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Antimicrobial, Proximate, and Toxicity Studies of the Aerial Plant Parts of *Drynaria Laurentii* obtained from Effurun Delta State

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ABSTRACT

Phytochemical screening revealed the presence of Saponin, tannins, phenolic compound, carbohydrates, glycoside, flavonoid, alkaloids, protein, and steroids for the solvents extracts. Proximate analysis results recorded 17.40, 7.4, 4.31, 6.02, 54.16, and 9.81 against moisture content, ash, fat, crude fiber, carbohydrate, and crude protein respectively. Mueller Hinton agar medium with some clinical pathogenic microbes such as *Methicillin Resist Staphaureus, Staphylococcus aureus, Vancomycin-Resistant enterococci, Helicobacter pylori, Escherichia coli, Klebsiella pneumoniea, Salmonella typhi, Proteus mirabilis, Candida albicans, Candida krusei, Candida tropicalis* revealed that the minimum inhibitory concentration for all the solvent extracts and organisms occurred at 2.5 mg/ml, except for *Salmonella typhi* which occurred at 5 mg/ml in methanol extract. Minimum bacterial/fungicidal concentration for all organisms occurred at 10 mg/ml except for *Methicillin Resist Staphaureus, Escherichia coli,* and *Candida tropicalis occurred* at 5 mg/ml in ethyl acetate and *Helicobacter pylori* which occurred at 5 mg/ml in methanol. The aqueous plant extract was not toxic at 1 mg/l, 10 mg/l, and 100 mg/l indicating the safety of the plant as a good source of medicinal plant. Generally, *Drynaria laurentii* possesses bioactive phytochemicals with an appreciable level of nutrient contents in the dry samples; inhibit the growth of microorganisms and not toxicity at the stated concentrations.

1. INTRODUCTION

The use of bioactive compounds from medicinal plants as therapeutic agents has been an important area in biomedical and natural product research. A medicinal plant is any plant whose organs contain valuables that can be used for healing purposes or which are originators for chemo-pharmaceutical semi-synthesis (Nascimento et al, 2012). Such a plant will have its parts such as leaves, roots, rhizomes, stems, barks, flowers, fruits,

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grains, or a seed applied in the control or treatment of disease cases and therefore contains chemical components that are medically, respondent. These non-nutrient plant chemical compounds or bioactive components are often referred to as phytochemicals. Examples of Phytochemicals are flavonoids, phenols, carbohydrates, tannins, alkaloids, carbohydrates, etc. Ogwuche *et al.*, 2020 revealed that proximate analysis on a plant is used to rate the nutritional properties such as protein, carbohydrates, lipids, water, and ash contents. The total energy content of an organism is supplied by the protein, lipid, and carbohydrate while water and ash add to the mass of the organism (AOAC, 2016). Antimicrobial activity can be defined as a shared or joint term for all active principles (agents) that stop the growth of bacteria, prevent the formation of microbial colonies, and may kill microorganisms. Several scientists have revealed trials of antimicrobial studies of medicinal plants as reported by Arya and Kumar, (2005); Chandran *et al.*, (2015); Odeja *et a.l*, (2016). Toxicology testing is also known as safety assessment is the process of determining the degree to which a substance of interest negatively impacts the normal biological functions of an organism, given certain exposure duration, route of exposure, and substance concentration. This study focused on the assessment of phytochemicals, proximate analysis, anti-microbial activities, and toxicity studies of the aerial plant part of the *Drynaria laurentii* plant using standard analytical techniques.

2. MATERIALS AND METHODS

2.1 Collection and Identification of the Plant

Fresh mature leaves of *Drynaria laurentii* were gotten from Ugbomro community located in Effurun, Delta State, Nigeria. The plant was sent to the Department of Botany, Ahmadu Bello University Zaria, for identification where it was given the voucher specimen number ABU09003 by a botanist called Abubakar B.Y.

2.2 Preparation of the plant

The aerial plant parts of *Drynaria laurentii* were collected in large quantities. They were carefully stripped off of soil particles and carefully washed with deionized water to remove soil debris. . The plant material was then spread on a flat surface to air dry in the lab at room temperature (27 °C) for 8 days. The dried plant material was cut into smaller pieces and then blended to a fine powder using a blender (Vogel, 2007).

