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PHYTOCHEMICAL AND NUTRITIONAL COMPOSITION OF COMMONLY USED HERBAL GALACTAGOGUES IN ILORIN, NORTH CENTRAL, NIGERIA

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ABSTRACT

The phytochemical and proximate analysis of ten different plant extracts of herbal galactagogue in Ilorin was investigated. Ethnobotanical investigation confirmed that K. africana, A. vogelii, B. coccineus, L. taraxacifolia, A. ringens, A. sativum, A. coriaria, S. bialfrae, S. anthelmia, B. diffusa, are commonly used as herbal galactagogues. The plants were collected, sorted, washed and then air dried. They were later analysed for phytochemicals qualitatively using Standard protocols. The results of the analysis indicated that most of all the phytochemicals screened for were present in all the ten plant samples except for few plants like Launaeata raxacifolia, Brysocarpos coccineus and Allium sativum where flavonoids were absent. Anthraquinone and Polyphenol were also absent in both Brysocarpos coccineus and Allium sativum. The proximate analysis conducted on each plant samples showed that ash, crude fibre, ether fat and dry matter were present in considerable amount which makes the studied plants very effective when used by breastfeeding mothers. This further indicated that herbal galactagogues are low in fat, high in proteins, moderate in ash content, and contains crude fibre in high quantity. It is important for researchers to isolate and identify the bioactive compounds of the studied ethnobotanicals for production of novel galactagogue drugs.

Keywords: *Ethnobotanicals, galactagogues, proximate analysis, phytochemicals.*

INTRODUCTION

Medicinal plants serve great role and importance to the health of individuals and communities. The medicinal importance of these plants lies in some chemical substances that produce a definite physiological action on the human body (Edeoga *et al.*, 2005; Kolawole *et al.*, 2014).

The useful products obtained from plants directly or indirectly, demonstrate their importance to man. Plants serve as a source of food (Katsayal *et al.*, 2004 and Kawo, 2007), medicinal product (Caceres *et al.*, 1991; Ezeamuzie *et al.*, 1996; Adoum *et al.*, 1997), energy (Oladele and Yisa, 2000) and shelter to man and his livestock (Ogunkunle and Oladele, 2004).

In human beings, some phytochemicals have been found to be protective and preventive against many degenerative diseases and pathological processes such as ageing (Burns *et al.*, 2001; Adeyemi *et al.*, 2014). The most important of these bioactive constituents of plants are alkaloids, tannins, flavonoids, and phenolic compounds (Hill, 2003). Increased in vegetable utilization and consumption are critical to alleviate world-wide incidence of nutritional deficiencies (Yang *et al.*, 2006). Survey and investigations on some plants indicated that galactagogue plant is one of the promising plants which could contribute to increased intake of some essential nutrients and health-promising phytochemicals. Phytochemicals are present in virtually all of the fruits, vegetables, legumes (beans and peas), and grains we eat, so it is quite easy for most people to include them in their diet (FSSAI, 2010).

Galactagogues are agents or substances that can induce or enhance breast milk secretion. They include foods, herbal medicines and pharmaceutical drugs. They can be helpful in solving milk supply issues not only by increasing milk production, but also by supporting the nursing mother's confidence (Westfall, 2003). Breastfeeding is an unequalled way of providing ideal food for healthy growth and development of infants, and exclusive breastfeeding is the optimal way of feeding infants (Kramer and Kakuma, 2002). Breast feeding is associated with better nutritional and non-nutritional outcomes compared with formula feeding even in case of preterm birth (Chatterton *et al.*, 2000). A reduced breast milk production can occur in many circumstances, such as preterm birth, illness of the mother or the child, mother-baby separation, re-lactation after a prolonged suspension, indirect lactation (breast pump or manual milk expression), anxiety, fatigue, and emotional stress are powerful inhibitors of lactation (Zuppa *et al.*, 2010). Imbalance in maternal hormone, deficiency in the breast tissue itself or most often inadequate milk removal due to poor breast feeding techniques can also reduce breast milk production (Mohrbacher and Stock, 2003). Lactating mothers should consume a well-balanced diet, maintain adequate fluid intake and avoid substances known to decrease milk supply. A diet with increased protein and approximately 500 extra calories above what they need to maintain their weight will promote maximum milk production (Riordan and Auerbach, 1998).



