Journal of Medicinal Plant Research

Volume 10 Number 20, 25 May, 2016

ISSN 1996-0875

Academic Journals

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Journal of Medicinal Plants Research

Table of Contents: Volume 10 Number 20 25 May, 2016

ARTICLES

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Vol. 10(20), pp. 261-269, 25 May, 2016
DOI: 10.5897/JMPR2016.6105
Article Number: 69FAFE858733
ISSN 1996-0875

http://www.academicjournals.org/JMPR

Journal of Medicinal Plants Research

Full Length Research Paper

Pharmacological Activities of *Plectranthus scutellarioides* (L.) R.Br. Leaves Extract on Cyclooxygenase and Xanthine Oxidase Enzymes

Jutti Levita[1,3]*, Sri Adi Sumiwi[1], Tiara Indah Pratiwi[1], Ekky Ilham[1], Syafrudin Purnama Sidiq[2] and Moelyono Moektiwardoyo[2]

[1]Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Padjadjaran Jl. Raya Bandung-Sumedang km.21 Jatinangor, West Java, Indonesia.
[2]Postgraduate School Universitas Padjadjaran, Jl. Dipati Ukur 35 Bandung, West Java, Indonesia.
[3]Department of Pharmacy Biology, Faculty of Pharmacy, Universitas Padjadjaran, Jl. Raya Bandung-Sumedang km.21 Jatinangor, West Java, Indonesia.

Received 20 March, 2016; Accepted 5 April, 2016

***Plectranthus scutellarioides* (L.) R.Br. (family Lamiaceae) has been widely used in West Java, Indonesia, to cure various diseases. People boiled the leaves of the plant in water and consumed the tea daily until the symptoms reduced. This work was conducted to study the pharmacological activity of *P. scutellarioides* (L.) R.Br. extract on cyclooxygenases (COXs) and xanthine oxidase (XO) enzymes. The plant was purchased from Manoko plantation in Lembang, West Java, Indonesia. The leaves were sundried, crushed, and soaked in ethanol for 3 × 24 h, prior to be used. The extraction was continued further using ethyl acetate and water. Inhibitory activity of the extract on COXs was performed by measuring the absorbance of reduced-tetramethyl-*p*-phenylendiamine (TMPD) at 590 nm, which correlates to the level of PGH_2 production, while its inhibitory on XO was measured at 290 nm. *P. scutellarioides* (L.) R.Br. leaves extracts (ethanolic, ethyl acetate, and water) showed inhibition on COX-1 and COX-2 enzymes (40.43% for COX-1 and 97.04% for COX-2), while on XO, the water extract showed the highest inhibition (IC_{50} water extract = 6 µg/ml; IC_{50} allopurinol = 0.15 µg/ml). This plant could be further proposed as XO and nonselective COX inhibitors.**

Key words: Anti-inflammatory, cyclooxygenase (COX), gout, non-steroidal anti-inflammatory drugs (NSAIDs), prostaglandin, prostaglandin H_2 (PGH_2), xanthine oxidase (XO).

INTRODUCTION

The inflammatory response protects the body against infection and injury but it could become disregulated with deleterious consequences to the host. It is now evident that endogenous biochemical pathways activated during defense reactions can counter-regulate inflammation and promote resolution. Hence, resolution is an active rather

*Corresponding author. E-mail: jutti.levita@unpad.ac.id.

than a passive process, as once believed, which now promises novel approaches for the treatment of inflammation-associated diseases based on endogenous agonists of resolution (Serhan et al., 2007).

Plectranthus scutellarioides (L.) R.Br. which belongs to Lamiaceae or Labiatae family, is a native plant of Southeast Asia, including Indonesia. This plant could also be cultivated in tropical and temperate regions around the world (Hanelt et al., 2001; Acevedo-Rodriguez and Strong, 2012). *P. scutellarioides* (or *Coleus scutellarioides*) has been widely used in West Java, Indonesia, to cure various diseases (Roosita et al., 2008). People boiled the leaves of the plant in water and consumed the tea daily until the symptoms reduced.

Other species of the same family, known as *Plectranthus amboinicus* or Indian borage, exhibited antiplatelet aggregation ability, antibacterial activity, and antiproliferative effect against Caco-2, HCT-15, and MCF-7 cell lines (Bhatt et al., 2013).

Iranian researchers, Saghafi et al. (2013) reported that *Teucrium polium* extract in different regions is a rich source of antioxidant and showed inhibitory effect on xanthine oxidase.

