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PHYTOCHEMICAL AND NUTRITIONAL COMPOSITION OF COMMONLY USED PLANTS FOR THE TREATMENT OF DYSMENORRHOEA IN ILORIN, KWARA STATE, NIGERIA

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ABSTRACT

Ethnobotanical study revealed Anona senegalensis, Axonopus compressus, Gongronema latifolium, Lacosperma secundiflorum, Mitragyna inermis, Piliostigma thonningii, Piliostigma reticulatum, Senna podocarpa and Trema orientalis as the most frequently used medicinal plants in the treatment of dysmenorrhea in Ilorin. Phytochemical and nutritional composition analysis was carried out using standard procedures. Results revealed that the plant materials were preserved dried and the common method of preparation is decoction. The phytochemical screening confirmed the presence of alkaloids, anthraqinones, cardiac glycosides, flavonoids, polyphenols, saponins, tannins and tarpenoids in all the plants however, anthraquinones and cardiac-glycoside were absent in P. retculatum while terpenoid and polyphenol were also not present in T. orientalis. Proximate analysis showed that S. podocarpa (39.83±0.02) had highest dry matter content, ash content was high in G. latifolium (65.60±0.02) and protein was high in M. inermis (14.21±0.02) while T. orientalis (36.24±0.02) was high in crude fibre. There is significant difference in the percentage ash, crude fibre, dry matter, ether extract and protein content at $p<0.05$. Nevertheless, the crude fibre content varies among the species: no significant difference between G. latifolium, P. thonningii, and S. podocarpa (a); P. reticulatum and A. compressus (b); A. senegalensis and T. orientalis (cd) and L. secundiflorum and M. inermis (bc). Saponins, Polyphenols and Cardiac glycosides are responsible for the relief of muscle contractions in the uterus for easy flow of the blood. Flavonoids are significantly recognized for their anti-oxidant which helps to reduce pains due to oxygen received in the uterus. Likewise, alkaloid are analgesic, anti-inflammatory and improves blood circulation while terpenes also have antibiotic, antiviral, antiparasitic and antifungal properties Hence, the synergistic effects of plant/herb recipes play a noteworthy role in the treatment of dysmenorrhoea and several ailments in human.

KEY WORDS: *dysmenorrhoea, ethnomedicine, phytochemistry, proximate analysis, Ilorin*

INTRODUCTION

Historically, plants have been recognized and established to be source of medicine to human. This medicinal property lies in the compendious variety of chemical compounds that performs indispensable biological functions (Tapsell *et al*., 2006). Diverse compounds from plants have been identified alongside their immense contributions in modern medicine (Sivarajan & Balachandran 1994; Fabricant *et al*., 2001, Ríos & Recio 2005; Sahu *et al*., 2014; Chaudhary & Kaushik, 2017; Omwenga *et al*., 2017; Rayan *et al*., 2017; Opara *et al*., 2018). The evolutionary development of phytochemical screening was from the traditional use of plants by the folks hitherto (Handa *et al*., 2008). The acceptability was further justified because of the ready availability of these plants. The application of herbs/recipes to treat disease is becoming universal among non-industrialized societies since is often more affordable compared to modern pharmaceuticals/drugs. Man is able to obtain from them a wondrous array of industrial chemicals as raw materials for production of drugs and for other industrial purposes (Remington *et al*., 2007). The compounds can be derived from any part of the plant such as bark, leaves, flowers, roots (rhizomes, tuber and bulb), fruits, latex and seeds. The discovery of pristine bioactive compounds in plants involves methodical screening through regime laboratory activities and further analysed in a logical pathway. Parekh *et al.* (2006) reported that medicinal plants can be collected from their natural habitat or purchased from the market. Moreover, the extraction procedures can be carried on both fresh and dry plant samples. These plant extracts have been used in the treatment of many ailments in man and animal all over the world. Part of its application is in the treatment of dysmenorrhoea.

