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PROXIMATE, MINERAL AND PHYTOCHEMICAL ANALYSIS OF SOME MEDICINAL PLANTS COLLECTED FROM ORATHUR VILLAGE, THIRUPORUR TALUK KANCHEEPURAM DISTRICT TAMILNADU, INDIA

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Abstract. The use of medicinal plants has a long tradition as part of the human diet and has therapeutic agents. That is why they are well accepted by consumers and are generally considered to be environmentally friendly, efficient and generally considered to be safe alternative to antibiotics due to the presence of phytochemicals found in the leaves, stem bark, roots, flowers amongst others. Medicinal plant also possesses nutritional properties and play multiple pharmacological roles such as anti-inflammatory, antioxidant, anti-cancer, antimicrobial, anti-viral, anti-fungal, anti-helminthic, hepato-protective activity amongst others. This study was aimed at accessing the proximate, mineral and phytochemical composition of *Tephrosia purpurea*, *Adhatoda vasica*, *Crataeva nurvala*, *Bauhinia racemose*, *Holarrhena antidysenterica* and *Aegle marmelos*. Result on proximate analysis showed that moisture content varied from 13.57 – 16.02 %, dry matter (83.98 – 86.43 %), crude protein (5.06 – 7.12 %), ash (9.90 – 12.04 %), crude fibre (12.74 – 14.32 %), crude fat (0.10 – 0.22 %) and carbohydrates (40.30 – 50.17 %). Concentrations of calcium, phosphorus, potassium, magnesium, zinc, manganese, sodium and copper ranged from 120 – 148.0 mg/100g, 180.0 – 300 mg/100g, 66.8 – 94.2 mg/100g, 41.8 – 69.8 mg/100g, 27.9 – 44.6 mg/100g, 119 – 133 mg/100g and 8.21 – 13.1 mg/100g respectively. Quantitative evaluation of tannins showed that values varied from 39.00 – 46.50 mg/g, alkaloids (26.35 – 35.09 mg/g), saponins (20.05 – 30.40 mg/g), flavonoids (66.10 – 86.11 mg/g), terpenoids (40.71 – 45.88 mg/g) and phenols (106.8 – 125.4 mg/g). In conclusion, it was discovered that it contained some essential nutrients in significant quantities. However, values obtained varied due to age of plant, specie, processing method among others. The presence of phytochemicals in these plant suggests that it has pharmacological properties. Accessing the constituent's in this plants could lead to a novel drug discovery and curb the increasing cases in antimicrobial resistance.

Keywords: *Antimicrobials, plants, therapeutic, food safety, phytochemicals.*

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1. Introduction

Growing antibiotic resistance is leading to a continuous need for discovering new drugs and alternative treatment against diseases (Vera, 2022). Antimicrobial resistance poses a serious hazard to the populace making it difficult for diseases to be treated and also increasing mortality and morbidity (Vera, 2022; Ojediran, 2024). In 2009, the World Health Organization named antimicrobial resistance as one of the three greatest

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threats to human health and in 2011 the focus of the World Health day was "Combating antimicrobial resistance".

One of the alternatives that can be utilized for combating antimicrobial resistance is traditional herbal remedies or the use of medicinal plants (Inge & Rainer, 2020). Medicinal plants possess nutritional and pharmacological properties and have been used for the treatment of various ailments due to the presence of phyto-constituents or phytochemicals (alkaloids, tannins, flavonoids, terpenoids, phenols, saponins and so on) (Ojediran, 2024; Singh *et al*., 2022). According to John (2024); Alagbe (2021); Inge and Raine (2020), phytochemicals are eco-friendly, effective, safe and has no withdrawal period. They are found in many parts of plants including, root, stem bark, leaves, flowers, buds, amongst others and capable of performing multiple therapeutic activities (anti-inflammatory, antifungal, anti-atherosclerotic, immuno-stimulatory, antioxidant, hypolipidemic, cytotoxic, anti-parasitic and anti-thrombotic) in human beings and livestock (Alagbe, 2022; Musa *et al*., 2022).

In vitro studies have revealed that phytochemicals can inhibit the activities of some pathogenic organisms such as, *Escherichia coli*, *Salmonella spp*, *Staphyllococus spp*, *Aspergillus spp*, *Candida albicans*, *Bacillus spp* by perforating the lipid bilayer of these pathogens, increasing the cell wall permeability thus damaging their genetic material and preventing cell replication (Delphine, 2021). Qualitative and quantitative variations in the contents of nutrients and phytochemicals in plant materials can be influenced by age of plant, geographical locations, climate, species, method of processing and storage (Adewale *et al*., 2021; Ahmad *et al*., 2006).

