Original Article

Preliminary phytochemical, proximate and nutrient analysis indifferent leaf extracts of Jatropha curcasL

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ABSTRACT

The current study looks at the phytochemical analysis, proximate composition, and nutrient content of different Jatropha curcas L. leaf extracts in-vitro. Preliminary phytochemical studies were also carried out to identify the classes of compounds found in different J. curcas leaf extracts. Proximate analysis (moisture, ash, total protein, fats, fibre, carbohydrate, and energy content) was done using the Association of Official Analytical Chemists' methods. Atomic absorption spectrometry was used to examine macronutrients (Ca, Mg, Na, K) and micronutrients (Fe, Cu, Pb, Zn, Ni, Cr, Cd).The results of the study revealed that J. curcas has a higher proximate and nutrient value, with a strong association between the two. J. curcas has also been discovered to be useful in medicine and food. In conclusion, the thesis demonstrated the biological potency of the plant and provided scientific support for its use in Indian medicine.

Key word: *Phytochemical analysis, proximate analysis, Micro and macro nutrients, J. curcas*

Medicinal plants play an important role in providing primary health care to rural people, and they are used by around 80% of the world's marginal populations [1]. Plants have been the foundation of many traditional medicine systems around the world since the beginning of time and have continued to provide mankind with new remedies.Because of the unprecedented accessibility of complex chemical compounds, a wide range of medicinal plants, their distilled constituents, and natural products from these plants provide limitless prospects for new drug discovery [2] and have also been shown to have beneficial therapeutic potential. Plants have medicinal value in the form of chemical compounds that have a beneficial physiological effect on the human body [3], and since plants synthesize such a wide variety of chemical compounds, they have a lot of potential for drug discovery and growth [4].Synthetic products abound on the market, with high premiums, adverse side effects, and environmental consequences [5]

Medicinal plants and drugs extracted from them, on the other hand, are less expensive and have fewer side effects, making them common with the public [6]. While non-nutritive, most photochemical are considered to have disease-preventive properties. As a result, they provide protection against pathogens [7], and samples are a source of sugars, minerals, organic acids, dietary fibres, and phenolics, which have a wide range of actions, including antioxidants, anti-mutagenic, cardio preventive, anti-bacterial, and antiviral activities [8].Alkaloids, saponins, sugars, glycosides, flavonoids, gums, steroids, tannins, phenolic compounds, volatile oils, and other phytochemicals are synthesized from a variety of medicinal plants and are used to treat a variety of ailments [9]. The act of revealing below a certain limit results in a consistent manner in a physiologically essential function on the life system [10].

Plant cell metabolic products are active elements in medicinal plants, and a trace element plays an important role in metabolism [11]. Herbs provide us with nutritional and trace elements, as well as chemicals with medicinal value; each one plays an important role if a deficiency occurs, as it can contribute to irregular body growth [12]. Some essential elements have been discovered in the aerial parts of various medicinal plants that are used in the treatment of various diseases. Some doctors and locals used medicinal plants in high concentrations in various ways [13]. The excess of trace elements in soil, water, animals, and plants has been directly proportional to the pathological state of the human body. Diets that are consistently high in a trace element may have an impact on the function of certain organs in the body. Five medicinal plant species were examined to determine their elemental value for this purpose.

Protein and carbohydrates are essential nutrients for life. Protein is essential for nutrient analysis [14]. Carbohydrates and proteins are essential nutrients for plants. Nutrients are essential for the body's physiological functions. These nutrients play an important role in satisfying human needs for

energy and life processes.Moisture, ash, crude fibre, protein, and carbohydrate were measured in different species by [15]. The nutrient and proximate study of selected plant species' aerial parts is critical in determining their nutritional value. Since a variety of medicinal plant species are also used as food in addition to their medicinal benefits, assessing their nutritional value may aid in recognising the importance of these plants' species [16].