Dysmenorrhoea means painful periods during menstruation. It is a common problem affecting as many as 75% of females in the late teens and early twenties and gradually goes away (Proctor *et al*., 2006). It is more common in women who have not yet had a child and often goes away after childbearing and increasing age. Dysmenorrhoea can be primary or secondary. Primary dysmenorrhoea is a severe menstrual cramp that usually starts in the late teens, not caused by any disease or abnormality of the female organs and is more likely to affect girls during adolescence, and it eases as ladies mature, particularly after pregnancy. Secondary dysmenorrhoea usually starts years after the first period, sometimes in the thirties or forties and has a physical cause. Women with dysmenorrhoea have pains just above their pubic bone that may travel to their lower back and thighs. The pains usually start hours before the period begins and may last for several days. Secondary dysmenorrhoea may be caused by a number of conditions, including: fibroids – benign tumours that develop within the uterine wall or are attached to it, sexually transmitted disease (STD), an ovarian cyst or tumour and the use of an intrauterine device (IUD) (Proctor *et al*., 2005).

Menstrual pain is caused by the release of certain hormones called prostaglandins during the menstrual cycle. These hormones, called prostaglandins, cause muscle contractions in the uterus. The contractions decrease the amount of blood flow and oxygen the uterus receives, which causes the pain (Barnard *et al*., 2000). The highest risk for dysmenorrhoea is in women with the following features: smoking, drinking alcohol during the menstrual period, overweight, history of starting the period before the age of 11, age younger than 20, heavy bleeding during periods, depression or anxiety, dieting and never having delivered a baby. Women with severe menstrual pain experience dullness, throbbing, aching, cramp pain in the lower abdomen, back, or thighs. The pains may begin as early as 12 to 24 hours before the

periods start and are usually strongest on the first day of the period. Some women may also experience fatigue, weakness, nausea, vomiting, diarrhoea, headaches or light-headedness. The symptoms usually go away within 48 – 72 hours. Women who have secondary dysmenorrhoea (pain with a physical cause) may have pelvic pain or painful intercourse in addition to painful periods. This type of pain is usually caused by an abnormality of the uterus or the pelvis (Ylikorkala *et al*., 1978). The most common treatment for dysmenorrhoea is non-steroidal anti-inflammatory drugs (NSAIDS). These are medications containing as ibuprofen that are very effective in reducing menstrual pain (Milsom *et al*., 2002). NSAIDS will give the most relief if you begin taking them 1 to 2 days before your period starts and continue taking them for 2 to 3 days. Another way to decrease menstrual pain is to use a hormonal form of birth control. This includes birth control pills, Depo-Provera and the IUD containing hormones. The hormones in these birth control methods prevent ovulation (the making of an egg by the ovary). This decreases the number of prostaglandins your body produces, which decreases both the amount of menstrual blood and the painful uterine contractions. There are also other comfort measures you can use without taking medication. These include: applying heat to your lower abdomen, taking a warm bath may decrease painful muscle spasms, getting adequate rest will decrease pain, exercising will increase endorphins (natural pain killers found in the brain) and decrease prostaglandins, eating a diet high in complex carbohydrates (whole grain bread and pasta, oatmeal, brown rice), fibre (fruits and vegetables with the peels, corn, cooked dried beans, and celery), fruits, and vegetables and low in salt may also help. Some women find relief from treatments such as yoga and acupuncture or other stress relieving measures. Others are helped by herbal supplements such as flax seed oil. Taking magnesium, Zinc and Vitamin E and Vitamin B1 (thiamine) supplements may also be helpful. Treatment of secondary dysmenorrhoea depends on the cause. Women with endometriosis (the most common cause of secondary dysmenorrhoea) may be treated with medication or surgery. Examination by a gynaecologist will be able to determine the cause and most successful treatment for secondary dysmenorrhoea (Creatsas *et al*., 1995).

MATERIALS AND METHODS

Study Area and Method of Investigation. An informal ethnobotanical survey for the plant used in treatment of dysmenorrhoea was carried out at herbal market (Oja-tuntun) in Ilorin, Kwara state. The city covers an area of 105km^2 with a population of 847,582 at 2006 census, (NBS, 2006). The interview was done using a semi-structural method (Sofowora, 1993). The investigation was conducted in Yoruba language and the respondents were herb sellers in the area of survey. Different herb sellers were visited at the market place. The survey was based on some commonly used medicinal plants in treatment of Dysmenorrhoea. The local names, parts of plant used, and method of preparation were recorded (Sofowora, 1993).