Maternal micronutrient deficiencies during lactation can cause a major reduction in the concentration of some of these nutrients in breast milk, with subsequent infant depletion (Allen and Graham, 2003). The main mineral constituents of human milk are Sodium (Na), potassium (K), Calcium (Ca), Magnesium (Mg), Phosphorus (P), and Chlorine (Cl). Calcium concentrations reported in various studies vary from 25 - 35 mg/100 ml. Phosphorus at 13 - 16 mg/100 ml is much more constant but is lower in proportion to casein and calcium than in milks of most other animal species. Iron, copper, and zinc contents of human milk vary considerably and a long list of other trace elements has been reported.

The use of natural products in inducing and increasing milk production has a long history (Zuppa, 2010) and nearly all cultures have promoted one substance or another as a galactagogue to encourage the synthesis and secretion of breast milk (Henderson, 2003). Many botanical galactagogues are derived from plant producing latex (milky sap) or whose shape resembles the breast (doctrine of signature). The drugs are, in their majority, not exclusively employed to increase the flow of breast milk but serve as multi-functional remedies (Perry, 2005), their use occasionally finds a parallel in popular veterinary practice to stimulate milk production in cattle and other mammals (Bruckner, 2000). This study evaluate the nutritional values and therapeutic potentials of ten botanical galactagogues with a view to providing scientific insight into their use and preservation of indigenous knowledge of the use of botanicals used as galactagogues.

MATERIALS AND METHODS

Ethnobotanical Investigation of plant samples

The selection of medicinal plants for this study was based on ethnobotanical information from literature and oral interview of local herb sellers on plant used as galactagogues. The interview was carried out at a local herbal market (Oja-Oba) in Ilorin, Kwara State, Nigeria.

Collection and Identification of plant samples

The plants were identified and authenticated at the University of Ilorin Herbarium (UIH). The representative voucher specimens of the test plants were preserved and documented at the Herbarium for future references.

Preparation and Processing of Plant Materials

The plant samples collected were air dried at room temperature for about three weeks, while the samples bought at the market were dried for one week to ascertain thorough dryness. The dried samples were chopped into smaller pieces samples, ground into uniform powder using mortar with pestle and electric blender (Model No: CB-8231-A) and stored in glass container prior to use

Phytochemical Screening

The phytochemical screening of the samples was carried out using standard procedures (Harbone, 1984;

Sofowora, 1993; Evans, 1996; Raaman, 2006; Tiwari *et al.*, 2011; Gbadamosi *et al.*, 2012).

Proximate Analysis of Plant Samples

The proximate analysis of the powdered plant samples for protein, fat, fiber, ash and dry matter was determined using the methods described in AOAC (1990) at the Department of Plant Biology, Faculty of Life sciences and Department of Chemistry, Faculty of Physical Sciences, University of Ilorin.

RESULTS

The profile percentage studied ethnobotanicals reveals 70% of trees, 20% of herbs, and 10% of shrubs as the percentages of plant habit and also shows the use-values of plant part percentages as 40% of barks, 30% of leaves, 20% of roots, 10% of fruits, (Table 1).

The methods of preparation are decoction, concoction and paste. The decoctions are taken orally, concoction are eaten as vegetable and paste are applied topically on the breast. The method of preparations of the plant samples used showed that the decoction method is the appropriate method to be used when preparing herbal galactagogues for lactating mothers who need it (Table 2).

The phytochemical screening of the different samples of herbal galactagogue shows that most of all the phytochemicals are present in each samples. Alkaloids was present in all the plant samples, Flavonoides was present in all except in *Brysocarpus coccineus*, *Allium sativum*, and *Launaea taraxacifolia*, while Tannins was present in all samples, Saponins was present in all samples, Terpenoides was present in all plant samples, Polyphenols was present in all except *Allium sativum*, Anthraquinones was present in all except *Brysocarpus coccineus* and Cardiac glycosides was present in all plant samples (Table 3).

The proximate analysis of the plant samples of Herbal galactagogue shows that; the moisture contents of the some of the plant samples did not indicate any significant difference. *Brysocarpus coccineus*, *Spigelia anthelmia*, *Boerhaavia diffusa*, *Kigelia africana*, were all (1.08%) while *Launaea taraxacifolia* and *Aristolochia ringens* are both (1.11%) and *Allium sativum* with 0%. There was a significant difference in all the plant samples in the analysis of the crude fibre of the plants. With *Brysocarpus coccineus* having (20.58%), *Spigelia anthelmia* having (12.82%), *Anthocleis tavogelii* with (19.28%), *Albizia coriaria* with (23.02%). For the ash content of the plant samples, there was no significant difference between them; *Brysocarpus coccineus* has the highest percentage with (4.60%), then *Spigelia anthelmia* having (1.45%), *Anthocleis tavogelii* with (1.92%), *Boerhaavia diffusa* with (2.34%), *Kigelia Africana* with (2.76%), *Allium sativum* with (2.40%), *Senecio bialfrae* with (1.87%), *Albizia coriaria* with (2.55%), *Launaea taraxacifolia* with (2.63%), and *Aristolochia ringens* with (2.94%).