Therefore, this study was carried out to examine the proximate, mineral and phytochemical analysis of some medicinal plants collected from Orathur village, Thiruporur Taluk Kancheepuram district Tamilnadu, India.

2. Materials and methods

Experimental location

This experiment was carried out at the department of biochemistry, Sumitra Research Institute, Gujarat India situated between 28º 18' N and 70º 35' E India in the month of October 2022. Kits/ equipment's used for the study were handled based on the manufacturer's recommendation on each package insert.

Collection of medicinal plants and their processing

Fresh leaves of medicinal plants (*Tephrosia purpurea*, *Adhatoda vasica*, *Crataeva nurvala*, *Bauhinia racemose*, *Holarrhena antidysenterica* and *Aegle marmelos*) were collected from different sites at Orathur village, Thiruporur Taluk Kancheepuram district Tamilnadu, India and sent to the department of Crop protection at Sumitra Research Institute, Gujarat for proper identification by a certified taxonomist and assigned individual voucher numbers: AA/2022DA, AB/2022DA, AC/2022DA, AD/2022DA, AE/2022DA and AF/2022DA respectively. Thereafter, plants were sorted into different groups, washed under running tap water and air dried for 2 weeks until a constant weight was achieved. Dried leaves were grinded into powder with an electric blender and stored in a clean labeled airtight plastic container before it was sent to the laboratory for further evaluation.

Proximate analysis of samples

Proximate composition of each medicinal plant were determined using diode array based near infra-red reflectance and trans reflectance analyzer (Model NIRSTM DA

1650). 100 g of each sample is placed in the collector after the machine was calibrated following the manufacturers lay down procedures. To maintain further precision, it was adjusted at an optical bandwidth (8.75 nm), spectral resolution (1.0 nm), absorbance ranges (up to 2 AU), wavelength accuracy (less than 0.05 nm), photometric noise (400 – 700 nm less 50 micro au; 700 – 2500 nm less than 20 micro au) before results on moisture content, crude protein, crude ash, ether extract and carbohydrate was generated via the visual display unit in 60 seconds. Dry matter was computed by subtracting the moisture content in each sample from 100.

Mineral analysis of samples

Mineral compositions were analyzed using Atomic absorption spectrophotometer fully automated flame and graphite furnace system (Model AAS – 4000). Each component is maintained at different conditions to ensure precision in results. 100 g of each sample is injected into the machine and adjusted at different specifications; graphite furnace system is transversally heated and maintained at a temperature range of 3000℃, detection limit (Cd<0.04ng/ml) and sensitivity (50ng/ml absorption >0.40 Abs) while the monochromator was placed at wavelength accuracy, resolution, reproducibility (0.15nm, 0.2nm and <0.05nm), blazed wavelength (250nm), focus (300 nm) and wavelength range (185nm – 1000nm).

Quantitative evaluation of phyto-constituents in samples

Phyto-constituents were analyzed according to the procedures recently published by Alagbe (2024). 100 grams was used for each analysis and each constituent were recorded at different optical density (alkaloids, 500 nm), flavonoids (460 nm), terpenoids (370 nm), alkaloids (550 nm), tannins (480 nm), steroids (250 nm) and phenols (670 nm) using GC-MS 6800 gas chromatography/mass spectrometer. To ensure precision, gas chromatography chamber where the sample is first injected is maintained at an inlet temperature of 450℃, column temperature (4 – 450℃, pressure range (0 – 100 psi ± 0.002 psi) and heating rate up to 1201/min while the mass spectrometer unit is adjusted at an ion source temperature (100 – 350℃), stability (± 0.10 amu/48 hours), mass range (1.5 – 1000 amu), scan rate (up to 10000 amu/sec) and ionization energy (5 eV – 250 eV).

Statistical analysis

All measurement was carried out in triplicates and results was analyzed using Statistical Package for Social Science (SPSS for Windows (IBM), version 25, Chicago, USA, 2011). Obtained results were expressed as means ± SEM.