Sample collection and Authentication of Plant Materials. Ten medicinal plant parts were collected locally from the Market (Oja-tuntun) in Ilorin Metropolis with the assistance of herbal sellers. The plants were duly identified at University of Ilorin Herbarium (UIH) and University of Lagos Herbarium (LUH), Nigeria.

Preparation of Collected Plant Materials. The different parts of the plant were collected and air dried at room temperature for three weeks. The dried samples was pulverized

into smaller pieces and then grinded into powdery form using mortar and pestle and electric blender. These are stored in glass containers for further use.

Phytochemical Screening. The phytochemical screening of the samples was carried out using the same Department and Department of Chemistry Faculty of Physical Sciences, University of Ilorin. The steps taken for the phytochemical screening are in line with standard procedures (Harborne, 1973; Sofowara, 1993; Trease & Evans, 1989). The bioactive compounds to extract include; alkaloids, tannins, saponins, cardiac glycosides, anthraquinones, flavonoids, polypheniols, terpenoids.

Nutritional Composition of the Plant Samples. The nutritional composition of the powdered plant samples for protein, fat, crude fibre, ash and dry matter was determined in triplicate using the standard methods (AOAC, 2000; Adeyemi *et al.,* 2014; Gbadamosi *et al.,* 2012) at the Department of Plant Biology, Faculty of Life Sciences and Department of Chemistry, Faculty of Physical Sciences, University of Ilorin.

Determination of dry matter of plant samples. The plant sample was thoroughly mixed with water in a bottle. The water content was determined by weighing out 2 g of the sample into a silica dish which has been previously ignited and weighed, it was dried in the oven for 24 hrs at 100°C, and it was then allowed to cool for 10 minutes in a desiccator before weighing (Ianovici, 2016).

$$\% \text{ moisture (residual)} = \frac{\text{wt. of sample taken} - \text{wt. of sample after drying}}{\text{wt. of sample}} \times 100$$

Dry matter = 100 - % of moisture (Gbadamosi *et al*, 2012).

Determination of ash of plant samples. The residue from the moisture was charred over a flame and the furnace was ignited until the ash was grey, it was allowed to cool and then weighed.

Determination of ether extract (oil) of plant samples. A Soxhlet extractor was fixed with a reflux condenses and a small flask which has been previously dried in the oven and weighed; 1 g of sample was weighed and transferred to a fat free extraction thimble which was plugged lightly with cotton wool. Then the thimble was placed in the extractor and petroleum ether was added, once it siphoned more ether was added until the barrel of the extractor is half full. The ether boils gently and it was left to siphon ten times, then the flask was detached and the content was poured into the ether stock bottle. The condenser and the flask were replaced and the ether was distilled until the flask was dry. The flask which now contained all the oil was detached; the oil was cooled and then weighed (Gbadamosi *et al* , 2012).

$$\% \text{ ether extracts} = \frac{\text{wt. of oil}}{\text{wt. of sample}} \times 100$$

Determination of crude protein of plant samples. 2g of the sample was weighed into a Kjeldahl flask, 5 g of anhydrous sodium sulphate and 25ml of concentrated H_2SO_4 were added to it. Thereafter it was placed in the fume cupboard and heated gently for 5 - 10 minutes after which frothing have nearly ceased and the solution gives a green coloration. It was allowed to cool and was diluted with water, the % N_2 in the sample was determined using the micro Kjeldahl apparatus (Ajai *et al*., 2012).

Determination of crude fibre of plant sample. 25 ml of 10 % sulphuric acid was measured with a pipette into a beaker and 175 ml of water was added while the residues from

the ether extract was added and allowed to boil. When the liquid had boiled for exactly 30 minutes, it was poured into the funnel and filtered by suction. The residue was washed with hot water until it was free from acid, then the residue was turned into a digesting flask and 200 ml of 1.25 % sodium hydroxide solution which was previously boiled was added. It was then filtered through a Whatman No.4 filter paper and the whole solution was poured into the filter and washed with boiling water and 1% hydrochloric acid until it was free from acid. The residue was washed twice with 95% alcohol and three times with petroleum ether using small quantities; the residue was allowed to drain and was transferred into a silica dish. It was thereafter dried in the oven to remove all organic matter and weighed after cooling (Ajai *et al.,* 2012).