Some drugs, such as the widely used cyclooxygenase-2 (COX-2) inhibitors, have been proven to be toxic (Gilroy et al., 1999; Bannenberg et al., 2005; Serhan et al., 2007), whereas others possess pro-resolving actions, such as glucocorticoids (Rossi and Sawatzky, 2007), cyclin-dependent kinase inhibitors (Rossi et al., 2006), and aspirin (Serhan, 2007). Non-steroidal anti-inflammatory drugs (NSAIDs) work by inhibiting both COX isoforms, thus the conversion of arachidonic acid into prostaglandin is disturbed (Katzung, 2007). All NSAIDs in clinical use have been shown to inhibit COX, leading to a marked reduction in PG synthesis. The inhibition by aspirin is due to irreversible acetylation of the cyclooxygenase component of COX. In contrast, NSAIDs like indomethacin or ibuprofen inhibit COX reversibly by competing with the substrate, arachidonic acid, for the active site of the enzyme (Vane et al., 1990). Aspirin is the most commonly non-steroidal anti-inflammatory drug, which low doses could be used to prevent and treat cardiovascular diseases. Recent studies showed that there is increasing evidence that aspirin initiates biosynthesis of novel anti-inflammatory mediators by means of interactions between endothelial cells and leukocytes. These mediators are classified as aspirin-triggered 15-epi-lipoxins (Chiang et al., 2004).

Xanthine oxidase (XO) is a member of group of enzymes known as molybdenum iron-sulphur flavin hydroxylases (Symons et al., 1989). It catalyses the oxidation of hypoxanthine to xanthine and then to uric acid, the final reactions in the metabolism of purine bases (Zarepour et al., 2010). Xanthine oxidase inhibitors (XOI) are much useful, since they possess lesser side effects compared to uricosuric and anti-inflammatory agents. Allopurinol is the only clinically available XOI, which also suffers from many side effects such as hypersensitivity syndrome, Steven's Johnson syndrome and renal toxicity. Thus, it is necessary to develop compounds with XOI activity with lesser side effects compared to allopurinol. Flavonoids and polyphenols have been reported to possess xanthine oxidase inhibitory activity. In addition, flavonoids also have anti-inflammatory and antitumor properties (Umamaheswari et al., 2013; Lio et al., 1985).

This work was aimed to study the pharmacological activity of *P. scutellarioides* (L.) R.Br. leaves extracts (ethanolic, ethyl acetate, and water) on cyclooxygenases (COXs) and xanthine oxidase (XO) enzymes.

MATERIALS AND METHODS

Plant

The fresh plant was purchased from Manoko plantation at Lembang, West Java, Indonesia, in November 2015. The specimen (No. 1011/11.CO2.2/PL/2015) was determined at Laboratory of Identification and Determination, School of Life Sciences and Technology, Bandung Institute of Technology, Indonesia, and confirmed as *P. scutellarioides* (L.) R.Br. (family Lamiaceae).

Preparation of extracts

The leaves were sundried in a glass-roofed room for 5 days, and then 1.2 kg of the dried leaves were crushed to powder and soaked in 1 L of 70 % ethanol for 3 × 24 h at room temperature. The extraction was continued sequentially using ethyl acetate and water. The extracts were filtered through Whatman No. 41, the solvent was vacuum-evaporated at 40 to 60°C, followed by freeze-drying process, prior to be further used.

Phytochemical screening

Phytochemical screening was performed according to standard method using specific reagents to detect secondary metabolites (alkaloids, flavonoids, polyphenols/tannins, terpenoids, quinones, and saponins) in *P. scutellarioides* (L.) R.Br. leaves extracts.

Thin layer chromatography (TLC) analysis

TLC was performed on silica GF_{254} plate using a mixture of *n*-butanol, acetic acid, and water (4:1:3) was used as eluent for ethanol and water extracts, whereas a mixture of toluene, ethyl acetate, and acetic acid (7:2:1) was used for ethyl acetate extract. The spots were observed using $AlCl_3$ as spray reagent.

Spectrophotometry analysis

Spectrophotometry analysis was performed to the ethanol extract (with and without $AlCl_3$) at 220 to 450 nm. Quercetin was used as standard.

High performance liquid chromatography (HPLC)

Reversed-phase HPLC was performed on LC-10AT VP (Shimadzu),

using Atlantis Hilicsilica C18 (Waters®) column, 150 mm × 4.6 mm × 5 µm, as stationary phase, and a mixture of acetonitrile, phosphoric acid, and methanol (40:50:10) as mobile phase. Flow rate was 0.8 ml/min, and detection was set at 339 nm. The chromatographic peak was confirmed by comparing the retention time of *P. scutellarioides* (L.) R.Br. leaves extract with that of quercetin standard.

Pharmacological assay

Inhibitory activity on COX enzymes

100 mg of freeze-dried extracts were dissolved in 50 ml of ethanol. The solution was diluted until three concentrations were obtained.

This assay was performed using Colorimetric COX Inhibitor Screening Assay No.705010 (Cayman Chemical Company): 150 µl of assay buffer, 10 µl of heme and 7 µl of enzyme (either COX-1 or COX-2) were added into each inhibitor well, followed by the addition of 20 µl of the extracts. The plate was stirred and incubated for 5 min at 25°C. Then, 15 µl of colorimetric substrate solution was added to all wells, followed by 20 µl of arachidonic acid. The plate was stirred and incubated precisely for 2 minp at 25°C. Finally, the absorbance was measured at 590 nm in 5 min interval. Acetosal was used as drug standard.

