Journal of Advances in Microbiology Research

E-ISSN: 2709-944X
P-ISSN: 2709-9431
JRM 2023; 4(1): 118-122

www.microbiojournal.com
Received: 29-11-2022
Accepted: 31-12-2022

Diso SU
Department of Pharmaceutical Technology, School of Technology, Kano State Polytechnic, Nigeria

Mukhtar MD
Department of microbiology, Bayero University Kano, Nigeria

Dutsinma UA
Department of microbiology, Bayero University Kano, Nigeria

Correspondence
Diso SU
Department of Pharmaceutical Technology, School of Technology, Kano State Polytechnic, Nigeria

Phytochemical screening of leaves, seed, stem and root bark extracts of *Mangifera indica* (Mango)

Diso SU, Mukhtar MD and Dutsinma UA

Abstract
Phytochemical are substance produced mainly by plants, and these substances have biological and inhibitory properties. Therefore, plant represented the main source of ingredient for making drugs in pharmaceutical industries. The aim of the study was to screen for phytochemicals from leaf, seed, stem and root bark of *M. indica*. Water, Ethanol and n-hexane were the solvents used for the extraction process. Preliminary phytochemical screening was carried out conventionally using laboratory method. The quantitative phytochemical analysis of the extracts was conducted using spectrophotometric method. Phytochemical screening of the leaf, stem and root bark, and seed extracts revealed the presence of tannins, alkaloids, saponins, glycosides, flavonoids, phenols, steroid and anthraquinone. In the present study, steroid was only present in stem bark while anthraquinone was present in seed extract. The quantitative analysis of the bark extracts showed that the leaf extract contain high percentage of flavonoid (4.8%), followed by alkaloid (3.7%), Stem back extract contain high percentage of alkaloid (3.65%), followed by flavonoid (3.1%) while the root extract contain alkaloid (3.2%), flavonoid (2.8%), terpenoid (1.4%) and glycoside (0.17%). It is concluded that *M. indica* contain vital secondary and can be a good source for production of new drugs in pharmaceutical industries.

Keywords: Extract, *Mangifera indica*, phytochemicals, alkaloid, flavonoid

Introduction
Plant as natural product is classified as one of the traditional system of medicine in ancient cities and all over the world (Sarker and Naher, 2007) [23]. Several researches published findings that described therapeutic activity of various extracts of plant either single or in combination with another (Igoli *et al*., 2005) [12]. World Health Organization describe medicinal plants as those containing substances in one of its organ that can be used for therapeutic purpose or can be used as a precursor for chemo-pharmaceutical synthesis (WHO, 2014) [28]. Hence the medicinal plants are used for treatment of disease and this is attributed to the presence of bioactive in them called phytochemicals (Doughari, 2004) [9]; (Nostro *et al*, 2000) [18]. Phytochemicals are naturally occurring compound in the medicinal plant parts such as leaves, stems and roots (Abdulwadood *et al*, 2013) [1]. Phytochemical are mostly secondary metabolites which includes; flavonoids, steroid, alkaloid, phenolic compound saponins, tannin and terpenoid (Krisnaiah *et al*., 2007) [14].
Mangifera indica commonly called Mango tree belongs to family Anacardiaceae. It is perennial, fast growing tree. In tropical regions, the tree can grow up to 30 meter in height but in sub-tropical region, the growth rate consistently reduced (Farina *et al*., 2013) [11]. There is growing attention of many researchers around the on the therapeutic ability of *M. indica* (Masud Parvez, 2016) [17]. The plant is rich source of phytochemical and diverse group of micronutrients (Shahidi *et al*., 1992) [24] and many organic acids which exert health benefit (Berardini *et al*., 2005) [8], with gallic acid being the most represented phenol compound in this fraction (Masibo and He, 2008) [15]. The extensive survey of literature revealed that *Mangifera indica* is an important source of many pharmacologically and medicinally important chemicals such as mangiferin, mangiferonic acid, hydroxymangiferin, polyphenols and carotenes. Many different pharmacological activities such antimicrobial, antioxidant, anti-inflammatory, antitumor and antidiabetic have reported in mangiferin which is an important component of *M. indica*. The study was aimed to screen for phytochemicals from different parts of *M. indica*.

