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Ethno-medicinal Properties and the Phyto-chemical Analysis of Some Plants Used in Treating Arthritis and Typhoid Fever in Nigeria, West Africa

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Abstract: Reported cases of arthritis and typhoid fever have been on the increase in Nigeria, West Africa. This has led us into the ethno-botanical and phytochemical studies of some plants used in the treatment of these diseases in African traditional practice. Twenty plants were screened for phytochemical compounds. The habits of the test plants were 90% trees, 50% herbs, 40% shrubs and 20% climbers. The plant parts used were 100% leaves. All the tested plants contained high levels of varied concentrations of saponins, alkaloids and flavonoids compared with their levels of tannins and carotenoids. Further studies on these secondary metabolites should shed more light into the African trado-medical claim on these plant parts. This study will be of significance and value in therapeutics and drug development.

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Key words: Plants; phytochemicals; screening; typhoid fever; arthritis

Introduction

Plants have been indispensable sources of both preventive and curative medical preparations in centuries (Farnsworth, 1989; Trease and Evans, 2002). According to the World Health Organization (WHO), estimates of up 80% of the world's population, mostly in the developing countries have adapted trado-medicinal curative practices in health needs (Sofowora, 1993). With a value in therapeutics, plant part preparations are used in China, France and Germany as herbal remedies with less stringent side effects as assumed in the medical world (Trease and Evans, 2002). Plants have been recorded as containing phtochemicals which act as antioxidants, interfere with hormonal actions, stimulate body enzymes, interfere with DNA replication, inhibit bacterial function (bacteriocidal or bacteriostatic) (Ojewole, 1984).

In the present investigation, certain plants in Nigeria, West Africa used in trado-medical treatment of typhoid fever and arthritis were screened for phytochemical properties with a view to justifying their application in African traditional curatives and the possibility of the development of drugs of herbal sources over the synthetic and with fewer side effects on human health.

2. Materials and Methods

2.1 Collection of Plants

Morinda lucida, *Cymbopogon citrates*, *Citrus aurantifolia*, *Citrus parasidica*, *Blighia Sophia* were obtained along the Polytechnic Road, University of Ibadan, Ibadan, Nigeria. *Spondia mombin*, *Azadirachta indica*, *Khaya gratifolia*, *Momordica charantia* and *Alstonia boonei* were gotten from the Department of Forest Resource Management, University of Ibadan, Nigeria. *Musa paradisiaca*, *Phyllantus amarus*, *Carica papaya*, *Psidia guajava*, *Solemostemon monostachyus*, *Terminalia catappa*, *Ocimum gratissimus*, *Boerhavia diffusa*, *Paraquentina nigrescens* were collected inside the Idia Hall, University of Ibadan, Ibadan, Nigeria.

2.2 Plant Identification

All plant samples were identified at the species level by Dr. L.A. Adebisi at the Department of Forestry, University of Ibadan, Ibadan, Nigeria.

2.3 Preparation of Plant Materials

The plant parts were washed thoroughly, cut into small parts and air-dried. They were then milled into coarse powder. The powdered samples were stored in glass containers at room temperature (28°C).

2.4 Phytochemical Screening

The qualitative and quantitative screening of powdered plant samples were carried out at Kappa Biotechnology Laboratories (Research Support R & D Analytical Services), Trans Amusement Park, Old Airport Road, Bodija, Ibadan, Nigeria using standard methods.

2.4.1 Methods of screening

(a) Alkaloids

Materials were: Sample, acetic acid, ethanol, filter paper, ammonia, weighing balance, Oven at 60°C, measuring cylinder.

Method

One gram of sample (Q) was weighed and 20ml of 10% acetic acid in ethanol was added. The mixture was shaken and allowed to stand for 4hr. This mixture was then filtered. The filtrate was allowed to evaporate to about a quarter of its original volume and thereafter one drop of concentrated ammonia was added. Precipitate formed was filtered through a weighed (Q1) filter paper. The filter paper was allowed to dry in oven at 60°C. After draught to constant weight, the filter paper re-weighed (Q2).

$$\% \text{ of the Alkaloids} = \frac{Q2 - Q1}{Q} \times 100$$

(b) Carotenoids

Materials were: Sample, acetone, filter paper, water, funnel, petroleum ether, measuring cylinder, standard graph, weighing balance.

Method

One gram of sample was weighed into 20ml acetone, left for 1hr and filtered. Ten ml of water was added to the filtrate. The filtrate was poured into separating funnel. Five ml of petroleum ether was added and allowed to flow through the side of the funnel. The mixture was left for some minutes to separate. Thereafter, the lower layer was discarded. The absorbance of the sample was then taken at 440nm and read off a standard graph.

(c) Flavonoids

Materials were: Sample, methanol, stop watch, filter paper, weighed petri dish, oven at 40°C.

Method

One gram of sample extracted with 10ml of 80% methanol. This was left to stand for 2hr. The sample was then filtered into a weighed petri dish. The filtrate was put into a oven to dry at 40°C. The sample weight was determined after drying in petri dish to a constant weight.