Inhibitory activity on XO enzyme

Freeze-dried extracts (50 mg) were dissolved in 25 ml of dimethyl sulfoxide (DMSO). The solution was diluted until various concentrations were obtained.

This assay was performed using Xanthine Oxidase Inhibitor Screening Assay (Sigma Aldrich, USA): 1 ml of extract solution was added by 3 ml of phosphate buffer and 2 ml of xanthine substrate solution. The mixture was preincubated at 30°C for 10 min, and was added by 0.1 ml of xanthine oxidase enzyme solution. The mixture was homogenized and incubated at 30°C for 30 min. The reaction was stopped by using 1 ml of HCl 1 N and the absorbance of uric acid was measured at 290 nm. Allopurinol was used as standard. The percentage of inhibition was calculated by

$$\text{Percentage of inhibition} = \{ (A-B) - (C-D)\}/(A-B)\} \times 100$$

where A is the activity of the enzyme without the compound, B is the control of A without the compound and enzyme, C and D are the activities of the compound with or without XO ,respectively. The assay was done in triplicate and IC_{50} values were calculated from the percentage of inhibition (Sahgal et al., 2009).

RESULTS AND DISCUSSION

Preparation of extracts

Dried leaves extraction (1.2 kg) resulted in 234.61 g of ethanol extract (19.55%), whereas the ethyl acetate and the water extracts were 9.71 and 26.06 g, respectively.

Phytochemical screening

Qualitative analysis by phytochemical screening of *P. scutellarioides* (L.) R.Br. leaves extracts revealed the presence of polyphenols, flavonoids, saponins, and quinones (Table 1)

Table 1 showed the results of phytochemical screening. Both the dried leaves and the extracts of *P. scutellarioides* (L.) R.Br. contain polyphenols, flavonoids, saponins, and quinones (indicated with positive mark in the table). No alkaloids and terpenes are observed in either the dried leaves or extracts. These results were compared with those of Bhatt et al. (2013) who had worked on *P. amboinicus* or Indian borage of the same family, Lamiaceae. They reported that this plant contained phenolics (49.91 mg GAE/g extract), flavonoids (26.6 mg RE/g extract), and condensed tannins (0.7 mg TAE/g extract) (Bhatt et al., 2013).

Thin layer chromatography (TLC) analysis

TLC analysis of the ethanol extract, ethyl acetate fraction, and water fraction, resulted 3, 6, and 6 spots, respectively (Rf value ranged between 0.29 and 0.91), which gave colour with $AlCl_3$ (Figure 1).

Spectrophotometry analysis

Spectrophotometry analysis result is as shown in Figure 2. Figure 2 shows that quercetin (red) has two bands which maximas are detected at 258 and 375 nm, whilst the extract indicated peaks at 260 and 335 nm.

The UV lambda maxima of quercetin-3-*O*-rhamnoside and quercetin-uronic acid were 256 and 352 nm (Plazonić et al., 2009), which are closely similar with those of our extract.

According to Sisa (2010), all flavonoids have aromatic chromophores, as indicated by UV absorptions in the 250 nm region of their UV spectra. These compounds may undergo π,π* excitation and react from π,π* excited states. Certain flavonoids contain carbonyl chromophores and absorb light in the 300 nm region. They may undergo n,π* excitation to react from n,π* excited states. Carbonyl chromophores that are conjugated with the aromatic ring (e.g., acetophenones and chalcones) absorb UV light in the 350 nm region. The n,π* and π,π* excited states of these compounds are almost degenerate and the state from which their reactions originates is sometimes controversial. Polyphenolic chalcones may absorb light in the visible region as is evident by their colours (Sisa et al., 2010).

There is an occurance of batochromic shift (a shift of the maxima to longer wavelength) of the first bands of both extract and quercetin. The shift confirmed the presence of flavonoids in *P. scutellarioides* (L.) R.Br. leaves extract.

High performance liquid chromatography (HPLC)

HPLC analysis result is as shown in Figure 3. Figure 3b

Table 1. Phytochemical Screening of *P. scutellarioides* (L.) R.Br. leaves extracts.

Secondary metabolite	Dried leaves	Extract		
		Ethanol	Ethyl acetate	Water
Alkaloids	-	-	-	-
Polyphenols	+	+	+	+
Flavonoids	+	+	+	+
Saponins	+	+	+	+
Quinones	+	+	+	+
Terpenes	-	-	-	-