2.3 Extraction of the plant

150 g of the pulverized plant materials were carefully weighed and loaded into a Soxhlet extractor. It was extracted successively with n-Hexane, Ethyl acetate, and Methanol by hot continuous percolation method in the soxhlet apparatus for 72 hours respectively. Solvents used were those of JHD and general-purpose reagents. The extracts were concentrated in vacuo at 40 ^{o}C using a rotary evaporator and subjected to air-drying to give dried crude extracts Majekodunmi et al, 2015; Hossain *et al.*, 2014.

2.4 Phytochemical studies

The phytochemical screening of the extract was done to identify the main active groups constituent present in the solvent extracts by their color reaction. The test procedures were carried out based on standard procedures by (Trease and Evans, 2008), (Sofowora, 1993), and (Ingle *et al*., 2017).

Test for alkaloids- 0.2 g of extract was shaken with 1 % HCl for two minutes. The mixture was filtered and a Wagner's reagent was added. The formation of a precipitate indicates the presence of alkaloids.

Test for saponin - 0.2 g of extract was shaken with 5 ml of distilled water in a test

tube frothing which persist on warming was evidence for the presence of saponin.

Test for steroids- 0.2 g of extract was dissolved in 2 ml chloroform. Concentrated sulphuric acid was carefully added to firm a lower layer. A reddish-brown color at the interphase indicated the deoxy sugar characteristics of cardenolides.

Test for anthraquinones - 0.2 g of extract was shaken with 4 ml of benzene. The mixture was filtered and 2 ml of 10 % ammonia solution was added to the filtrate. The mixture was shaken and the presence of pink, red, or violet color in the ammoniac phase indicates the presence of free anthraquinones.

Test for glycosides- The extract was hydrolyzed with HCl solution and neutralized with NaOH solution. A few drops of Fehling's solution A &B were added. A red precipitate indicates the presence of glycosides.

Test for phlobatannins - The extract was dissolved in distilled water and filtered. The filtrate was boiled with 2 % HCl solution. A red precipitate shows the presence of phlorotannins

Test for tannins - 0.2 g of the extract was stirred with distilled water and filtered. Ferric chloride was added to the filtrate. A blue-black, green or blue-green precipitate was taken as evidence of tannin presence.

Test for flavonoids- A little amount of magnesium powder and a few drops of concentrated hydrochloric acid were added to 3 ml of the extracts. A red or intense red coloration indicates the presence of flavonones.

Test for phenol- 0.2 g of extract was dissolved in 2 ml of ferric chloride solution. A green or dirty green precipitate indicates the presence of phenolic compounds.

Test for cardiac-active glycosides- 0.2 g of the extract was dissolved in 2 ml of glacial acetic containing one drop of ferric chloride solution followed by the addition of 1ml of concentrated sulphuric acid. A brown ring at the interface confirmed the presence of cardiac glycosides.

Test for reducing sugar-0.2 g of the extract was shaken with distilled water and filtered. The filtrate was boiled with drops of Fehling's solution A& B for two minutes. An orange precipitate on boiling with the Fehling's solution indicates the presence of reducing sugar.

2.5 Proximate analysis

Proximate analysis helps to ascertain nutrient content. The following procedures were followed.

2.6 Determination of ash content

A clean petri dish was weighed and 2.0 g of the sample was added to it. The petri dish and its content were then placed in a muffle furnace for 8 hrs at 550 ^{o}C. Then the content was cooled in the desiccator, and the heating and cooling process was done continuously until a steady weight was achieved. The weight of the petri-dish and residue was recorded and used to estimate the ash content**.**

2.7 Determination of crude fiber composition

100 ml of 1 % H_2SO_4 was added to 1 g of the sample in a 1L conical flask and allowed to boil for 20 minutes. The contents were then filtered through a Buckner funnel and rinsed with deionized water. 100 ml of 1% boiling NaOH was added to the filtrate, gently boiled for another 20 mins, and then filtered again. Hot deionized water, 5 % HCl, and dimethyl ether were respectively used to wash the residue, which was later oven-dried at 55 °C for 6 hrs. The residue was then cooled, weighed, and later heated at 200 °C for 50 mins. Finally, the ash was

cooled and weighed, and the fiber content was calculated.