Materials and Method

Collection and identification of Plant Materials

The leaf, seed, stem and root bark used in this study were collected from the premises of Bayero University Kano. Identification and authentication of the plant materials was conducted at the Herbarium in the Department of Plant Science, Bayero University Kano. The plant was given a voucher number BUKHAN 0348 and the voucher specimens were deposited in the Herbarium for future reference. The samples were washed thoroughly and air dried for the period of two weeks. The materials were grinded into powder using sterile pestle and mortar under laboratory condition. The powder was stored in air tight container and stored for further use.

Extraction of the Plant Materials

Water, ethanol and n-hexane solvents were used in the process of extraction. One hundred grams (100 g) of the powdered leaves was weighed out and mixed with 500 ml of distilled water, in a separate sterile conical flask and allowed to stand for three days. The mixtures were filtered using Whatman filter paper and the extracts were evaporated to dryness in water bath at 50^0C. About 100 g of the fine powder of the plants parts were also subjected to soxhlet extraction by using n-hexane and ethanol for 48 hours. The resulting extracts obtained from different solvents were evaporated to dryness at 40^0 C in rotary evaporator under reduced pressure. The extract was stored in dark air tight container at 4°C (Ali *et al*., 2017) [7].

Preliminary Phytochemical Screening

The powder of the plant materials was subjected to phytochemical screening using standard method described by Jigna *et al*. (2006) [13] and Ali *et al*. (2017) [7]. Phytochemical such as flavonoid, alkaloid, terpenoid, steroid, tannin, saponin, anthraquinone, phenol and glycoside were determined.

Quantitative Phytochemical Screening

The quantitative phytochemical analysis of the plant materials was conducted using Spectrophotometric method as described by Adeniyi *et al*. (2009) [2].

Results

Phytochemical Screening of *M. indica* leaf Extracts

Table 1 present the qualitative phytochemical screening of *M. indica* leaf extracts, preliminary phytochemical screening indicated the presence of alkaloid, flavonoid, phenol, tannin, glycoside and terpenoid. Saponin and reducing sugar are present in aqueous and ethanol extract only.

Table 1: Preliminary phytochemical Screening of *M. indica* leaf Extract

S/N	Phytochemicals	Aqueous	Ethanol	n-hexane
1	Alkaloid	+	+	+
2	Saponin	+	+	-
3	Phenol	+	+	+
4	Flavonoid	+	+	+
5	Glycoside	+	+	+
6	Tannin	+	+	+
7	Reducing sugar	+	+	-
8	Steroid	-	-	-
9	Terpenoid	+	+	+
10	Anthraquinone	-	-	-

Key: + = Present of phytochemical, - = Absent of phytochemical

Phytochemical Screening of *M. indica* Stem bark Extracts

The phytochemical screening of *M. indica* stem bark extracts is presented in Table 2. The preliminary phytochemical screening of the aqueous, ethanol and n-hexane of *M. indica* stem bark extracts indicated the presence of alkaloid, flavonoid, phenol, tannin, glycoside, steroid and terpenoid. Saponin and reducing sugar are present in aqueous and ethanol extract only.

Table 2: Preliminary phytochemical Screening of *M. indica* Stem bark Extract

S/N	Phytochemicals	Aqueous	Ethanol	n-hexane
1	Alkaloid	+	+	+
2	Saponin	+	+	-
3	Phenol	+	+	+
4	Flavonoid	+	+	+
5	Glycoside	+	+	+
6	Tannin	+	+	+
7	Reducing sugar	+	+	-
8	Steroid	+	+	+
9	Terpenoid	+	+	+
10	Anthraquinone	-	-	-

Key: + = Present of phytochemical, - = Absent of phytochemical

Phytochemical Screening of *M. indica* root bark Extracts

The phytochemical screening of *M. indica* root bark extracts is presented in Table 3. The preliminary phytochemical screening of the aqueous, ethanol and n-hexane of *M. indica* root bark extracts indicated the presence of alkaloid, flavonoid, phenol, tannin, glycoside and terpenoid. Saponin and reducing sugar are present in aqueous and ethanol extract only.