Table 1: Profile of botanical galactagogues used in the study

S/N	Plant	Family	Local name	Plant habit	Part used	Voucher number
1	<i>Byrsocarpus coccineus</i>	Connaraceae	Ado	Tree	Fruits	*UIH004/1122
2	<i>Spigelia anthelmia</i>	Loganiaceae	Egbo aran	Tree	Barks	UIH002/194
3	<i>Anthocleista vogelii</i>	Loganiaceae	Egbo	Small tree	Barks	UIH005/1123
4	<i>Boerhaavia diffusa</i>	Nyctaginaceae	Etipan ola	Whole Herb	Barks	UIH006/1124
5	<i>Kigelia africana</i>	Bignoniaceae	Pandoro	Tree	Fruits	UIH001/655
6	<i>Allium sativum</i>	Liliaceae	Garlic	Tree	Leaves	UIH007/1125
7	<i>Senecio bialfrae</i>	Asteraceae	Worowo	Herb	Roots	UIH008/1126
8	<i>Albizia coriaria</i>	Fabaceae	Ajaigi	Tree	Barks	UIH009/1127
9	<i>Launaea taraxacifolia</i>	Asteraceae	Yanrin	Shrub	Leaves	UIH010/1128
10	<i>Aristolochia ringens</i>	Aristolochiaceae	Akoigun	Small tree	Roots	UIH003/1121

*UIH- University of Ilorin Herbarium

Table 2: Indigenous recipes and their methods of preparation and administration.

S/N	HERBAL COMBINATION AND DOSAGE	METHOD OF PREPARATION
1	<i>Byrsocarpus coccineus</i> fruits and leaves are boiled in water and 200 ml taken three times daily after meal to induce lactation.	Decoction
2	The ripe fruit of <i>Kigelia africana</i> is made into a paste and massaged on the breast. A decoction (200 ml) of the fruit is taken twice daily to induce secretion of breast milk.	Decoction and paste
3	The bark and leaves of <i>Launaea taraxacifolia</i> are boiled in water and 200 ml taken twice daily after meal.	Decoction
4	The leaves of <i>Boerhaavia diffusa</i> are eaten as vegetable in soup to enhance secretion of breast milk. The leaves could also be squeezed in water as drink.	Concoction
5	<i>Spigelia anthelmia</i> leaves are made into paste and rubbed on the breast	Paste
6	Stems of <i>Albizia coriaria</i> are boiled in water and 150 ml taken twice daily after meal.	Decoction
7	The bark of <i>Anthocleista vogelii</i> is boiled in water and 200 ml taken twice daily after meal.	Decoction
8	The roots of <i>Senecio bialfrae</i> are boiled in water and 100 ml taken twice daily after meal.	Decoction
9	Leaves of <i>Allium sativum</i> are eaten as vegetable in soup.	Concoction
10	Leaves of <i>Aristolochia ringens</i> are eaten as vegetable in soup.	Concoction

Table 3: Phytochemical Screening of Herbal Galactagogue Plants

Parameter	Alk (%)	Fla (%)	Tan (%)	Sap(%)	Terp (%)	Polyphenol (%)	Anth (%)	Cardiac glycoside (%)
<i>Albizia coriaria</i>	+	+	+	+	+	+	+	+
<i>Allium sativum</i>	+	-	+	+	+	+	+	+
<i>Anthocleis tavogelii</i>	+	+	+	+	+	-	+	+
<i>Aristolochia ringens</i>	+	+	+	+	+	+	+	+
<i>Boerhaavia diffusa</i>	+	+	+	+	+	+	+	+
<i>Byrsocarpus coccineus</i>	+	-	+	+	+	+	+	+
<i>Kigelia Africana</i>	+	+	+	+	+	+	+	+
<i>Launaea taraxacifolia</i>	+	-	+	+	+	+	-	+
<i>Senecio bialfrae</i>	+	+	+	+	+	+	+	+
<i>Spigelia anthelmia</i>	+	+	+	+	+	+	+	+

Keys+ represents that the chemical is present or confirmed in each samples
- represents that the chemical is absent in each samples