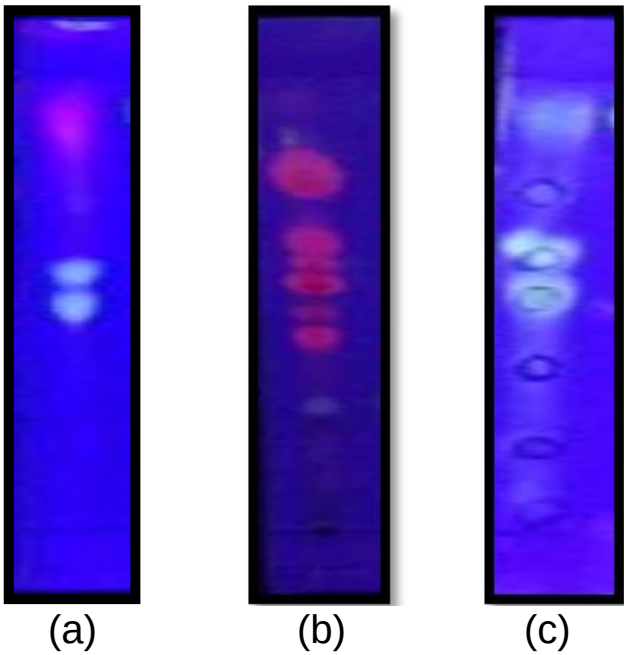

Figure 1. TLCs of (a) ethanol extract; (b) ethyl acetate fraction; (c) water fraction of *P. scutellarioides* (L.) R.Br.

shows a dominant peak in *P. scutellarioides* (L.) R.Br. leaves extract, which eluted at 4.91 min (Rt of quercetin standard = 4.88 min as shown in Figure 3a).

Inhibitory activity on COX enzymes

The basic principle of this kit is the oxidation of TMPD by the peroxidase activity of the heme, to form a colored compound which absorbs at λ 590 nm.

Figures 4 and 5 show that all extracts possess inhibitory activity on both COX-1 and COX-2 enzymes, although it is weaker when compared with acetosal. The inhibitory activity of *P. scutellarioides* (L.) R.Br. leaves extract on COX-2 is stronger than on COX-1 (40.43% for COX-1 and 97.04% for COX-2), thus this plant could be further proposed as a nonselective COX inhibitor.

We compared the results with those of other researchers. Ravikumar and colleagues concluded that aqueous and ethanolic extracts of leaves of the same genus, *Plectranthus amboinicus* (Lour.) Spreng, showed anti-inflammatory activity (Ravikumar et al., 2009; Devi and Periyanayagam, 2010).

Inhibitory activity on XO enzyme

Inhibitory activity of *P. scutellarioides* (L.) R.Br. leaves extract on XO enzyme is as shown in Figure 6. Figure 6 shows that all *P. scutellarioides* (L.) R.Br. leaves extracts, which contained flavonoids (Table 1), possess inhibitory activity on XO enzyme. According to Umamaheswari et al. (2009), inhibitory activity on XO enzyme might be attributed to the presence of benzopyran ring in the flavonoids. They concluded that flavonoids could be a promising remedy for the treatment of gout and related