3. Results and discussion

Proximate composition of different medicinal plants collected from Orathur village, India is presented in Table 1. Moisture content obtained in this study varied from 13.57 – 16.02 %, dry matter (83.98 – 86.43 %), crude protein (5.06 – 7.12 %), ash (9.90 – 12.04 %), crude fibre (12.74 – 14.32 %) and carbohydrates (40.30 – 50.17 %). Leaves from Tephrosia purpurea had the highest moisture content (16.02 %) followed by Aegle marmelos (15.22 %), Aegle marmelos (15.10 %), Holarrhena antidysenterica (14.80 %), Bauhinia racemose (14.12 %) and Adhatoda vasica (13.57 %). The moisture content recorded in this study is similar to those obtained in Cnidoscolus aurifolia (12.24 %), *Indigofera tinctoria* (13.60 %), *Daniellia oliveri* stem bark (12.61 %) and *Delonix regia* leaves (14.37 %) reported by Akaninyene and Uwemedimo (2016); Alagbe et al. (2020). This suggests that the samples can be stored for a longer period without deteriorating due to microbial growth (Alagbe *et al*., 2020). Dry matter values obtained is in agreement with those obtained for Balanites aegyptiaca stem bark (88.13%); Alchornea cordifolia stem bark (89.00%) but lower than those reported for Chenopodium ambrosiodes (10.60%), Morinda lucida leaves (20.80%), Veronia amgydalina leaves (20.80%) reported by Aborisade et al. (2017); Musa et al. (2020). Crude protein values were highest in Bauhinia racemose leaves (7.12%) while Tephrosia purpurea leaves had the lowest concentration (4.93%). Result obtained for crude protein was similar to those reported for Balanites aegyptiaca stem bark (6.60%) by Musa et al. (2020) but lower than values reported for Daniellia oliveri leaves (25.03%) and Leptadenia hastata leaves (17.96%) recorded by Lawal et al. (2002). This variation could be due to species, age of plant, geographical location and processing methods employed (Agubosi *et al*., 2022; Alagbe, 2022). Protein are necessary for growth and the repair of worn-out tissues (Singh *et al*., 2022). However, values reported was not within the daily recommended intake for birds (8.0 – 12.0%) (Sales & Janesens, 2003; NRC, 1994). Bauhinia racemose leaves had a higher concentration of 12.04% followed by Crataeva nurvala leaves (11.55%), Holarrhena antidysenterica leaves (11.30%), Tephrosia purpurea (10.69%), Adhatoda vasica (10.41%) and Aegle marmelos leaves (9.90%). Values obtained were higher than those recorded for Vitex doniana leaves (1.04%), Cnidoscolus aurifolia (6.64%) reported by Lawal et al. (2002); Akaninyene et al. (2016). This result suggests that Bauhinia racemose leaves contains significant quantity of minerals relative to the other plants making them useful in enzymatic activities in the body (Ojediran, 2024). Dietary crude fibre play a significant role in the preventing coronary heart disease and facilitating the digestion of foods (John, 2024). However, results obtained showed that Holarrhena antidysenterica had the highest value of 14.32 % while Tephrosia purpurea leaves had the lowest concentration (13.53%). Results obtained were lower than values recorded for Crescentia cujete leaves (19.72%) by Musbau et al. (2018) but higher than those of Crataeva nurvala leaves 6.32 % and Crataeva nurvala stem bark (9.72%) reported by Nahar et al. (2023). Crude fat values which varied from 0.10 – 0.22% were higher in Holarrhena antidysenterica (0.22%) and lower in Bauhinia racemose leaves (0.10%). However, values were within the values reported by Nahar et al. (2023) for Crataeva nurvala leaves (0.16%) and Crataeva nurvala stem bark (0.12%). Values for carbohydrates showed that Bauhinia racemose had the highest concentration (50.17%) which is within the daily recommended intake for birds (NRC, 1994) compared to Holarrhena antidysenterica which had the lowest value (40.30%). Values obtained was higher than those recorded for Crataeva nurvala leaves (17.68%) and Cnidoscolus aurifolia leaves 2.27% reported by Nahar et al. (2023); Akaninyene et al. (2016). Carbohydrates are needed to supply energy for body process and aids the absorption of calcium (Singh *et al*., 2022).