Jatropha species are members of the Euphorbiaceae family and are used in traditional folklore medicine in Africa, Asia, and Latin America to treat a variety of ailments. Physic nut, purging nut, or pig nut are both names for J. curcas. Previous research has found that J. curcas leaf extract has substantial wound healing activity [17], antidiabetic activity [18], immunomodulatory effect [19] and antiparasitic/disinfectant activity.The plant's bark extract has been shown to have wound-healing properties[17] the root isolated fraction has been shown to have anti-diarrhoeal properties [20], curcin from seeds has been shown to have anti-tumour activity [21], and the latex contains alkaloids with anti-cancerous properties. The nutritional value of J. curcas medicinal plants species was assessed for this reason.

Table 1: Preliminary Phytochemical Analysis of *J. Curcas*

Class of Compounds	Test Performed	Extracts						
		Hexane	Diethyl ether	Ethanol	Ethyl acetate	Acetone	Methanol	Aqueous
Alkaloids	Mayer's	-	-	-	-	+	++	++
	Wagner's	-	-	-	-	+	++	++
Flavonoids	H_2SO_4	-	-	+	+	+	++	++
	Lead Acetate	-	-	+	+	+	++	++
Steroids	Liebermann - Burchard	-	-	-	+	+	+	+
Terpenoids	Salkowski	-	-	-	-	+	+	+
Anthroquinone	Borntragers	-	-	-	-	+	++	++
Phenols	Ferric Chloride	-	-	+	-	+	++	++
	Lead Acetate	-	-	+	-			
Saponin	Foam	+	+	-	+	-	-	-
Tannin	Braemer's	-	-	+	-	+	+	+
Carbohydrates	Fehling	-	-	+	+	+	+	+
Oils and Resins	Filter Paper	+	+	+	+	-	-	-

Note: "+" = Present, "++" = More Active, "-" = Absent

MATERIALS AND METHODS

Collection and Extraction of Plant Material: The leaves of J. curcas were collected and preserved in the Alpha Omega Research Centre (AORC073). The plant materials were washed and dried in the shade using running tap water. The leaves have been crushed and ground into a coarse powder. These coarse powders (25 g) were extracted sequentially using Soxhlet instruments in 250ml of each solvent (hexane, diethyl ether, ethanol, ethyl acetate, acetone, methanol, and aqueous). The extracts were processed before being taken up for further investigation. The dissolved solvents for these extracts are DMSO (dimethyl sufloxide).

Phytochemical Screening: All extracts of J. curcas were subjected to preliminary phytochemical analysis using standard methods defined by Brain and Turner [22] Evans [23].

Proximate and Chemical Analysis: Each collected plant sample was dried in the shade and finely ground to raw flour using an electric grinding machine (National Model MX 491N). The researchers were then carried out using the Association of Official Analytical Chemists (AOAC) standard techniques from [24].The moisture content of the sample was measured by drying it in the oven at 105°C until it reached a constant weight. The total organic nitrogen value of the sample was determined using Micro-apparatus Kjeldahl's to determine the crude protein value [25]. The crude lipids were extracted in petroleum ether at 40-60°C using the Soxhlet apparatus, followed by rot-evaporation of the solvent to dryness.Dry result of lipid estimation was ignited for fibre content estimation, and the ash contents were calculated and taken as equal to fibre contents [26]. The difference method was used to quantify the carbohydrate content of each sample as stated below: Carbohydrate (%) = 100- (moisture (%) + protein percentage (%) + lipid (%) + ash contents (%)). Whereas, the energy value of each sample was determined by using the following formula: K calories/100 gm = 9 (crude fats (%)) + 4 (carbohydrates (%) + proteins (%))

Elemental Analysis:The plant was burned to ash, then the ash was dissolved in HCl to make it into a solution. The macro- and micronutrients were thenmeasured using a Perkin Elmer single beam atomic absorption spectrometer.