Determination of carbohydrate composition
The composition of total carbohydrate was determined by summing up the percentage values of other components (moisture, protein, crude fiber, fat, and ash) and subtracting by 100**.**

2.8 Determination of protein composition

Three grams of Kjeldahl digestion catalyst and 10ml of 1.0% concentrated H_2SO_4 and little anti-bumping agents were added to 0.5 g of the sample in a 50 ml Kjeldahl digestion flask. The flask was heated until foaming stopped and then the content liquefied. Heating was further intensified, with occasional rotation of the flask, until the color of the content changed from ash to blue-green/pale green. The content was cooled and moved to a 100 ml volumetric flask; an inch addition of distilled water filled it up to its capacity. 20 ml of the diluted digest was transferred into a 100 ml distillation flask containing some anti-bumping chips. The flask was then connected to a condenser whose receiver linked to a Buchner funnel placed in a 250 ml beaker that contains 15 ml of 2% boric acid solution into which 2 drops of methyl red-methylene blue (double indicator) were added. Into the flask was added 20 ml of 50% NaOH solution. When the colour of the boric acid in the receiver flask changed from purple to pale green and then the volume in the beaker was almost equal to the original volume, the distillation was stopped. The ammonia was then released into the boric acid solution. The boric acid-ammonia distillate was titrated with 1.0 M HCl acid. The appearance of a pink coloration marked the end of the titration. The nitrogen content, which is used to calculate the protein content, was then calculated using the titer value.

2.9 Determination of fat composition

This estimation was performed using the successive Soxhlet extraction method. 5 g of the powdery form of the plant sample was weighed and wrapped with a filter paper and placed in a thimble. The thimble was covered with cotton wool and placed in the extraction column that was connected to a condenser. 100 ml of n-Hexane was used to extract the lipid.

2.10 Antimicrobial screening
The antimicrobial activities of ethyl acetate, methanol, and n-hexane plant extracts were determined using pathogenic microbes. The microbes were obtained from the department of medical microbiology ABU teaching hospital Zaria. These procedures were followed according to Cowan (1999).

0.1 mg of the extract was weighed and dissolved in 10 ml of DMSO to obtain a concentration of 10 mg/ml (the initial concentration of the extract used to determine its antimicrobial activities). The method used for screening the extracts is the diffusion method. Mueller Hinton agar medium was used as the growth medium for the microbes, the medium was prepared according to the manufacturer's instructions sterilized at 121 °C for 15 mins which were poured into the sterile Petri dishes and were allowed to cool and solidify. The sterilized medium was seeded with 0.1 ml of the standard inoculum of the test microbe, the inoculum was spread evenly over the surface of the medium by the use of a sterile swab. By the use of a standard cork borer of 6 mm in diameter, a well was cut at the center of each inoculated medium. 0.1 ml of the solution of the extract of the concentration of 10 mg/ml was then introduced into the well on the inoculated medium. Incubation was made at 37 °C for 24 hrs, after which the plates of the medium were observed for the zone of inhibition of growth, the zone

was measured with a transparent ruler, and the result was recorded in millimeters.

2.11 Determination of minimum inhibition concentration

The minimum inhibition concentration of the extract was determined using the broth dilution method. Mueller Hinton broth was prepared, 10mls was dispensed into test tubes and was sterilized at 121 °C for 15 mins, and the broths were allowed to cool. Mc- Farland's turbidity standard scale number 0.5 ml was prepared to give the solution. Normal saline was prepared, 10 ml was dispensed into a sterile test tube and the test microbe was inoculated and incubated at 3 °C for 6 hrs. Dilution of the microbe was done in the normal saline until the turbidity marched that of the Mc-Farland's scale by visual comparison at this point the test microbe has a concentration of about 1.5 X c/ml. Two-fold serial dilution of the extract was done in the sterile broth to obtain the concentrations of 10 mg/ml, 5 mg/ml, 2.5 mg/ml, 1.25 mg/ml, 0.63 mg/ml. The initial concentration was obtained by dissolving 0.1 mg of the extract in 10 ml of the sterile broth. Having obtained the different concentrations of the extract in the sterile broth, 0.1 ml of the test microbe in the normal saline was then inoculated into the different concentrations, incubation was made at 37 °C for 24 hrs after the test tubes of the broth were observed for turbidity (growth) the lowest concentration of the extract in the sterile broth shows no turbidity was recorded as the minimum inhibition concentration.

2.12 Determination of minimum bacterial and minimum fungicidal concentrations

MBC/MFC was carried out to determine whether the test microbes were killed or only their growth was inhibited. Mueller Hinton agar was prepared sterilized at 121 ^{o}C for 15 mins poured into sterile Petri dishes and were allowed to cool and solidly. The contents of the MIC in the serial dilutions were then subcultured onto the prepared medium, incubation was made at 37 °C for 24 hrs., after which the plates of the medium was observed for colony growth, MBC/MFC was the plates with the lowest concentration of the extract without colony growth.