Table 1. Proximate composition of different medicinal plants collected from Orathur village, India

Medicinal plants	[1]MC (%)	[2]DM (%)	[3]CP (%)	Ash (%)	[4]CF (%)	[5]CHO (%)	[6]CFF
Tephrosia purpurea leaves	16.02± 0.08	83.98±0.56	4.93±0.71	10.69±1.66	13.53±0.06	42.18±2.33	0.12±0.00
Adhatoda vasica leaves	13.57± 0.45	86.43±0.22	6.99±0.51	10.41±0.97	14.05±0.07	46.22±1.51	0.14±0.01
Crataeva nurvala leaves	15.10± 0.93	84.90±0.18	5.08±0.06	11.55±1.52	13.80±0.43	41.05±1.41	0.18±0.02
Bauhinia racemose leaves	14.12± 0.14	85.88±0.38	7.12±0.19	12.04±1.88	12.74±0.02	50.17±0.97	0.10±0.00
Holarrhena antidysenterica leaves	14.80± 0.64	85.20±0.30	4.95±0.02	11.30±2.84	14.32±0.09	40.30±0.21	0.22±0.06
Aegle marmelos leaves	15.22± 0.42	84.78±0.26	5.06±0.58	9.90±0.73	14.00±0.12	40.96±0.40	0.11±0.00

[1]Moisture content; [2]dry matter; [3]crude protein; [4]crude fibre; [5]carbohydrates; [6]crude fat

Mineral composition of different medicinal plants collected from Orathur village, India expressed in mg/100g is presented in Table 2. Bauhinia variegate leaves had the highest concentration of calcium (148 mg/100g), phosphorus (300 mg/100g), potassium (94.2mg/100g), magnesium (162.0mg/100g), zinc (69.8mg/100g), manganese (44.6mg/100g), sodium (133.0 mg/100g) and copper (13.1mg/100g) while Aegle marmelos had the lowest concentration with calcium (120 mg/100g), phosphorus (180.0 mg/100g), potassium (60.4mg/100g), magnesium (100.0mg/100g), zinc (51.7 mg/100g), manganese (31.9 mg/100g), sodium (121.0mg/100g) and copper (10.2mg/100g). Values of calcium, phosphorus, potassium, magnesium, zinc, manganese, sodium and copper in Tephrosia purpurea, Adhatoda vasica, Crataeva nurvala, Holarrhena antidysenterica and Aegle marmelos leaves varied from 125.0 – 141.0 mg/100g, 180.0 – 291.0 mg/100g, 66.8 – 86.3 mg/100g, 100.0 – 151.0 mg/100g, 41.80 – 61.30 mg/100g, 27.9 – 40.8 mg/100g, 119.0 – 125.0 mg/100g and 8.21 – 12.4 mg/100g respectively. However, all values were within the daily recommended allowance (FDA, 2019; Julian, 2021). Calcium concentration reported in this study was higher than values recorded for Hippocratea myriantha (210 mg/100g) and Urera trinervis leaves (220 mg/100g) reported by Andzouana and Mombouli (2012). Calcium are needed for the healthy bones in animals (NHC, 2002). Potassium, magnesium, manganese and zinc values obtained were lower than values reported for Xylopia aethiopica 94.11 mg/100g, 0.22 mg/100g, 0.003 mg/100g and 0.020 mg/100g by Abolaji et al. (2007). Minerals are needed as a co-factor of metabolic enzyme, regulate heart rate, membrane potential, regulate body fluid and maintain pH balance (NHC, 2002).

Table 2. Mineral composition of different medicinal plants collected from Orathur village, India (mg/100g)

Medicinal plants	[1]Ca	[2]P	[3]K	[4]Mg	[5]Zn	[6]Mn	[7]Na	[8]Cu
Tephrosia purpurea leaves	125±2.17	233±2.4	82.1±1.8	112±4.9	61.3±0.8	30.2±1.8	123±6.60	11.2±0.01
Adhatoda vasica leaves	140±2.00	291±4.2	78.5±2.0	109±5.6	56.4±0.9	34.5±1.5	125±5.57	10.9±0.00
Crataeva nurvala leaves	137±1.82	262±3.7	66.8±2.7	151±5.3	42.1±0.3	40.8±1.0	119±3.10	12.4±0.04
Bauhinia variegate leaves	148±1.61	300±2.5	94.2±2.5	162±4.1	69.8±0.5	44.6±0.9	133±2.84	13.1±0.01
Holarrhena antidysenterica leaves	141±1.50	262±3.3	86.3±1.6	115±4.4	51.7±0.4	31.9±1.1	121±3.51	10.2±0.01
Aegle marmelos leaves	120±2.02	180±4.1	60.4±1.2	100±3.4	41.8±0.7	27.9±1.4	115±4.80	8.21±0.01