Table 3: Preliminary phytochemical Screening of *M. indica* Root bark Extract

S/N	Phytochemicals	Aqueous	Ethanol	n-hexane
1	Alkaloid	+	+	+
2	Saponin	+	+	-
3	Phenol	+	+	+
4	Flavonoid	+	+	+
5	Glycoside	+	+	+
6	Tannin	+	+	+
7	Reducing sugar	+	+	-
8	Steroid	-	-	-
9	Terpenoid	+	+	+
10	Anthraquinone	-	-	-

Key: + = Present of phytochemical, - = Absent of phytochemical

Phytochemical screening of *M. indica* seed extracts

The phytochemical screening of *M. indica* endocarp, seed and seed coat extracts is presented in Table 4. The preliminary phytochemical screening of the aqueous, ethanol and n-hexane of *M. indica* endocarp, seed and seed coat extracts indicated the presence of phenol, tannin, glycoside and terpenoid. Saponin is present in aqueous and ethanol extract only. Alkaloid is present in seed extract while flavonoid is found in endocarp only. Anthraquinone is present in endocarp and seed extract only.

Table 4: Qualitative phytochemical screening of *M. indica* endocarp, seed and seed coat extracts Endocarp Seed Seed coat

S/N	Phytochemicals	A	E	N	A	E	N	A	E	N
1	Alkaloid	-	-	-	+	+	+	-	-	-
2	Saponin	+	+	-	+	+	-	+	+	-
3	Phenol	+	+	+	+	+	+	+	+	+
4	Flavonoid	+	+	+	-	-	-	-	-	-
5	Glycoside	+	+	+	+	+	+	+	+	+
6	Tannin	+	+	+	+	+	+	+	+	+
7	Reducing sugar	-	-	-	-	-	-	-	-	-
8	Steroid	-	-	-	-	-	-	-	-	-
9	Terpenoid	+	+	+	+	+	+	+	+	+
10	Anthraquinone	+	+	-	+	+	-	-	-	-

Key: A = Aqueous, E = Ethanol, N = n-hexane, + = Present of phytochemical, - = absent of phytochemical

Quantitative Phytochemical Screening

Quantitative Phytochemical Screening of Leaf, Stem and Root bark Extract

The quantitative phytochemical analysis of *M. indica* leaf, Stem bark and root bark extracts is presented in Table 5. The results showed that the leaf extract contain high percentage of flavonoid (4.8%), followed by alkaloid (3.7%), least percentage was recorded by reducing sugar and glycoside with 0.125% and 0.136% respectively. Stem back extract contain high percentage of alkaloid (3.65%), followed by flavonoid (3.1%) least percentage was recorded by reducing sugar and glycoside with 0.20% and 0.21% respectively. on the other hand, the root extract contain alkaloid (3.2%), flavonoid (2.8%), terpenoid (1.4%) and glycoside (0.17%).

Table 5: Quantitative Phytochemical Screening of Leaf, Stem and Root bark Extract

S/N	Phytochemicals	Leaf	Stem bark	Root bark
1	Flavonoid	4.80±0.52	3.1±0.03	2.8±0.02
2	Phenol	1.34±0.02	1.20±0.02	1.07±0.02
3	Saponin	1.29±0.03	1.12±0.02	0.98±0.03
4	Tannin	1.97±0.01	1.24±0.02	1.07±0.01
5	Glycoside	0.136±0.01	0.21±0.01	0.17±0.01
6	Reducing sugar	0.125±0.01	0.20±0.01	0.18±0.01
7	Alkaloid	3.70±0.06	3.65±0.21	3.20±0.08
8	Terpenoid	1.80±0.02	1.61±0.03	1.40±0.02

Quantitative phytochemical screening of *M. indica* seed, Seed coat and endocarp extracts

The quantitative phytochemical analysis of *M. indica* seed, Seed coat and endocarp extracts is presented in Table 6. The results showed that the seed extract contain high percentage of flavonoid (2.8%), followed by alkaloid (2.1%), least percentage was recorded by reducing sugar and glycoside with 0.3% and 0.12% respectively. Seed coat extract contain high percentage of alkaloid (1.2%), followed by flavonoid (1.1%) least percentage was recorded by reducing sugar and glycoside with 0.20% and 0.11% respectively. on the other hand, the endocarp extract contain alkaloid (1.1%), flavonoid (0.95%), terpenoid (0.9%) and glycoside (0.17%).