2.13 Toxicity studies

The periwinkle snails used during this research course were obtained from the Effurun market. It is located at Uvwie Local Government Area of Delta State, Nigeria.

2.14 Test chemicals

For this research, the biosynthesized plant powder was used as the test chemicals for toxicity analysis.

2.15 Periwinkle toxicity bioassay

The periwinkle snails that were used were the brown-black periwinkle snails with a mean size of 3/4 inch wide and 1 inch long. The procedure of the International Organization for Standardization (ISO 2006) was adopted for the snail bioassays.

2.16 Acclimatization of test organisms

The snails were acclimatized in clean soils for seven days before the commencement of the experiment. 1000 g (1 kg) of natural soil of the organisms' habitats were placed into three (3) different test containers for each of the test concentrations and sprinkled with 100 ml of different concentrations of the pulverized plant. Cellulose was also added to the soil as food for the organisms to ensure they were not starved, after 4 hours ten healthy active organisms were cleaned, weighed, and carefully transferred into the test containers (ISO 2006). The experiment began with a range-finding test to establish a working range to determine the concentration to be used in the definitive

test. From the prepared stocked solution, a range-finding test using concentrations of 1 mg/l, 10 mg/, and 100 mg/ was carried out using the pulverized plant solution. Three replicates per treatment were prepared for the three concentrations for the pulverized plant solution. The control setup which contained distilled water was prepared alongside the pulverized plant solution. The organisms were kept in the laboratory and each of the test concentrations was labeled. The setup was covered with a net and held with a rubber band to prevent the organisms from dying.

2.17 Evaluation of growth rate and toxicology risk assessment

The weight of the organisms was measured again after exposure for the sub-lethal assessment to evaluate the growth rate and to estimate any inhibition resulting from exposure to the pulverized plant solution.

2.18 Assessment of response (mortality)

Mortality and the lethal test were evaluated on the 7^{th} day and for the sub-lethal experiments in all the replicates. Physical changes (morphology) and behavioral responses were also noted. The organisms would be considered dead if there was no movement when the periwinkle snails were prod with a metal rod or if there was no activity after 5 min of placing the snails on a white paper.

2.19 Soil samples

The soil samples were obtained from the Federal University of Petroleum Resources Effurun (FUPRE) building site at a depth of 0-10 cm. The soil samples were washed, air-dried, and sieved through a 2 mm mesh size sieve and used for fertility analyses.

2.20 Results

The results of the different analyses in this research work are presented below

Table 1: Showing Phytochemical screening result of extract of the aerial plant parts of Drynaria laurentii

Test performed	**Results for n-hexane Extract**	**Results for Ethylacetate Extract**	**Results for Methanolic Extract**
Appearance	Liquid	Liquid	Liquid
Colour description	Dark green	Deep green	
Saponin	+	+	+
Reducing Sugars	-	-	-
Alkaloids	-	+	+
Protein (Amino acids)	-	+	+
Steroids	-	+	+
Tannins	+	+	-
Anthraquinones	-	-	-
Phenolic compounds	+	+	+
Carbohydrate	+	+	+
Terpenoids	-	-	-
Glycosides	+	+	+
Flavonoids	+	+	+

Keys: (+) indicates present, **(-)** indicates absent.

Table 2: Showing the results of Zones of inhibition of the plant extract against the test with standard drugs.

Test Organism	Etha	Meth	n-H	Sparflo Xacin	Ciprofloxa cin	Flucona Zole
Methicillin Resist Staphaureus	26	21	18	30	0	0
Staphylococcus aureus	0	0	0	29	0	0
VanomycinResistant enterococci	20	18	0	0	34	0
Helico bacterpylori	27	23	20	0	35	0
Campylo bacterjejuni	22	20	19	35	30	0
Escherichia coli	25	20	0	0	37	0
Klebsiellap neumoniea	0	0	0	32	0	0
Salmonel latyphi	20	17	0	0	40	0
Proteus mirabilis	21	20	1	30	0	0
Candida albicans	0	0	0	0	0	32
Candida krusei	21	18	0	0	0	35
Candida tropicalis	23	20	18	0	0	33

Table 3. Showing the results of the Minimum inhibitory concentration of the extract against the test microorganism.