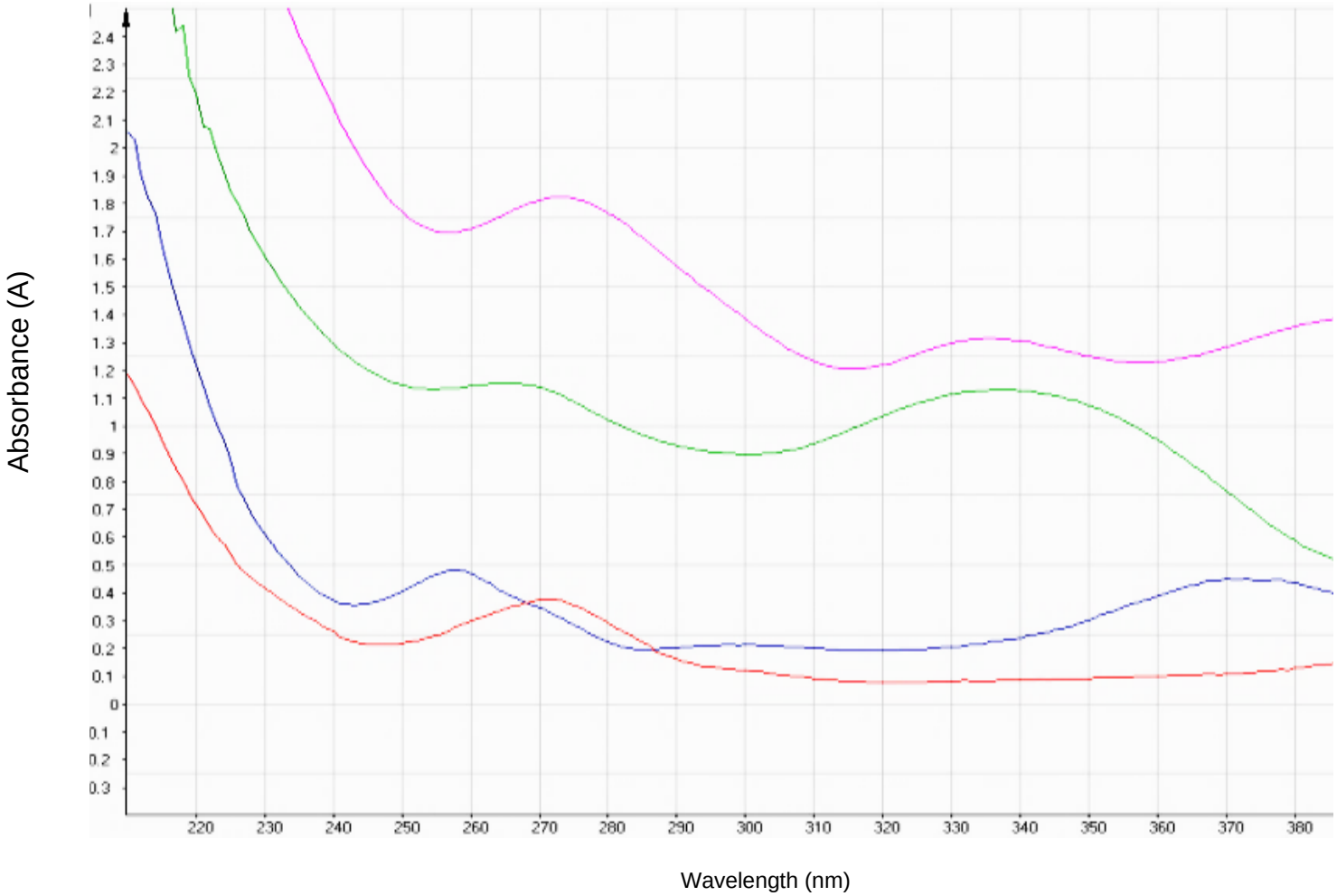

Figure 2. Spectra of quercetin standard + $AlCl_3$ (red); quercetin standard (blue); ethanol extract (green); and ethanol extract + $AlCl_3$ (pink).

inflammatory disorders (Umamaheswari et al, 2013). The water extract revealed the highest inhibition although it is weaker when compared with allopurinol (IC_{50} water extract = 6 µg/ml; IC_{50} allopurinol = 0.15 µg/ml), therefore this plant could be further proposed as XO inhibitor.

Conclusion

P. scutellarioides (L.) R.Br. leaves extracts (ethanolic, ethyl acetate, and water) show inhibition on COX-1 and COX-2 enzymes, while on XO, water extract showed the highest inhibition. This plant could be further proposed as both XO and COX inhibitors.