Discussion

Plants are consider as an important source of medicine and the role of medicinal plant in promoting human health is well documented from ancient time. Plants are known to contain several secondary metabolites such as saponin, alkaloid, flavonoid, tannin and terpenoid that have therapeutic function (Mboto, *et al*., 2009) [16]. Phytochemical screening of Mango leaf, stem and root bark, and seed extracts in this study have shown the presence of important phytochemical constituents such as tannins, alkaloids, saponins, glycosides, flavonoids, phenols, steroid and anthraquinone. In the present study, steroid was only present in stem bark while anthraquinone was present in seed extract. There are some slight variations in the types of phytochemicals extracted by the different solvents used in the extraction process. Differences in phytochemical contents of the plant parts may be due to variation in the chemistry of the solvents used in the extraction process which may selectively affect extraction of various bio-active metabolites. Finding of this study was in conformity with those of Doughari and Manzara (2008) [10], Talba *et al*. (2014) [27] and Nwanko and Osaro, (2014) [21] who both found different parts of *M. indica* such as leaf, stem and root bark extract contain similar phytochemicals. However, this finding was contrary to that of Aiyelaagbe and Osamudiamen, (2009) [4] who reported absent of alkaloid in *M. indica* leaf extract.

Table 6: Quantitative phytochemical screening of *M. indica* seed, Seed coat and endocarp extracts

S/N	Phytochemicals	Seed	Seed coat	Endocarp
1	Flavonoid	2.80±0.2	1.10±0.02	0.95±0.02
2	Phenol	1.00±0.02	1.32±0.02	0.87±0.02
3	Saponin	0.34±0.01	0.12±0.02	0.65±0.03
4	Tannin	0.75±0.01	0.67±0.02	0.47±0.01
5	Glycoside	0.12±0.01	0.11±0.01	0.17±0.01
6	Reducing sugar	0.30±0.01	0.20±0.01	0.18±0.01
7	Alkaloid	2.1±0.03	1.20±0.4	1.10±0.08
8	Terpenoid	1.7±0.01	1.30±0.05	0.90±0.02

The quantitative phytochemical screening of the plant parts showed that, the flavonoid content was higher in leaf (4.8%) and seed (2.8%) while alkaloid content was more pronounced in stem bark (3.65%) and root bark (3.2%). This finding supported the finding of Ali *et al*. (2020) [5] who found higher content of flavonoid in *M. indica* leaf extract. Phytochemical analysis of the plant showed the presence of bioactive components which have vital medicinal purpose (Yadav and Agarwala, 2011) [29].

The presence of various medicinally important phytochemicals such as flavonoid, alkaloid, saponin, tannin, terpenoid and phenolic compounds in M. indica indicated that the plant possess high profile therapeutic value and can be used in the healing of wound and treatment of various types of diseases. Healing of wound by the extracts of the plant may be attributed to the positive interference of total phenols and tannin. Total phenol is a good antioxidant, hence prevent plants and human body from oxidative damage due to free radicals (Okwu, 2005) [20]. The free radical scavenging and antioxidant of the plant are the factor responsible for the therapeutic effects against some diseases such as diabetes, cancer and cardiovascular diseases (Sroka and Cisowski, 2003) [26]. The flavonoid content of *M. indica* leaf and other parts is also vital due to possession of antioxidant activity and has been reported to provide protection to the cell against oxidative damage. The protective functions of flavonoid to the cells include protection against allergies, free radicals scavenging, microorganisms, platelets aggregation, ulcer, hepatoxins and tumor (Omotoso *et al*., 2020) [22]. The tannins as one of the secondary metabolites in *M. indica* had several medical

values. It has the ability to form chemical complexes with many bi-molecules and might be efficacious in precipitating poisonous materials in burned tissue. The tannins lead to improve and help to reduce scar formation tissue by inhibition of the formation and removal of reactive oxygen substance. The tannins n plants also help to relief pain and limit secondary infection. It also prevents plasma loss and as well used for inflammation treatment (Omotoso *et al*., 2020) [22].