Statistical Analysis: Each plant sample was subjected to proximate and elemental analysis three times, with the mean, standard deviation, and standard error determined for each parameter. Statistical Package for Social Sciences was used to conduct inter-element correlation (SPSS V.14)

RESULTS AND DISCUSSION

Secondary metabolites found in medicinal plants, such as alkaloids, flavonoids, steroids, and their corresponding active metabolites, have a high medicinal value and are commonly used in the pharmaceutical and drug industries. (Hexane, Diethyl ether, ethanol, ethyl acetate, acetone, methanol, and aqueous) extracts of J. curcas demonstrate higher yield percentages. When compared to other extracts, methanol extracts (81.36 percent) and aqueous extracts (80.23 percent) have higher yield percentages. This suggests that the essence of the solvent accounts for not only the yield of the extracts, but also their biological activities.

Phytochemical Screening

The phytochemical analysis of various extracts of J. curcasis shown in **Table 1.** The existence of alkaloids, flavonoids, steroids, Terpenoids, anthraquinone, phenols, tannins, and carbohydrates were reported in the J. curcas methanol and aqueous extracts, according to the qualitative findings presented in Table 1. Other extracts with mild activity include hexane, diethyl ether, ethanol, ethyl acetate, and acetone. When methanol and aqueous extracts were compared to other extracts, the researchers discovered that methanol and aqueous extracts had more constituents. Plant extracts were subjected to phytochemical examination, which indicated the existence of constituents with medicinal and physiological properties [27].

Phytochemicals such as phenols, tannins, flavonoids, saponins, glycosides, hormones, terpenoids, and alkaloids were discovered in the plant extracts. Total alkaloids, total flavonoids, total phenols, and total tannins were among the phytoconstituents investigated quantitatively. Acetone extracts have a total alkaloids content of 8.24 ± 0.03 mg/g, methanol extracts have a total alkaloids content of 10.22 ± 0.02 mg/g, and aqueous extracts have a total alkaloids content of 9.55 ± 0.04 mg/g.Ethanol extracts have a total flavonoid content of 4.23 ± 0.03 mg/g, ethyl acetate extracts have a total flavonoid content of 4.03 ± 0.03 mg/g, acetone extracts have a total flavonoid content of 4.38 ± 0.01 mg/g, methanol extracts have a total flavonoid content of 4.75 ± 0.03 mg/g, and aqueous extracts have a total flavonoid Total phenols are 7.34 ± 0.04 mg/g in ethanol extract, 7.57 ± 0.01 mg/g in acetone extract, 7.95 ± 0.03 mg/g in methanol extract, and 7.87 0.01 mg/g in aqueous extract. Total tannins are 2.56 ± 0.03 mg/g in ethanol extract, 2.84 ± 0.04 mg/g in acetone extract, 3.24 ± 0.03 mg/g in methanol extract, and 2.96 ± 0.02 mg/g in aqueous extract (**Figure- 1**).

One of the largest and most common classes of plant metabolites is phenolic compounds [28].They have biological properties such as anti-apoptosis, anti-aging, anti-carcinogen, anti-inflammation, anti-atherosclerosis, cardiovascular defense, and endothelial function enhancement, as well as angiogenesis and cell proliferation inhibition [29]. Medicinal plants high in phenolic compounds have been studied for their antioxidant properties in several studies. Plants produce natural antioxidants in the form of phenolic compounds like flavonoid, phenolic acids, and tocopherols [30]. Tannins bind to proline-rich proteins, preventing them from being synthesised. Flavonoids are hydroxylated phenolic compounds that plants produce in response to microbial infection and have been shown to have antimicrobial properties in-vitro against a wide range of microor-ganisms. Their ability to complex with extracellular and soluble proteins, as well as the bacterial cell wall, is most likely the reason for their activity. They are also strong antioxidants with anticancer properties [31].