Alk = alkaloids, Fla = flavonoids, Tan = tannins, Sap = saponins, Terp = terpenoids, Anth = anthraquinone



The proximate analysis of the plant samples of Herbal galactagogue shows that; the moisture contents of the some of the plant samples did not indicate any significant difference. *Brysocarpus coccineus*, *Spigelia anthelmia*, *Boerhaavia diffusa*, *Kigelia africana*, were all (1.08%) while *Launaea taraxacifolia* and *Aristolochia ringens* are both (1.11%) and *Allium sativum* with 0%. There was a significant difference in all the plant samples in the analysis of the crude fibre of the plants. With *Brysocarpus coccineus* having (20.58%), *Spigelia anthelmia* having (12.82%), *Anthocleista vogelii* with (19.28%), *Albizia coriaria* with (23.02%). For the ash content of the plant samples, there was no significant difference between them; *Brysocarpus coccineus* has the highest percentage with (4.60%), then *Spigelia anthelmia* having (1.45%), *Anthocleista vogelii* with (1.92%), *Boerhaavia diffusa* with (2.34%), *Kigelia africana* with (2.76%), *Allium sativum* with (2.40%), *Senecio bialfrae* with (1.87%), *Albizia coriaria* with (2.55%), *Launaea taraxacifolia* with (2.63%), and *Aristolochia ringens* with (2.94%).

The Ether (fat) analysis showed the result with no significant difference as follows; *Brysocarpus coccineus* having (0.46%), *Spigelia anthelmia* with (0.26%), *Anthocleista vogelii* with (0.19%), *Boerhaavia diffusa* with (0.67%), *Kigelia africana* with (0.41%), *Allium sativum* with (0.18%), *Senecio bialfrae* with (0.65%), *Albizia coriaria* having (0.44%), *Launaea taraxacifolia* having (0.35%), and *Aristolochia ringens* with (0.81%). The proximate analysis revealed that some of the plants were high in protein. The crude protein content of *Brysocarpus coccineus* was significantly high and the least was from *Allium sativum*. Food that provide more than 12% of the calorific value from protein are good sources of protein and proteins are very important molecules in human being and are involved in virtually all cell functions (Lloyd, 2012), in that context *Albizia coriaria*, *Brysocarpus coccineus*, *Aristolochia ringens*, *Launaea taraxacifolia*, *Anthocleista vogelii*, *Boerhaavia diffusa* are good sources of protein. Crude fat was highest in *Aristolochia ringens* (0.81%) followed by *Boerhaavia diffusa* (0.67%) while *Allium sativum* (0.18%) had the lowest (Table 4).

Table 4: Proximate Composition of different plant samples of Galactagogue (Mean Error! Reference

Parameters	Moisture content (%)	Ash content (%)	Crude fibre (%)	Ether Extract (%)	Dry matter (%)
<i>Albizia coriaria</i>	*1.16±0.02 ^a	2.55±0.00 ^a	23.02±0.01 ^a	0.44±0.02 ^b	99.84±0.02 ^a
<i>Allium sativum</i>	N.D	2.40±0.02 ^a	13.29±0.02 ^a	0.18±0.03 ^a	100.00
<i>Anthocleista vogelii</i>	0.31±1.55 ^a	1.92±0.03 ^b	19.28±0.01 ^a	0.19±0.01 ^a	99.69±0.02 ^a
<i>Aristolochia ringens</i>	1.11±0.01 ^a	2.94±0.03 ^a	23.44±0.02 ^b	0.81±0.01 ^b	98.89±0.03 ^a
<i>Boerhaavia diffusa</i>	1.08±0.01 ^a	2.34±0.02 ^b	17.04±0.03 ^b	0.67±0.03 ^a	98.92±0.01 ^a
<i>Brysocarpus coccineus</i>	1.08±0.01 ^a	4.60±0.07 ^b	20.58±0.03 ^b	0.46±0.02 ^a	98.92±0.01 ^b
<i>Kigelia africana</i>	1.08±0.01 ^a	2.76±0.01 ^b	18.36±0.03 ^a	0.41±0.03 ^a	98.92±0.01 ^b
<i>Launaea taraxacifolia</i>	1.11±0.01 ^a	2.63±0.03 ^a	22.20±0.03 ^a	0.35±0.01 ^b	98.89±0.02 ^a
<i>Senecio bialfrae</i>	0.96±1.74 ^a	1.87±0.02 ^a	17.22±0.01 ^b	0.65±0.02 ^b	99.04±0.03 ^b
<i>Spigelia anthelmia</i>	1.08±0.01 ^a	1.45±0.01 ^b	12.82±0.01 ^b	0.26±0.03 ^a	98.92±0.02 ^b

source not found. **SEM)**

Each value is a mean of three replicates ± Standard error of mean

Means with same letters across the row is not significant (p<0.05)