Ali, et al. (2018) [6] believed that plant alkaloid possess antibacterial activity. Plant alkaloid are used are vital as a basic medicinal agents for their antispasmodic, analgesic and bactericidal activity, it also protect human body against chronic diseases (Adesegu and Coker, 2001) [3]. The presence of alkaloids in mango leave supported the use of this plant part in the treatment of malaria and fever in Nigeria (Adesegu and Coker, 2001) [3]. Saponins possess the tendency to remove microorganism making them good for treatment of fungal and yeast infections. The saponins also lower blood cholesterol thereby reducing the risk of heart disease (Okwu and Emenike, 2006) [21]. Glycoside of plants can be used as cardiac stimulant (Sofowora, 1993) [25]. Steroids are importance in pharmacy as they possess compounds like sex hormones and can be used for drug production (Ali *et al*., 2018) [6]. Different parts of *M. indica* find their medicinal values due to the presence of respective phytochemical constituents. The presence of various phytochemicals in the tested plant reveals that this plant may be a good source for production of new drugs for various ailments.

Conclusion

Finding from the study indicated that various parts of *M. indica* are important source of phytochemicals such as tannins, saponin, flavonoids, alkaloid, steroid, terpenoid, anthraquinone, glycosides, and phenol. Thus the plants play a vital role in preventing various diseases due to the richness of phytochemicals. It is recommended that various part of M. indica can be used for medicinal purposes.

Conflict of Interest

Not available

Financial Support

Not available

References

1. Abdul Wadood, Ghufran M, Babar Jamal SB, Naeem M, Khan A, Ghaffar R, *et al.* Phytochemical Analysis of Medicinal Plants Occurring in Local Area of Mardan. Biochemistry & Analytical Biochemistry; c2013.
2. Adeniyi SA, Orjiekwe CL, ehiagbonare JE. Determination of alkaloids and oxalates in some selected food samples in Nigeria. Afr J Biotechnol. 2009;8(1):110-112.
3. Adesegu SA, Coker HAB. Plants used in traditional medicine against malaria, Nigerian. Journal of Pharmacology. 2001;32:50-62.
4. Aiyelaagbe OO and Osamudiamen PM. Phytochemical Screening for Active Compounds in Mangifera indica leaves from Ibadan, Oyo State. Plant Sciences Research, Ibadan. 2009;2(1):11-13.
5. Ali BA, Alfa AA, Tijani KB, Idris ET, Unoyiza US, Junaidu Y. Nutritional Health Benefits and Bioactive Compounds of *Mangifera indica* L (Mango) Leaves Methanolic Extracts Asian Plant Research Journal. 2020;6(2):41-51, DOI: 10.9734/APRJ/2020/v6i230126
6. Ali M, Nas FS, Yahaya A, Ibrahim IS. Phytochemical Screening of Some Spices Used as Condiment in Kano, North western Nigeria. Pharm Res. 2018;2(1):000150.
7. Ali M, Yahaya A, Zage AU, Yusuf ZM. *In-vitro* Antibacterial Activity and Phytochemical Screening of *Psidium guajava* on Some Enteric Bacterial Isolates of Public Health Importance 2017. Journal of Advances in Medical and Pharmaceutical Sciences. 2017;12(3):1-7. DOI: 10.9734/JAMPS/2017/31126
8. Berardini N, Fezer R, Conrad J, Beifuss U, Carle R, Schieber A. Screening of mango (Mangifera indica L.) cultivars for their contents of flavonol O- and xanthone C-glycosides, anthocyanins, and pectin. J. Agric. Food Chem. 2005;53:1563-1570.
9. Doughari JH. Phytochemicals: Extraction Methods, Basic Structures and Mode of Action as Potential Chemotherapeutic Agents. www.intechopen.com; c2004.
10. Doughari JH, Manzara S. In vitro antibacterial activity of crude leaf extracts of Mangifera indica Linn. Afr. J. Microbiol. Res. 2008;(2):67-72.
11. Farina V, Corona O, Mineo V, D'Asaro A, Barone F. Qualitative characteristics of Mango fruits (*Mangifera indica* L.), which have undergone preservation (Italian). Acta Italus Hortus. 2013;12:70-73.
12. Igoli JO, Ogaji OG, Tor-anyiin AT, Igoli NP. Traditional medicine practice amongst the Igede people of Nigeria part II. African Journal of Traditional, Complementary and Alternative Medicines. 2005:2(2):134-152.
13. Jigna P, Sumitra C. In-vitro antimicrobial activities of extracts of Launaeaprocumbns Roxb. (Labiateae), Vitis vinifera L. (Vitaceae) and Cyperus rotundus L. (Cyperaceae). Afri. Jornal Biomed. 2006;9(2):89-93.
14. Krishnaiah D, Sarbatly R, Bono A. Phytochemical antioxidants for health and medicine: A move toward nature. Biotechnolmol. Biology Rev. 2006;1:97-104.
15. Masibo M, He Q. Major Mango Polyphenols and Their Potential Significance to Human Health. Compr. Rev. Food Sci. Food Saf. 2008;7:309-319.
16. Mboto CI, Eja ME, Adegoke AA, *et al*. Phytochemical properties and antimicrobial activities of combined effect of extracts of the leaves of Garcinia kola, Vernonia amygdalina and honey on some medically important microorganisms. Afr. J. Microbiol Res. 2009;3:557-559
17. Masud Parvez GM. Pharmacological Activities of Mango (Mangifera indica): A Review. J. Pharmacogn. Phytochem. 2016;5:1-7.
18. Nostro A, Germano MP, D'angelo V, Mariano A, Lanattel MA. Extraction method and bioautography for evaluation of medicinal plants antimicrobial activity. Letter in Applied Microbiology. 2000;30: 379.
19. Nwankwo IU, Osaro-Mathew RC. Assessment of the phytochemical components of *Mangifera indica* (leaf) and *Musa paradisiacal* (roots) extracts and their antibacterial activity against some common pathogenic bacteria. Journal of Pharmacy and Biological Sciences (IOSR-JPBS). 2014;9(1):08-11.
20. Okwu DE. Phytochemicals, Vitamin and mineral