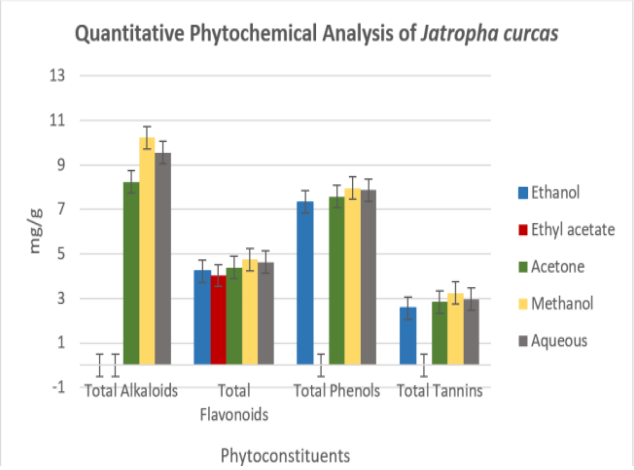

Figure 1: Quantitative Phytochemical Analysis of J. Curcas

Nutritional Analysis

Natural plant harvests have long contributed to the isolation of modern medicine and continue to plays an important role in the discovery of newer medications. Humans consume a wide range of plant derivatives as food, drugs, and dietary supplements [32].Plants offering rudimentary healthcare to the biosphere's outcasts. Plants contained basic nutrients such as fats, protein, carbohydrates, and phytochemical inhabitants, which are essential medicinally and are responsible for the growth and change of living beings. Plants are used to cure diseases locally, both raw and in liquid mixtures, without regard for their nutritional quality, which is essential for the proper physiological functioning of the human body [33].

Nutritional and proximate evaluation plays an important role in the activities that plants perform in-vivo or in-vitro, whether they are used as vegetables or medicines [34].The chemical makeup of J. curcas offers useful knowledge regarding its medicinal and nutritional properties. The moisture, ash, protein, fats, fibre, carbohydrates, and energy values of a variety of medicinal plants are shown in table below (**Figure 2**). The moisture content of ethanol extract (9.47%), ethyl acetate extracts (9.14%), acetone extract (10.66%), methanol extract (12.45%), and aqueous extract (12.45%) (13.74 %).

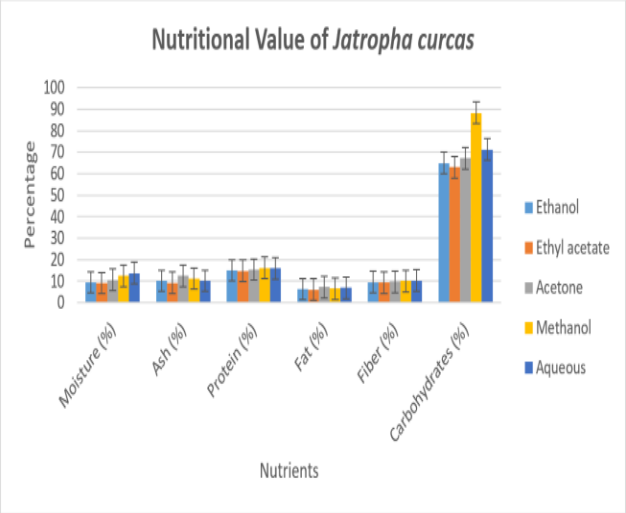

Figure 2: Nutritional Value of J. curcas

With the aid of a furnace, the percentage of ash was calculated at temperatures up to 600 degrees Celsius. Acetone extract (12.46 % ash) had the largest proportion of ash, followed by ethanol extract (10.13 % ash), ethyl acetate extract (9.23 % ash), methanol extract (11.22 % ash), and aqueous extract (11.22 percent ash) (10.22 %). Methanol extract has a high protein content (16.24%) and a low protein content in other extracts, whereas acetone extract has a high-fat content (7.23 %). The aqueous extract has a high fibre content (10.24%), while the methanolextract has a high carbohydrate content (88.43%) and a high energy content (490.36 Kcal/100g) (**Figure - 3**).The samples were found to be a good source of carbohydrates and to some extent of protein.