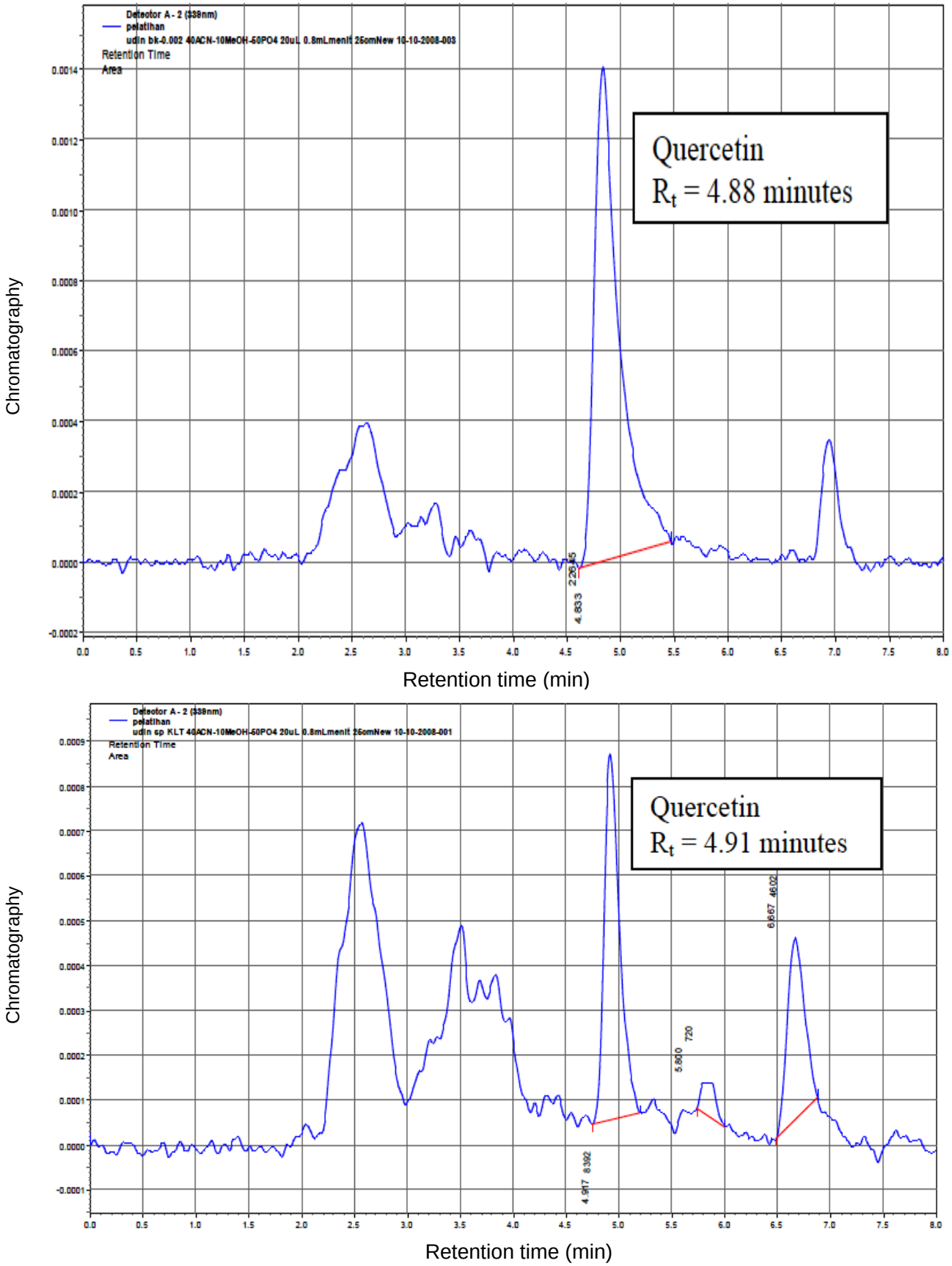

Figure 3. HPLC chromatograms of (a) quercetin standard and (b) ethanol extract.

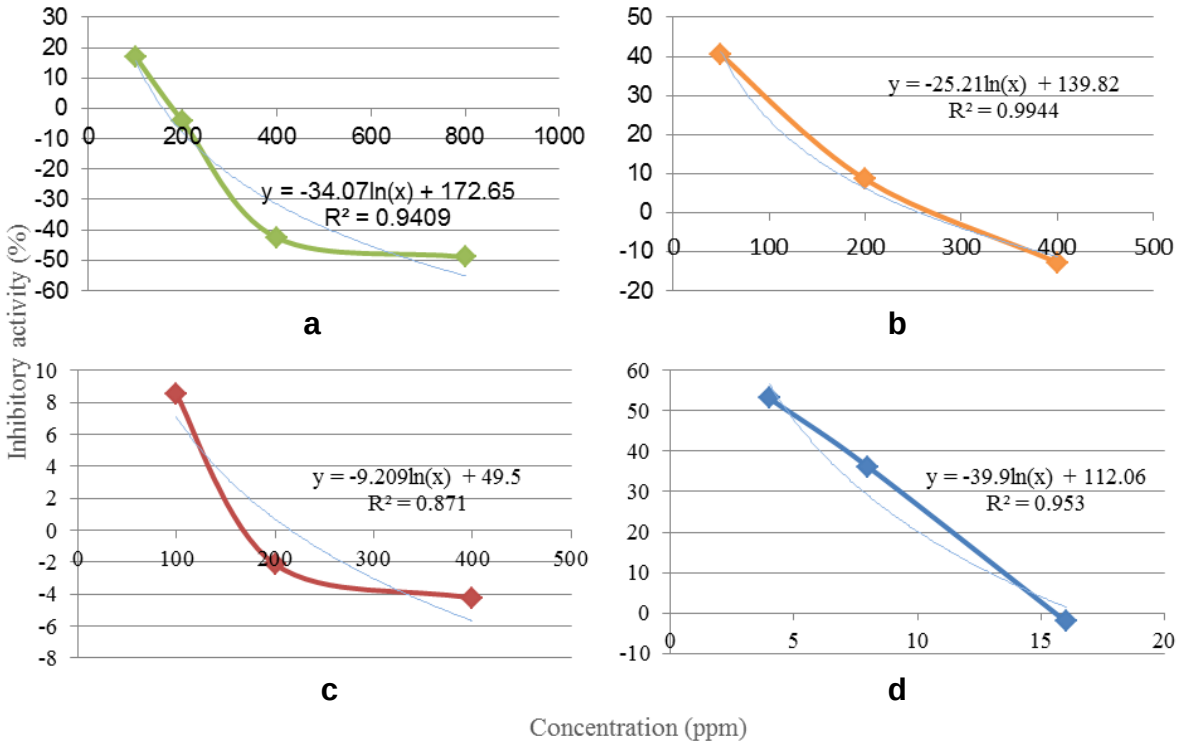

Figure 4. Inhibitory activity of (a) ethanol extract; (b) ethyl acetate fraction; (c) water fraction; (d) acetosal on COX-1.