Statistical Analysis. Analysis of variance and comparison of means were carried out on all data of Nutritional composition of the plant samples using Statistical Analysis System (SAS). Differences between means were assessed for significance at $p<0.05$ by Duncan's Multiple range test (DMRT) (Gbadamosi *et al*., 2012).

RESULTS AND DISCUSSIONS

The ethnobotanical study revealed nine species that are regularly purchased and used by Ilorin indigenes to treat dysmenorrhoea (Table 1). The life form of these species spans grass, shrub and tree, hence the plant part used varies respectively from leaves, stem/twigs, bark and roots. Moreover, the plants were preserved dry and most prevalent method of application is decoction.

TABLE 1: Profile of the studied plants

SN	Scientific Name	Family	Local Name	Description and Uses	Parts Used
1	*Gongronema latifolium* Benth.	Asclepiadaceae	Madunmaro (Y)	Climbing shrub up to 5 m long, stems is hollow, all parts soft-hairy to glabrous, with woody base and fleshy roots, containing latex. Leaves are opposite, simple and entire. A decoction of leaves or leafy stems is commonly taken to treat diabetes, dysmenorrhoea and high blood pressure (Akuodor *et al*., 2010).	Stems
2	*Piliostigma thonningii* (Schumach.) Milne-Redh.	Fabaceae-Caesalpinioideae	Abafe (Y) Camel's foot	Tree to 10m high, stem dark brown, rough, and hairy. Leaves are larger, simple, alternate 7.5-10cm long and 10-18cm broad. The fresh leaves and flowers of this tree can be chewed to reduce thirst. Bark infusions are used to treat diarrhoea, dysmenorrhoea, ulcers, gastric and heart pains (Venter *et al*., 1996).	Leaves
3	*Piliostigma reticulatum* (DC.) Hochst.	Fabaceae-Caesalpinioideae	Camel's foot	Tree to 9 m high. Bark is dark grey to brown, fibrous and corky, slash dark red. Leaves are small, thick, leathery, grey-green, 6-12 cm long x 4-8 cm wide in cattle-hoof shape. Leaves and bark have haemostatic and antiseptic properties which cure ulcers, boils, wound, boil and malaria (Burkill, 1995).	Stem barks
4	*Senna podocarpa* (Guill. & Perr.) Lock	Fabaceae-Caesalpinioideae	Ajarere(Y)	Shrub to 5m tall, spirally arranged leaves. Flower; yellow. Toxin effects of extracts of leaves may result from prolonged intake of high doses, but with moderate use the extracts are not considered harmful (Abo *et al*., 2002).	Leaves

5	*Axonopus compressus* (Sw.) P. Beauv.	Poaceae	Idi (Y) Carpet grass (E)	It is often used as permanent pasture, ground cover and turf in moist low fertility soils particularly in shaded situations. It has stouter culms and stolons. Leaves are 9-12mm wide and it forms a dense mat over the surface of the ground (Barnard, 1969).	Leaves
6	*Laccosperma secundiflorum* (P. Beauv.) Küntze	Arecaceae	Okuku (Y)	Climbing palm of great length of stem of 35 metres or more long up to 3 cm diameter enclosed in spiny leaf-sheaths. It has thorny stems which it uses to wrap around nearby trees and the stem yields a potable sap (Burkil, 1985).	Stem bark
7	*Mitragyna inermis* (Willd) O Ktze.	Rubiaceae	Giyayya(H) False Abura (E)	Tree to 10m high, leaves opposite, flower cream. The bark is used in treatment of diuretics, malnutrition, rheumatism and stomach troubles (Sarpong, 2011).	Leaves
8	*Trema orientalis* (L.) Blume	Ulmaceae	Afee (Y) Charcoal tree (E)	Tree to 6m high, leaves alternate and serrated. A bark infusion is reported drunk to control dysentery and a leaf decoction is used to deworm dogs (Orwa *et al*., 2009).	Leaves
9	*Annona senegalensis* Pers..	Annonaceae	Abo (Y) Wild custard apple (E)	Shrub or small to 8meters high. Leaves broadly ovate and almost circular. Often yellowish on the Adaxial while pale green on the abaxial. Flower cream (Schmidt et al., 2002) Used in the treatment of diarrhoea, dysentery and sleeping-sickness (Burkil, 1985).	Leaves