N.D means not determined

DISCUSSION

Tree bark is one of the most important non-timber forest products. In developing countries, it is used for multiple purposes particularly in traditional medicines (Annae, 2014). The studied ethnobotanicals revealed that trees have the highest percentages (70%) and shrubs with the lowest 10%. Also, the percentage of barks used as the plant part for this study has the highest range with 40% and fruits having the lowest percentage of 10%. The results in agreement with Gbadamosi and Okolosi (2013) who reported 50% trees and 10% shrubs.

The results obtained from phytochemical analysis of the studied plant establish the presence of almost all the chemicals tested for. Phytochemicals are non-nutritive plant chemicals that have protective or disease preventive properties, they are found generally in plants (www.phytochemicals.info).

Yakubu *et al.* (2005) reported that the presence of saponins, polyphenols and cardiac glycosides may be responsible for the acclaimed anti-anemic potential of plants used in traditional medicine. Saponins are expectorants and cough suppressants.



Flavonoids are widely distributed in plants fulfilling many functions. They have been shown to have antifungal activity *in vitro* (Galeotti *et al.*, 2008). Flavonoids are significantly recognized for their antioxidant, anti-carcinogenic, antimicrobial and antitumor properties (Manikandan *et al.*, 2006). The potent antioxidant activity of flavonoids reveals their ability to scavenge hydroxyl radicals, superoxide anions and lipid peroxyradicals, this may be the most important function of flavonoids (Alan and Miller, 1996). They also induce mechanisms that kill cancer cells in the breast and inhibit tumor invasion (Williams *et al.*, 2004).

Saponins were also tested for in the plant samples and were present in all. They have been shown to possess both beneficial in lowering cholesterol and deleterious in cytotoxic permeability of the intestine (Price *et al.*, 1987; Oakenful and Sidhu, 1989).

Although some saponins have been shown to be highly toxic under experimental conditions, acute poisoning is relatively rare both in animals and man (Osagie, 2002). Studies have illustrated the beneficial effects on blood cholesterol levels, cancers, bone health and stimulation of the immune system. The studied plant samples also contain alkaloids which are nitrogen-containing naturally occurring compound, commonly found to have antimicrobial properties due to their ability to intercalate with DNA of the microorganisms (Kasolo *et al.*, 2010). This could be responsible for the effectiveness of the plants as galactagogues though the exact mode of action is not understood yet. Tannins are polyphenols that are obtained from various parts of different plants belonging to multiple species. Tannins can also be effective in curbing haemorrhages as well as restrict bare swellings. Long-term and/or excessive use of herbs/vegetables containing high concentrations of tannins is not recommended (Reed, 1995). Phenols are strong antioxidants which prevent oxidative damage to biomolecules such as DNA, lipids, and

proteins which play a role in chronic diseases such as cancer of the breast and cardiovascular disease. Plant phenols may interfere with all stages of the cancer process, potentially resulting in a reduction of cancer risk.

The results obtained from proximate analysis of the galactagogues plants established that relatively high in fibre and protein but low in fats which provides the babies with adequate support in their growing stages. Crude fibres are important part of diets and also decrease serum cholesterol level, diabetes, colon and breast cancer (Ishida *et al.*, 2000). Moisture content is low as their dry matter is high which hinders the growth of microorganisms and the storage life would be high. This factor is also because the medication or use of these plants as galactagogues are done mostly by decoction which allows limited moisture content in the plants (Personal research). These results are also in agreement with the values of Gbadamosi and Okolosi (2013).

The usage of herbs requires a lot of water in which the dry matter of the samples diffuses into the water. They are also highly proteinous which are very important molecules in human being and are involved in virtually all cell functions. The ash content is relatively low from 1.45-4.60% and there was no significant difference between them ($p > 0.05$). The low amount of fat in each sample indicates that the plants are not sources of lipids accumulation which can cause arteriosclerosis and aging (Antia *et al.*, 2006). The high protein and low fat characteristics of the plant samples of herbal galactagogues have been reported by Gbadamosi and Okolosi (2013). From the findings of this research it can be established that the studied plants have essential phytochemicals which are importance in ensuring healthy living. Also further studies should be done by researchers to ascertain the galactagogues activity of the studied plants likewise their mode of action.

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