Test Organism	10mg/ml	5mg/ml	2.5mg/ml	1.25mg/ml	0.63mg/ml	10mg/ml	5mg/ml	2.5mg/ml	1.25mg/ml	0.63mg/ml	10mg/ml	5mg/ml	2.5mg/ml	1.25mg/ml	0.63mg/ml
Methicillin Resist Staph aureus	-	-	o*	+	++	-	-	o*	+	++	-	0*	+	++	+++
Staphylococcus aureus															
Vanomycin Resistant enterococci	-	-	o*	+	++	-	-	o*	+	++					
Helicobacter pylori	-	-	-	0*	+	-	-	o*	+	++	-	-	o*	+	++
Campylobacter jejuni	-	-	o*	+	++	-	-	o*	+	++	-	0*	+	++	+++

Escherichia coli	- - o* + ++	- - o* + ++	
Klebsiella pneumoniea			
Salmonella typhi	- - o* + ++	- o* + ++ +++	
Proteus mirabilis	- - o* + ++	- - o* + ++	- 0* + ++ +++
Candida albicans			
Candida krusei	- - o* + ++	- - o* + ++	
Candida tropicalis	- - o* + ++	- - o* + ++	- 0* + ++ +++

KEY: - = No turbidity (No growth), o* = MIC, + = Turbid (light growth), ++ = Moderate turbidity, +++ = High Turbidity.

Table 4. Showing the results of the Minimum bactericidal/fungicidal concentration of the extract against the test microbe.

Test Organism	10mg/ml 5mg/ml 2.5mg/ml 1.25mg/ml 0.63mg/ml	10mg/ml 5mg/ml 2.5mg/ml 1.25mg/ml 0.63mg/ml	10mg/ml 5mg/ml 2.5mg/ml 1.25mg/ml 0.63mg/ml
Methicillin Resist Staph aureus	- o* + ++ +++	0* + ++ +++ ++++	0* + ++ +++ ++++
Staphylococcus aureus			
Vanomycin Resistant enterococci	0* + ++ +++ ++++	0* + ++ +++ ++++	
Helicobacter pylori	- - o* + ++	- o* + ++ +++	0* + ++ +++ ++++
Campylobacter jejuni	0* + ++ +++ ++++	o* + ++ +++ ++++	0* + ++ +++ ++++
Escherichia coli	- o* + ++ +++	0* + ++ +++ ++++	
Klebsiella pneumoniea			
Salmonella typhi	0* + ++ +++ ++++	0* + ++ +++ ++++	
Proteus mirabilis	o* + ++ +++ ++++	0* + ++ +++ ++++	o* + ++ +++ ++++
Candida albicans			
Candida krusei	0* + ++ +++ ++++	o* + ++ +++ ++++	
Candida tropicalis	- o* + ++ +++	0* + ++ +++ ++++	o* + ++ +++ ++++

Table 5: Showing the result of proximate analysis

Test performed	**Results**
Total mass of sample	15g
Appearance	Powdery
Colour Description	Green
Moisture content (%)	17.40
Ash content (%)	7.40
Crude Fat	4.31
Fibre	6.02
Carbohydrate	54.16
Crude Protein	9.81

Table 6. Showing the results of percentage mortality of periwinkle snails when expose to the aqueous plant extract of *Drynaria laurentii.*

Tanks	Conc. of *D. laurentii*	Log10 conc. *D. laurentii*	Initial no of PS	Survived PS	Dead PS	% mortality =dead PS/initial no of snail x 100	% mortality (corrected for control)
1	100	2	10	7	3	30	30-0 = 30
2	10	1	10	9	1	10	10-0 = 10
3	1	0	10	10	0	0	0
Control	0 (control)	0	10	10	0	0	0

3. DISCUSSION

Phytochemical analysis conducted on the plant extracts revealed the presence of constituents that are known to exhibit medicinal as well as physiological activities (Sofowora 1993). The result of the phytochemical analysis of the aerial plant parts of *D. laurentii* (Table 1) shows that n-hexane, ethyl acetate, and methanol extracts revealed the presence of the following bioactive agents put together; Saponin, tannins, phenolic compound, carbohydrates, glycoside, alkaloids, protein, steroids, tannins, phenolic. But there was the absence of sugar, anthraquinone, and terpenoids in all three extracts while alkaloids, protein, steroids, glycosides were absent in the n-Hexane extract while tannins were absent in the methanolic extract. Saponins are reported to be known to produce an inhibitory effect on inflammation (Just et al, 1998). Saponins have the property of precipitating and coagulating red blood cells. Steroids have been reported to have antibacterial properties (Raquel, 2007) and they are very important compounds especially due to their relationship with compounds such as sex hormones (Okwu, 2001). Alkaloids have been associated with medicinal uses for centuries and one of their common biological properties is their cytotoxicity (Nobori et al, 1994). Glycosides

are known to lower blood pressure according to many reports (Nyarko and Addy, 1990). The result obtained in this study suggests that this plant proves to be an increasingly valuable reservoir of bioactive compounds of substantial medicinal merit.