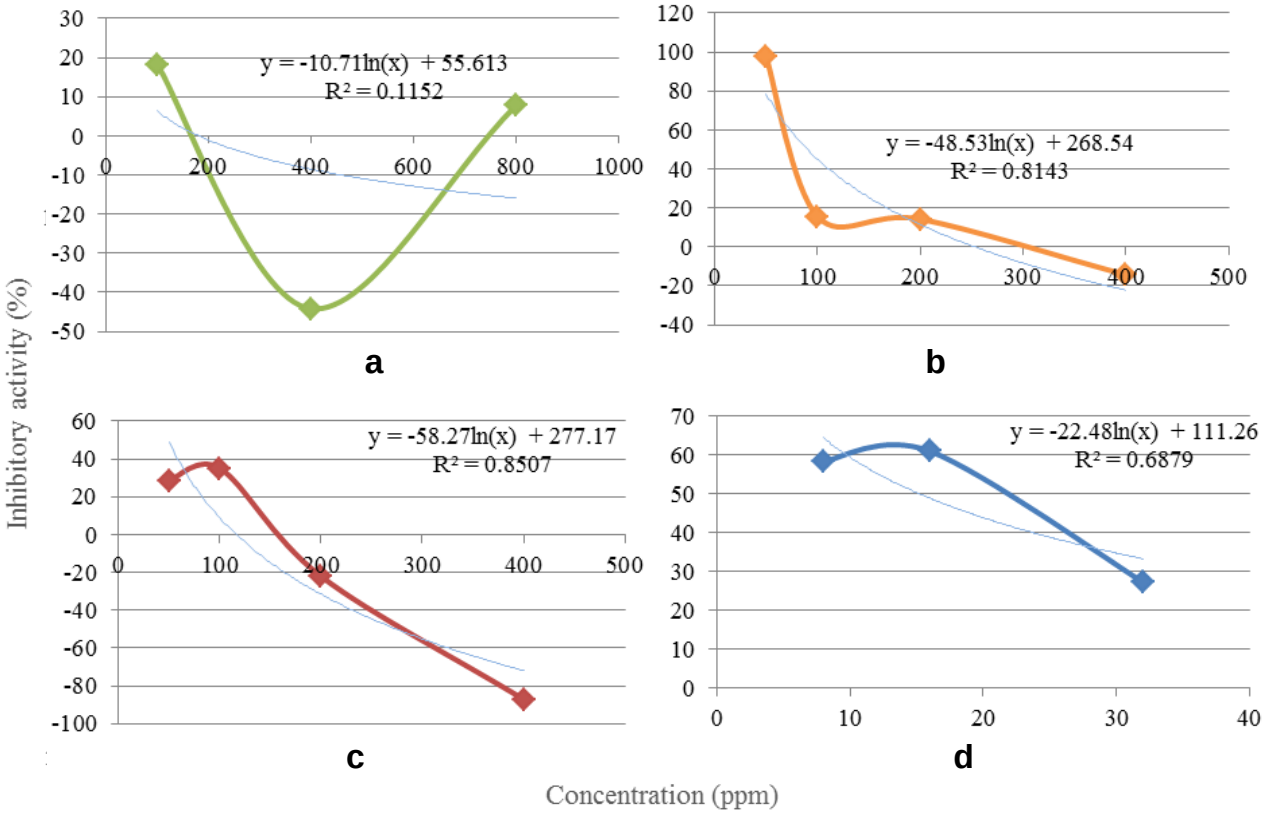

Figure 5. Inhibitory activity of (a) ethanol extract; (b) ethyl acetate fraction; (c) water fraction; (d) acetosal on COX-2.