content of two Nigerian medicinal plants. International Journal of Molecular Medical Advanced Science. 2005;375-381.
21. Okwu DE, Emenike IN. Evaluation of the Phytonutrients and Vitamins Contents of *Citrus* Fruits. International Journal of Molecular Medical Advanced Science. 2006;2(1):1-6.
22. Omotoso OD, Alfa AA, Olorunnado SE, Tijani KB. Histomorphological characterization of *Pneumococcal meningitis* in bone marrow of wistar rats treated with Bridelia ferruginea and Ciprofloxacin. International Journal of Medicine and Health Development. 2020;25:2.
23. Sarker SD, Nahar L. Chemistry for Pharmacy Students General, Organic and Natural Product Chemistry. England: John Wiley and Sons; c2007. p. 283-359.
24. Shahidi F, Janitha PK, Wanasundara PD. Phenolic antioxidants. Crit. Rev Food Sci. Nutr. 1992;32:67-103.
25. Sofowora A. Medicinal plants and traditional medicine in African. Ibadan: Spectrum Book Ltd; c1993.
26. Sroka Z, Cisowski W. Hydrogen peroxide scavenging, antioxidant and antiradical activity of some phenolic acids. Food Chemistry Toxicol. 2003;44:753-758.
27. Talba AM, Suleiman MM, Raji MA, Oniye SJ. Phytochemical Screening and In-vitro Antibacterial Activity of Mangifera indica (Mango) Kernel on Aeromonas caviae. Journal of Pharmacy. 2014;4:45-50.
28. World Health Organization (WHO). Use of antibacterials outside human medicine and result and antibacterial resistance in humans. World Health Organization. Archieved from the Original on 2014 May 13.
29. Yadav R, Agarwala M. Phytochemical analysis of some medicinal plants. Journal of Phytochemistry. 2011;3(12):104.

How to Cite This Article
Diso SU, Mukhtar MD, Dutsinma UA. Phytochemical screening of leaves, seed, stem and root bark extracts of *Mangifera indica* (Mango). International Journal of Clinical and Diagnostic Pathology. 2023;4(1):118-122.