*Keys: *Local language in Yoruba-(Y) and *English common name-(E)*

TABLE 2: Phytochemical analysis of the test plants

Species	Alk	Anth	C. glyc.	Flav	Polyph	Sap.	Tan	Terp
A. compressus	+	+	+	+	+	+	+	+
A. senegalensis	+	+	+	+	+	+	+	+
G. latifoliumm	+	+	+	+	+	+	+	+
L. secundiflorum	+	+	+	+	+	+	+	+
M. inermis	+	+	+	+	+	+	+	+
P. reticulatum	+	-	-	+	+	+	+	+
P. thonningii	+	+	+	+	+	+	+	+
S. podocarpa	+	+	+	+	+	+	+	+
T. orientalis	+	+	+	+	-	+	+	-

*Keys:*Tan.- Tannins; Flav.- Flavonoids; Terp.- Terpenoids; Polyph.- Polyphenols; Anth.- Anthraquinones; C.glyc.- Cardiac Glycoside; Sap.-Saponins; Alk.- Alkaloids, (+) Present; (-) Absent*

Phytochemical screening results. The qualitative phytochemical screening unveiled the presence of eight bioactive compounds contain the in these species namely; Alkaloids, Anthraquinones, Cardiac-Glycoside, Flavonoids, Polyphenols, Saponins, Tannins and Terpenoids (Table 2). However, anthraquinones and cardiac-glycoside were absent in *P.retculatum* while terpenoid and polyphenol were also not present in *T. orientalis*.

Nutritional composition analysis. The quantitative results of the nutritional components detected from the plant species are presented in Table 3. *S. podocarpa* had the highest dry matter content (39.83), however, there is a significant difference in the dry matter content of all the species. The highest ash content was recorded for *G. latifolium* (65.60) nevertheless; there is a significant difference in the ash content across the species. Furthermore,

varying concentrations of ether extract were also observed across the species which are significantly different but the concentration was notably higher in *S. podocarpa* (51.94). The highest crude fibre content (36.24) was found in *T. orientalis*. Although there is significant difference in the crude fibre content, besides no significant difference between some species which can be grouped into four namely; (a) *G. latifolium*, *P. thonningii* and *S. podocarpa*; (b) *A. compressus* and *P. reticulatum*; (c) *L. secundiflorum* and *M. inermis*; and (d) *A. senegalensis* and *T. orientalis*. Protein content was significantly high (14.21) in *M. inermis* and there is significant different in protein distribution from the species.

TABLE 3: Results of the nutritional composition of powdered plant samples

Sample	Ash (%)	Crude fibre (%)	Dry matter (%)	Ether extract (%)	Protein (%)
A. compressus	28.31±0.02^{i}	33.92±0.02^{b}	36.68±0.02^{d}	51.43±0.02^{b}	9.43±0.02^{e}
A. senegalensis	32.77±0.02^{f}	36.18±0.02^{cd}	37.29±0.02^{f}	50.64±0.02^{d}	8.47±0.02^{b}
G. latifolium	65.60±0.02^{a}	26.81±0.02^{a}	29.52±0.02^{b}	50.80±0.02^{c}	6.70±0.02^{a}
L. secundiflorum	29.94±0.02^{j}	35.08±0.02^{bc}	37.12±0.02^{e*}	47.56±0.02^{h}	9.21±0.02^{d}
M. inermis	32.33±0.02^{g}	35.06±0.02^{bc}	37.75±0.02^{g}	48.22±0.02^{g}	14.21±0.02^{j}
P. reticulatum	63.77±0.02^{c}	34.13±0.02^{b}	36.64±0.02^{d}	47.04±0.02^{j}	10.51±0.02^{h}
P. thonningii	61.71±0.02^{e}	26.29±0.02^{a}	29.13±0.02^{a}	47.29±0.02^{i}	8.63±0.02^{c}
S. podocarpa	28.59±0.02^{h}	26.86±0.02^{a}	39.83±0.02^{i}	51.94±0.02^{a}	11.02±0.02^{i}
T. orientalis	61.79±0.02^{d}	36.24±0.02^{cd}	39.32±0.02^{h}	49.82±0.02^{e}	10.06±0.02^{f}