The result of the antimicrobial activities as shown in Table 2, Table 3, and Table 4 were determined using Mueller Hinton agar medium with some clinical pathogenic microbes such as *Methicillin Resist Staphaureus, Staphylococcus aureus, Vancomycin-Resistant enterococci, Helicobacter pylori, Escherichia coli, Klebsiella pneumoniea, Salmonella typhi, Proteus mirabilis, Candida albicans, Candida krusei, Candida tropicalis.* The zones of inhibition were comparable with those of modern drugs. Minimum Inhibitory Concentration for all the solvent extracts and organisms occurred at 2.5 mg/ml, except for *Salmonella typhi* which occurred at 5 mg/ml for methanol extract. Minimum bacterial/fungicidal concentration of ethyl acetate, methanol, and n-hexane fraction for all organisms occurred at 10mg/ml except for *Methicillin Resist Staphaureus, Escherichia coli,* and *Candida tropicalis which occurred* at 5 mg/ml for ethyl acetate and *Helicobacter pylori* which occurred at 5 mg/ml for methanol. The efficiency of the different extracts of *D. quercifolia* on antibacterial activity reported by Kandhasamy *et al.*, (2008) revealed that the ethanolic and methanolic extracts of the rhizome of *D. quercifolia* exhibited a broad spectrum of antibacterial activity. The extracts inhibited the growth of pathogenic bacteria 80 and 70% respectively.

The results of proximate analysis on *D. laurentii* as shown in Table 5 reviewed the quantification for moisture, ash, fat, fiber, crude protein, and carbohydrate. The presence of these nutrients explains their importance in nutrition and dietary role. Amongst other researches and results, Ogwuche *et al.*, (2020) and Ogidi *et al*., (2019) also reported a medicinal plant with appreciable nutritional value. This indicates that the *D. laurentii* plant has an appreciable level of carbohydrates, proteins, moisture content, crude fat, fiber, ash contents in dry samples. This confirms the *Drynaria laurentii* plant as a good source of these nutrients and possible dietary value. The results revealed that the aerial parts of the plant of *D. laurentii* are a good source of mineral elements as they contained a high percentage of ash. Moisture content is in the range of 7-17% indicating that aerial parts of the plant are good for formulating because low moisture content prevented microbial growth (Shellard, 1958). Aerial plant parts appeared to be a good supplement for protein, carbohydrate, and fat, which are the major building blocks of nutrition (Anyasor *et al.*, 2011).

The acute toxicity result shown in Table 6 reveals that this plant might be considered as a broad non-toxic but at higher concentrations other than the one used in this study they may have adverse effects on survival, and at nonlethal concentrations, they may affect the reproduction rates of the snails. Research has shown that drugs derived from medicinal plants may also contain harmful ingredients. Thus it becomes very necessary to identify all possible interactions of herbal remedies (Nielsen and Brant 2002).

These results are comparable to the results of some authors who reported on preliminary Phytochemical Screening and toxicity test of leaf and root parts of the snake plant, showing it is less toxic and very effective in the therapeutic remedy for gastric ulcers (Berame *et al*., 2017) and on toxicity studies on the leaves of *Senna alata*, a medicinal plant from Burkina Faso, in mice and rats, showing the results of the toxicity tests, that the aqueous extract of the

leaves of *Senna alata* was practically non-toxic in acute treatment. Thereby justifies its use in traditional medicine in Burkina Faso in the treatment of many diseases (Filkpièrè *et al.*, 2020).

4. CONCLUSION

The results obtained from this research revealed that the aerial plants' parts of *Drynaria laurentii* contain various medicinally active substances which can help resist fungi and bacteria infections and are a good source of carbohydrate, crude fiber, protein, crude fat, ash content, and moisture content on the plant. The results indicated that the *Drynaria laurentii* plant has an appreciable level of carbohydrates and proteins, moisture content, crude fat, fiber, ash contents in dry samples. The antimicrobial properties show its activeness against a wide range of microorganisms. Toxicity studies of the plant reveal the safety of the plant and as such plays an important role in the treatment of venereal diseases.

Recommendation

We recommend that further research be carried out on *D. laurentii* as not more have been reported in literature concerning this plant.

Conflict of Interest

Authors declare that there are no conflict of interest

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