using standard methods to detect the phytochemicals that is present, and where the presence of a given phytochemical was established, then the amount of that phytochemical was determined quantitatively using methods that have been previously described [11].

2.5 Statistical Analysis

Results are expressed as mean \pm SDM and n=3 for all readings.

3. RESULTS

3.1 Proximate Composition of *Carica papaya* Seed

The proximate analysis of *C. papaya* seed powder showed that fat is the most abundant nutrient followed by carbohydrate and fibre in that order. The sample has moderate protein and ash. Also moisture content was low. The result is shown on Table 1.

Table 1. Proximate composition of matured *Carica papaya* seed

Proximate parameter	Amount (%)
Carbohydrate	23.34 \pm 0.04
Protein	9.65 \pm 0.45
Ash	10.25 \pm 0.06
Moisture	7.34 \pm 0.05
Fibre	21.25 \pm 0.04
Fat	27.72 \pm 0.02

n = mean \pm SDM

3.2 Phytochemical Contents of Different Solvent Extracts of *Carica papaya* Seed

The crude seed extracts of *C. papaya* extracted using water, methanol, ethyl acetate, chloroform and n-hexane screened for the presence of six major phytochemicals namely flavonoids, alkaloids, saponins, cardiac glycosides, tannins and anthraquinones showed that flavonoids, alkaloids and saponins are prominently present in all the extracts in varying composition while other phytochemicals are present in relatively minute quantities except anthraquinone which

was not detected in all the extracts. The results of the qualitative and quantitative phytochemical analyses are shown on Table 2 and Table 3 respectively.

4. DISCUSSION

The high level of fat observed in the proximate composition of *C. papaya* seed indicate that the seed could serve as a source of energy and this is supported by the high level of carbohydrate (25%). Therefore *C. papaya* seed could be ranked as energy-rich seed. The low moisture content (7.34%) in the present study could be an indication of high shelf life of *C. papaya* seed. This is because literature has reported that moisture content of foodstuff is known to influence its shelf life and that lower moisture resist early spoilage of food by retarding the growth of microorganism [12]. The crude fibre content of *C. papaya* seed recorded in this study, 23.25% is lower than the 25.23% recorded previously in a similar study [13]. Previous researchers have reported that high dietary fibre plays important roles in the normal functioning of large intestines, and has physiological effects on lipids and glucose metabolism as well as mineral bioavailability [14]. The same workers also reported that dietary fibre can protect gastrointestinal tract against certain disorders and play roles in the prevention of some kinds of cancers [14]. Crude protein content of 9.65% shows that protein constitutes a good proportion of *C. papaya* seed. Protein is an essential constituent of diet and is required for survival and many other functions in the body. Ash is the residue that remains after the organic matter in a substance is burnt off. It is used to determine the quantity of all the minerals that is present [15]. The amount of ash obtained in the present study, 10.25% is comparatively higher than 5.21% recorded previously in a related study [13] however additional research is required to determine the mineral content of matured *C. papaya* seed.

Phytochemical screening shows that aqueous, methanol, ethyl acetate, chloroform and n-hexane extracts of *C. papaya* seed contain varying amount of Flavonoids, alkaloids and saponins depending on the extraction solvent used. These phytochemicals forms the major constituents of *C. papaya* seed and previous workers have reported several medicinal activities associated with these bioactive compounds. For example, flavonoids and alkaloids possess antioxidant activities and can

Table 2. Qualitative phytochemical analysis of five different solvent extracts of matured *Carica papaya* seed

Solvent	Flavonoids	Alkaloids	Saponins	Tannins	Cardiac glycoside	Anthraquinones
n-Hexane	+	+	+	+	+	-
Chloroform	+	+	+	+	+	-
Ethyl acetate	+	+	+	+	+	-
Methanol	+	+	+	+	+	-
Aqueous	+	+	+	+	+	-

+ = detected, - = not detected

Table 3. Phytochemical contents of five different solvent extracts of crude *Carica papaya* seed

Solvent	Flavonoids	Alkaloids	Saponins	Tannins	Cardiac glycoside
n-Hexane	34.04 ±0.08	16.20 ±0.02	26.78±0.04	0.04±0.002	1.97±0.02
Chloroform	36.76 ±1.02	21.62 ±0.06	26.76 ±1.04	0.14 ±0.060	1.96 ±1.02
Ethyl acetate	23.50 ±0.04	19.88 ±0.06	23.50 ±0.02	0.09 ±0.002	2.18 ±0.04
Methanol	38.68 ±0.42	27.62 ±0.24	28.64 ±0.02	0.03 ±0.001	1.20 ±0.04
Aqueous	35.85 ±1.02	27.26 ±0.04	25.86 ±0.04	0.09 ±0.002	0.84 ±0.60

n = mean ± SDM

scavenge reactive oxygen species and lipid peroxy radicals [16,17]. Flavonoids also have several other medicinal activities which include antibacterial, anti-inflammatory, anti-allergic and anti-neoplastic activities among others [18]. Alkaloids are reported to possess muscles relaxant property because of its ability to inhibit the acetylcholine receptor spots which enable muscle to unwind at neuromuscular intersections [19]. Other reported properties of alkaloids include antimicrobial, amoebicidal and anticancer activities [20]. Saponins are reported to exhibit cytotoxic effect and growth inhibition against a variety of cells hence their reported anti-inflammatory and anti-cancer activities [21]. However, this activity of saponins could generate adverse physiological responses when eaten in uncontrolled quantity by animals [22]. Cardiac glycosides and tannins are detected in minute quantities in the present study, and while cardiac glycosides are known to have roles in the therapy of heart failure and cardiac rhythm disorders because of its ability to increase the output force of the heart thus increasing heart rate of contractions by acting on the cellular sodium- potassium ATPase pump [23], tannins are reported to play roles in wound healing and assist in the formation of new tissues on wounds and inflamed mucosa hence it's use as antiulcer and anti-inflammation [24] Anthraquinones was not detected and this is in contrast with previous study which qualitatively detected this phytochemical in ethanol and chloroform but not

in benzene extracts of unripe *C. papaya* seed that was-dried for two weeks [25].

5. CONCLUSION

The findings of this study have shown that seeds of *C. papaya* contain all the major nutrients required in nutrition and may therefore serve as component of human diet. Also depending on the extraction solvent used, the plant material could contain considerable quantities of many important bioactive compounds namely flavonoids, alkaloids and saponins, and small amounts of tannins and cardiac glycosides. These phytochemicals have several reported medicinal activities and implies that *C. papaya* could serve as a promising medicinal plant.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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