[1]Calcium; [2]Phosphorus; [3]Potassium; [4]Magenesium; [5]Zinc; [6]Manganese; [7]Sodium; [8]Copper

Phyto-constituent's in different medicinal plants collected from Orathur village, India (mg/g) is presented in Table 3. Alkaloids, tannins, saponins, flavonoids, terpenoids and phenols in Tephrosia purpurea, Adhatoda vasica, Crataeva nurvala, Bauhinia variegate, Holarrhena antidysenterica and Aegle marmelos leaves ranged from 26.35 – 35.09 mg/g, 39.00 – 46.50 mg/g, 20.05 – 30.40 mg/g, 66.10 – 92.16 mg/g, 40.70 – 45.88 mg/g and 102.1 – 125.4 mg/g respectively. The medicinal property of herbs is due to the presence of different complex chemical substance as secondary metab olites, which are exclusively accumulated in different parts of the plants, (Haniyeh *et al*., 2010; John, 2024). Values recorded for tannins, saponins, flavonoids and phenols in this study was lower than values recorded for Gossypium herbaceum leaf 69.56 mg/g, 66.67 mg/g, 91.03 mg/g and 219.20 mg/g reported by Oloruntola et al. (2023) but higher than those reported by Falowo et al. (2023) on Crassocephalun crepidiodes and Dysphania ambrosiodes leaves. This variation could be attributed to age of plant, species, processing method, geographical location amongst others (John, 2024; Ojediran *et al*., 2024). The result in this experiment suggests that all the plants determined contain several bioactive compounds with therapeutic properties (anti-inflammatory, antioxidant, anti-fungal, antimicrobial, immune-stimulatory, cytotoxic, hepato-protective, anti-viral, anti-helminthic, amongst others) (Agubosi *et al*., 2022). For instance, flavonoids and terpenoids have been suggested to possess antioxidant (Yu *et al*., 2014), antibacterial activity (Edeoga *et al*., 2005), antimicrobial and anti-cancer properties (Zakariya *et al*., 2017). Saponins are reported for hypoglycemic activity, antioxidant activity, cytotoxic and antimicrobial activity (Edeoga *et al*., 2005). Olajuyige et al. (2011) reported that alkaloids have analgesics, anti-plasmodial, antiprotozoal and antimicrobial activity. Phenols are reported for antioxidant, anti-cancer, antimicrobial and anti-inflammatory activity (Jing-Chung *et al*., 2007).

Table 3. Phyto-constituent's in different medicinal plants collected from Orathur village, India (mg/g)

Medicinal plants	Alkaloids	Tannins	Saponins	Flavonoids	Terpenoids	Phenols
Tephrosia purpurea leaves	26.35±0.61	42.07±1.04	20.05±2.83	86.11±0.05	41.23±0.05	102.1±6.77
Adhatoda vasica leaves	30.91±1.00	40.35±1.88	22.18±2.00	72.03±1.00	40.80±0.07	108.4±5.06
Crataeva nurvala leaves	29.37±1.02	43.11±1.03	30.00±1.83	66.10±0.08	42.19±0.01	113.1±4.11
Bauhinia variegate leaves	35.09±1.10	46.50±1.15	30.40±2.02	92.16±0.02	45.88±0.00	125.4±3.56
Holarrhena antidysenterica leaves	28.55±0.83	41.22±1.97	27.50±1.56	71.90±0.04	40.71±0.02	106.8±3.09
Aegle marmelos leaves	29.63±1.22	39.00±2.31	22.00±1.19	80.11±0.00	43.20±0.01	112.1±1.24

4. Conclusion

In conclusion, Tephrosia purpurea, Adhatoda vasica, Crataeva nurvala, Bauhinia variegate, Holarrhena antidysenterica and Aegle marmelos leaves contains several nutritional and medicinal properties at various concentrations which could be attributed to age of plant, species, harvesting method, processing technique amongst other factors. This plants have huge potential in addressing the increasing cases of antimicrobial resistance. It can also be used to promote food safety and livestock production once it is supplemented in their diets.

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