(d) Saponins

Materials were: Sample, ethanol, water bath at 55°C, stop watch, filter paper, petroleum ether, funnel, butanol, sodium chloride, weighed petri dish.

Method

One gram of sample was weighed and 15ml of ethanol was added. This was put in a water bath at 55°C for 4hr. The sample was then filtered. The residue was washed twice with 20% ethanol. The extract was reduced to about 5ml in an oven. Five ml of petroleum ether was added to the concentrated extract inside a separating funnel. The petroleum extract layer was discarded and 3ml of butanol was added to the sample. Washing was done with 5ml of 5% sodium chloride. The butanol-sample layer was later recovered onto a weighed petri dish. This was put in an oven and allowed to evaporate into dryness. The residue was then weighed.

(e) Tannins

Materials were: Sample, acetone, acetic acid, stop watch, filter paper, standard graph

Method

One gram of sample was weighed and extracted with 25ml of solvent mixture of 80:20 acetone: 10% glacial acetic acid for 5hr. The sample was filtered and absorbance taken at 500nm. The absorbance of the reagent's blank was also measured. A standard graph with 10, 20, 30, 40, 50 mg/100g of tannic acid was taken. The concentration of tannin was read taking into consideration the dilution factors.

3. Results

The profile of plants in this investigation revealed that the samples were from the families Euphorbiaceae, Laminaceae, Nictaginaceae, Asclepiadaceae, Caricaceae, Anacardiaceae, Rubiaceae, Maliaceae, Apocynaceae, Sapindaceae, Myrtaceae, Combretaceae, Rutaceae, Poaceae, Musaceae, Cucurbitaceae. The test plants were 90% trees, 50% shrubs, 40% herbs, 20% climbers (Tables 1 & 2).

Table 1: Profile of plants used for the treatment of arthritis

Botanical name	Common name	Family name	Part used	Habit
Alstonia boonei	Stool wood	Apocynaceae	Leaf	Tree
Phyllanthus amarus	Stone plant	Euphorbiaceae	Leaf	Herb
Solenostemon monostchyus		Lamiaceae	Leaf	Herb
Boerhavia diffusa	Pig weed	Nictaginaceae	Leaf	Herb
Parquentia nigrescens		Asclepiadaceae	Leaf	Climber
Carica papaya	Pawpaw	Caricaceae	Leaf	Shrub
Spondias mombin	Hog plum	Anacardiaceae	Leaf	Shrub
Morinda lucida	Brimstone tree	Rubiaceae	Leaf	Tree
Khaya grandifolia	Mahogany	Maliaceae	Leaf	Tree
Blighia sapida	Akee	Sapindaceae	Leaf	Tree

Table 2: Profile of plants used for the treatment of typhoid fever

Botanical name	Common name	Family name	Part used	Habit
Psidium guajava	Guava	Myrtaceae	Leaf	Tree
Taminalia catappa	Almond	Combretaceae	Leaf	Tree
Citrus aurantifolia	Key lime	Rutaceae	Leaf	Tree
Cympobogon citrates	Lemon grass	Poaceae	Leaf	Herb
Azadirachta indica	Neem tree	Maliaceae	Leaf	Tree
Musa paradisiaca	Banana	Musaceae	Leaf	Shrub
Citrus paradisi	Grape fruit	Rutaceae	Leaf	Tree
Mormodica charantia	Bitter lemon	Cucurbitaceae	Leaf	Climbers
Ocimum grattisium	African basil	Lamiaceae	Leaf	Herb
Carica papaya	Pawpaw	Caricaceae	Leaf	Shrub

Table 3: Bioactive compounds in plants and their average amount used in the treatment of arthritis

Plant	Tannins (mg/100g)	Saponins (mg/100g)	Alkaloids (mg/100g)	Flavonoids (mg/100g)	Carotenoids (mg/100g)
Spondias mombin	45.5	650	2350	1550	137
Alstonia boonei	94	1200	3340	2190	67
Blighia sapida	58	950	965	860	34
Phyllantus amarus	96	620	1870	1140	185
Solenostemon monostachyus	76	865	3450	1150	95
Khaya gratofolia	64	560	680	1590	45
Boerhavia diffusa	72	760	1740	2140	171
Parquetina nigrescens	53	90	890	1165	86
Morinda lucida	166	350	3520	860	55
Carica papaya	138	1075	2460	650	245

From the results of Table 3, there seems to be a general, very high amount of alkaloids and flavonoids, moderate amount of saponins but little amount of tannins and carotenoids in the tested plant extracts.