**Values having different letter along the same column are significantly different (p<0.05).*
The values represent mean of three replicates ±standard error of mean

During the investigation, it was made known that preparation of the plant parts for treatment of Dysmenorrhoea is majorly done through decoction process. Decoction method was used for the extraction of the water soluble and heat stable constituents from crude drug by boiling it in water for 15 minutes, cooling, straining and passing sufficient cold water through the drug to produce the required volume (Remington *et al.*, 2007). The preference in preparation method may depend on potency of the herbal remedy. From the phytochemical analysis, all the investigated phytochemical parameters were found in all the nine (9) species except in *P. reticulatum* where anthraquinones and cardiac glycosides are absent (Table 2). However, there is a significant difference in the percentage ash content, protein content and ether extract among the studied plant species. The phytochemical screening of the plants studied showed that the leaves and stem-barks were rich in Terpenoids, Flavonoids, and Alkaloids, this in accordance with the results of Amirkia and Heinrich (2014). Alkaloids have been reported by Babbar (2015) and Amirkia & Heinrich (2014) to function as analgesic, muscle relaxant, pain relief, cramps reliever, anti-hypertensive, regulates vascular and blood disorder. Flavonoids are significantly recognized for their anti-oxidant which helps to reduce pains due to oxygen received in the uterus (Murry *et al.,* 1995). Flavonoids improve blood circulation, anti-bacteria, antioxidant and anti-inflammatory (Erasto *et al*., 2004; Sharma, 2006) while terpenes also have antibiotic, anti-inflammatory, antiviral, antiparasitic and antifungal properties (Paduch *et al*., 2007). They were known to show medicinal activity as well as exhibiting physiological activity. Tannins, Polyphenols, Anthraquinones and Cardiac glycosides were present also in almost all the plants except in *Piliostigma reticulatum* and

Trema orientalis. These corroborate with the studies carried out by Gbadamosi *et al*. (2012). The presence of Saponins, Polyphenols and Cardiac glycosides may be responsible for the relief of muscle contractions in the uterus for easy flow of the blood (Adjanohun *et al.,* 1996). It was also reported that the presence of Flavonoids, Saponins and Tannins acts as an anti-inflammatory and the Alkaloids enhance the mood and give a sense of well-being (Ezeamuzie *et al*., 1994). Also, Saponins was reported to be tropical antibiotics to relieving dysmenorrhoea (Evans *et al*., 1965).

The nutritional composition of a food is the estimation of the nutritive value in its chemical form. In this study, the dry matter contents of 70% the low-moisture content obtained in the plant is in agreement with the findings of Lock (1988), who obtained higher dry matter yield in leaves and stem bark of *Senna nigricans*, associated with long storage of the plants. Ash content which is an indicator for minerals element present in the samples was high in *Gongronema latifolium* (65.60±0.02) which is an indication that *Gongronema latifolium* contains high quantity of mineral elements. Also, *Senna podocarpa* is also high in percentage composition of total fat which contains the essential fatty acids and vitamin to regulate the nervous system of a person having dysmenorrhoea (Abo *et al*., 2002). The result from the proximate analysis also showed that the stem-bark of *Axonopus compressus* was high in crude fibre compared to the other plant samples studied. During research, it was revealed that the decoction of stem-bark of *Chasmanthera dependens* with *Aristolochia ringens* and *Picralima nitida* with other plants studied for the treatment of dysmenorrhoea will speed up its effectiveness with a careful administration of appropriate dosages.

CONCLUSION

This study has provided information to explain the basis of ethnomedicinal use of commonly used medicinal plants for treatment of dysmenorrhoea. The presence of phytochemical and the nutrient in these plants can add to its therapeutic and nutritional values and therefore, they are recommended for further studies on the pharmacological significance of the phytochemicals they possess in the body. Further studies are therefore needed for the isolation and characterization of the specific phytochemical compounds responsible for treatment of dysmenorrhoea to the ladies suffering from menstrual cramps.

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