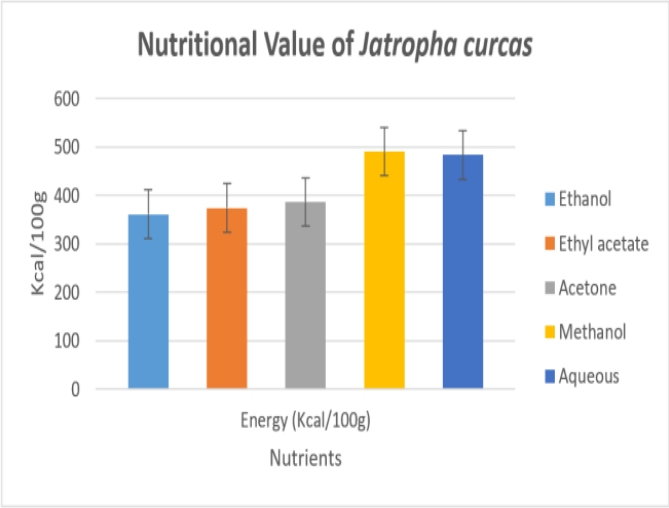

Figure 3: Energy content of J. curcas

Plants' nutritional value is determined by quanity of proteins, fibre, fats and oils, minerals, vitamins, and water they contain, all of which are essential forhuman and animal growth and development [35,36] Carbohydrates, fats, and protein are the three most important nutrients for survival. The quantity and quality of proteins in seeds are critical factors in plant selection for nutritional value, systematic classification, and plant improvement programmers [37]

Table 2: Correlation Matrix of Proximate parameters

Parameters	Correlation Coefficient	P value
Moisture Vs Ash	0.25	0.68
Moisture Vs Protein	0.93	0.21
Moisture Vs Fat	0.50	0.39
Moisture Vs Fiber	0.98	0.003*
Moisture VsCarbohydrate	0.64	0.24
Moisture Vs Energy	0.93	0.02*
Ash Vs Protein	0.44	0.45
Ash Vs Fat	0.72	0.06
Ash Vs Fiber	0.35	0.56
Ash Vs Carbohydrates	0.34	0.57
Ash Vs Energy	0.15	0.80
Protein Vs Fat	0.50	0.39
Protein Vs Fiber	0.94	0.01*
Protein Vs Carbohydrates	0.84	0.06
Protein Vs Energy	0.94	0.01*
Fat Vs Fiber	0.57	0.31
Fat Vs Carbohydrates	0.13	0.83
Fat Vs Energy	0.26	0.67
Fiber Vs Carbohydrates	0.65	0.23
Fiber Vs Energy	0.90	0.03*
Carbohydrate Vs Energy	0.81	0.09

Note: * - P< 0.05 (significant)

Elemental Analysis

K, Mg, Ca, Na, Fe, Mn, Zn, P, S, and Al were included in all samples of medicinal plants, indicating that they are responsible for curing a variety of diseases as well as providing animal fodder. The elemental contents of the analysed plant J. curcas in various extracts such as acetone, methanol, and aqueous extracts show a wide range of diversity. Plant species vary in the composition of elements and their balanced concentration [23]. The macronutrients and micronutrients included in Table 2 were macronutrients and micronutrients, respectively.Ca, Mg, K, Na, Fe, Cu, Zn, Cr, Cd, Pb, and Ni are some of the nutrients. Methanol extracts contain a lot of nutrients (**Table 2**).