Table 4: Qualitative analysis of plant extracts used in the treatment of arthritis

Plant	Tannins (mg/100g)	Saponins (mg/100g)	Alkaloids (mg/100g)	Flavonoids (mg/100g)	Carotenoids (mg/100g)
Spondias mombin	+	++	+++	++++	+++
Alstonia boonei	++	+++	++++	++++	++
Blighia sapida	++	++	++	++	+
Phyllantus amarus	++	++	+++	+++	++++
Solenostemon monostachyus	++	++	++++	+++	++
Khaya gratofolia	++	++	++	++++	+
Boerhavia diffusa	++	++	+++	++++	++++
Parquetina nigrescens	++	+	++	+++	++
Morinda lucida	++++	+	++++	++	++
Carica papaya	+++	+++	+++	++	++++

KEY:
++++ Very High
+++ High
++ Moderate
+ Low

The qualitative analysis was derived from the quantitative analysis and rated according to the highest and lowest figures present in the column.

Table 5: Bioactive compounds in plants and their average amount used in the treatment of typhoid fever

Plant	Tannins (mg/100g)	Saponins (mg/100g)	Alkaloids (mg/100g)	Flavonoids (mg/100g)	Carotenoids (mg/100g)
Musa paradisiaca	22	1865	780	2355	150
Azadirachta indica	165	1340	3600	1870	28
Momordica charantia	142	2750	2950	1520	235
Citrus sinensis	83	1350	760	980	74
Citrus aurantifolia	90	750	1475	680	162
Citrus paradise	125	980	450	880	78
Terminalia catappa	68	1945	2360	450	36
Ocimum gratissimus	186	1350	2110	2115	196.5
Cymbopogon citrates	175	345	1650	2255	232
Psidia guajava	25	450	2150	1350	116

As observed in Table 5, the amount of saponins, alkaloids and flavonoids in the tested plant extracts were high contrary to their very low amounts of tannins and carotenoids. These tested plants used in the treatment of typhoid fever seem to contain relatively high amounts of saponins, alkaloids and flavonoids.

Table 6: Qualitative analysis of plant extracts used in the treatment of typhoid fever

Plant	Tannins (mg/100g)	Saponins (mg/100g)	Alkaloids (mg/100g)	Flavonoids (mg/100g)	Carotenoids (mg/100g)
Musa parasidiaca	+	++++	++	++++	+++
Azadirachta indica	++++	+++	++++	++++	+
Momordica charantia	+++	++++	++++	++++	++++
Citrus sinensis	++	-	++	++	++
Citrus aurantifolia	++	++	++	++	+++
Citrus paradise	+++	++	+	++	++
Terminalia catappa	++	++++	+++	+	+
Ocimum gratissimus	++++	+++	+++	++++	++++
Cymbopogon citrates	++++	+	+++	++++	++++
Psidia guajava	+	+	+++	+++	+++

KEY:
++++ Very High
+++ High
++ Moderate
+ Low

Table 6 represents the qualitative phytochemical analyses of selected plant extracts used in the treatment of typhoid fever in the African-Nigerian locality.

4. Discussion and Conclusion

Plant screened contained phytochemical compounds in varied concentration. Most of the tested samples contained high amounts of saponin, alkaloids and flavonoids but moderate amounts of tannins and carotenoids.

Researches have shown that over 90% of most isolated chemical constituents of plants are alkaloids (Faparusi and Bassir, 1972). *Alstonia boonei* have been used topically to reduce swellings and in treating rheumatic fever, muscular pain and hypertension (Sarpong, 2011). In other findings, the anti-inflammatory properties of the alcohol extract of *Alstonia boonei* have been applied in herbal treatment of muscular pain and rheumatic fever (Majekodunmi *et al*., 2008).

In this investigation, carotenoids seem low in *Azadiractha indica*. This finding tally with those described by Evans and Trease (1989); and by Unnikannan *et al.* (2013) who studied the effects of chromium on certain tree species. These secondary metabolites observed in *A. indica* could be responsible for its antimicrobial activities on *S. aureus*, *E.coli* and *S. typhi* characterizing the specific active constituent responsible for its therapeutic value.

Alkaloids are known for their anti-inflammatory effects. Flavonoids which are naturally occurring phenolic compounds with anti-oxidative properties have earlier been described in *Carica papaya* and *Parquentina nigrescens* (Imaga *et al.*, 2010).

Phytochemicals exert antimicrobial activities through different mechanisms. For instance, tannins act by iron deprivation, hydrogen binding or specific interactions with vital proteins such as enzymes found in microbial cells (Akinpelu *et al.*, 2008; Adejuwon *et al.*, 2011). Tannins have also been reported to induce anti-plasmodial activities (Dharmananda, 2003; Faparusi *et al*., 2012).

Akinjogunla *et al.* (2011) reported the efficacy of extracts of *Ocimum gratissium* on *Escherichia coli.*

Terminalia catappa had been earlier been observed to contain high amount of saponins in comparison with all other secondary metabolites. Saponins are major natural anti-oxidants with anti carcinogenic properties. They have reducing power capabilities and are recognized as inhibitors of peroxidation (Odugbemi, 2008).

Conclusively, the phytochemical compounds found in these plant samples may play significant roles in the treatment of arthritis and typhoid fever evidenced from existing literature and findings on these compounds. Their extraction and purification should be of value to drug development and therapeutics.

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