Table 3: Concentration of Macro and Micro-nutrients of J. curcas in ppm (1 ppm = 1mg)

Nutrients	Acetone	Methanol	Aqueous
Ca	3620	5631	4892
Mg	28243	30125	29426
K	3105	3486	3251
Na	253	524	489
Fe	64.3	98.2	86.6
Cu	6.5	7.4	7.1
Zn	25.3	31.4	28.2
Cr	0.5	1.8	1.2
Cd	0.3	1.3	0.9
Pb	0.1	1.1	0.5
Ni	1.7	2.8	2.1

Plants naturally produce primary and secondary metabolites that plays an important role in controlling some of the most important functions for plant growth and development. Green leafy plants, for example, contain essential minerals such as Ca, Fe, Zn, Mg, Cu, Mn, and nutrients such as carbohydrates, proteins, fats, and crude fibre when eaten as fruit. Plants also contain a large number of vitamins and hormone precursors [1] The role of medicinal plants in the treatment of various diseases can be seen in their widespread use from antiquity to the present day.The physicochemical studies are mainly concerned with the identification of adulterants as well as the efficacy and purity of the drug. Maintaining ionic equilibrium necessitates the use of sodium and potassium. This relationship between sodium and potassium in foods helps to prevent hypertension and atherosclerosis[38]. Calcium is a necessary mineral for strong bones and teeth, as well as providing structural rigidity to the body and aiding in blood clotting and cellular permeability. Manganese is necessary for the structure of enzymes and is also essential for the formation of hemoglobin [39] Phosphorus, an enzymatic component required for proper immune function, energy metabolism, and body acid-base balance, is in short supply.

Table 4: Descriptive Statistics of Nutritional Analysis

Parameters	Mean content	Std. Deviation
Moisture	11.09	1.96
Ash	10.65	1.23
Protein	15.51	0.63
Fat	6.60	0.46
Fibre	9.78	0.36
Carbohydrates	71.02	10.21
Energy Value	419.00	62.59

Copper is a mineral that is used in many enzymes as a structural component. Ceruloplasmin, a critical protein involved in iron oxidation, is made up of it. Magnesium is essential for bone formation, energy metabolism, and enzymatic activity catalysis. As compared to other minerals, chromium was found to be moderately poor. It plays a unique role in a variety of important functions, including the development of muscle mass and the maintenance of blood glucose levels .Zinc serves as a stimulator in the pancreas, causing beta cells to release insulin and allowing natural glucose tolerance to be maintained. It is also essential for tissue growth and repair. Iron is needed for the production of haemoglobin, the transport of oxygen, and the body's immunity [37]. Minerals such as Mn, Zn, Mg, Cu, Fe, Na, K, Ca, and traces of chromium, all of which are present in prescribed quantities, can be helpful to diabetic patients [40]. Furthermore, due to the plant's low lipid content, it may be used as a dietary supplement for obese people. Furthermore, the total element concentration becomes a significant parameter for assessing plant stress, nutritive value, and toxicity, as well as a trademark on species-related data [34]. A better understanding of the importance of minerals and valuable biomolecules in plants paves the way for medicinal plants to be used as both food and medicine.Minerals are also used by plants as structural components in carbohydrate and protein metabolism [35]

CONCLUSION

To summarize, medicinal plants are rich in macro and micro secondary metabolites, as well as the potential elements needed by living organisms. The current study concludes that medicinal plants can plays an important role in the maintenance of a healthy life and normal body functioning by providing energy-rich nutrients for growth and development in medicinal plants' secret form. The plant J. Curcas shows best activity in methanol and aqueous extract when compared to other extracts. In quantitative analysis methanol shows more quantity when compared to ethanol, ethyl acetate, acetone and aqueous extracts. Nutritional parameters were carried out for moisture, ash, protein, fat, fiber, carbohydrates and energy in that methanol and aqueous extracts shows similar activity.

The medicinal plants have the ability to provide vital nutrients to humans and domestic animals, according to the findings. Nutrients of sufficient value are needed to live a healthy life and achieve maximum productivity, as in the case of animals producing milk. Popular plant species, which provide a good quantity of these basic micro and macro elements, are included in their diet for this reason. It's worth noting that many of these plants are used in high concentrations for medicinal purposes by local physicians and ordinary citizens. It is therefore recommended that further research be done on proximate and elemental analyses of widely used plants by local people in order to assess their nutritional value and toxicity under a wider range of environmental conditions.

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