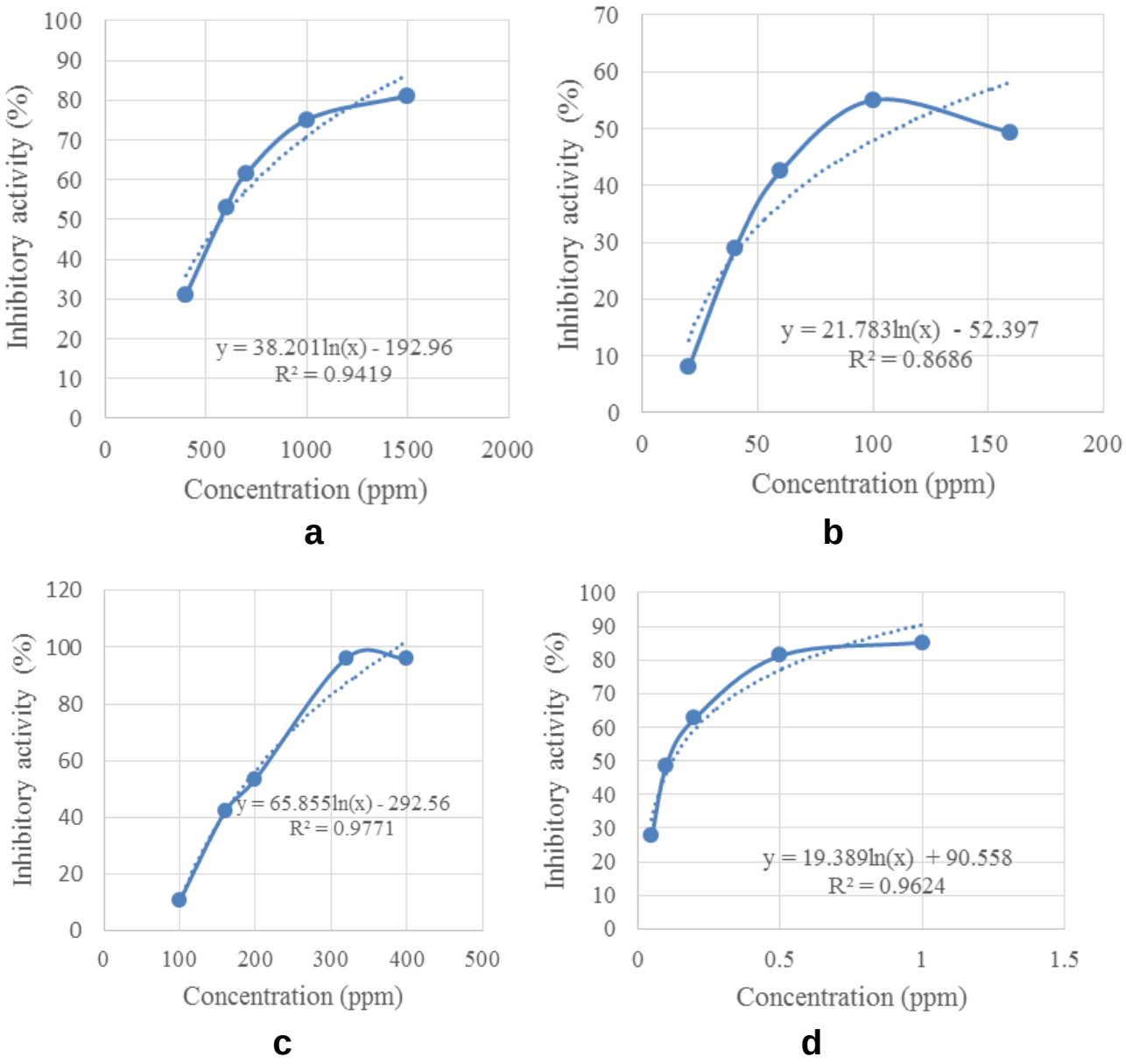

Figure 6. Inhibitory activity of (a) ethanol extract; (b) ethyl acetate fraction; (c) water fraction; (d) allopurinol on XO.

Conflicts of interests

The authors have not declared any conflict interests.

ACKNOWLEDGEMENTS

This project was funded by Universitas Padjadjaran via Academic Leadership Grant 2015.

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Vol. 10(20), pp. 270-277, 25 May, 2016
DOI: 10.5897/JMPR2015.6040
Article Number: 9BBEEA958735
ISSN 1996-0875

http://www.academicjournals.org/JMPR

Journal of Medicinal Plants Research

Full Length Research Paper

Ethnobotanical survey of medicinal plants used in the treatment of women related diseases in Akoko Region of Ondo-State, Nigeria

Olanipekun M.K. *, Arowosegbe S., Kayode J.O and Oluwole T.R.

Department of Plant Science, Ekiti State University, Ado-Ekiti, Ekiti-State, Nigeria.

Received 23 December, 2015; Accepted 11 March, 2016

An ethnobotanical survey was conducted to document medicinal plants commonly used for the treatment of women related diseases by the inhabitants of Akoko in Ondo-State, Nigeria. A total of 36 plants, belonging to 29 families were documented. The abundance status of the identified plants revealed that 24% of the plants were very abundant, 34% were abundant while 42% were scarce. *Aframomum melegueta, Ageratunm conyzoides, Alchornea laxiflora, Allium sativum, Aspilia africana, Ananas comosus, Carica papaya* were the most frequently mentioned plants. Most of the respondents found the plants to be effective (78%), 12.5% believed the plants as being highly effective while 8.5% believed that the plants were not effective as being reported. The factor of citation of plants ranged between 60 to 95, the plants were holistic in action, rarely toxic and or harmful. The diseases mentioned were veneral diseases, breast cancer, diabetes, pre and postnatal complications, infertility, menstrual disorder, vaginal discharge and fibroids.

Key words: Medicinal plants, diseases, women, abundance, biomedicine, frequency of citation,

INTRODUCTION

Medicinal plants are now recognized worldwide, both by the rural population and urban elite as an important healthcare resource especially for women. Ezeigbo (1996) observed that most Nigerian women labored under stress because they are over whelmed by the responsibilities of their homes and the society in order to sustain their traditional roles in the family effectively. She noted that the peace and stability of homes depend largely on the managerial abilities of women folks. She stressed further that women especially the mothers plan, organize, direct and coordinate all the resources of the home. Apart from their numerical strength, women have great potentials necessary to evolve a new economic in order to accelerate social and political development and consequently transformed the society into a better one (Awe, 1990),

In Nigeria, women are subjected to social, cultural, physical and mental disorders that constituted health

*Corresponding author. E-mail: mary.olanipekun@eksu.edu.ng, omarykenny@gmail.com.

hazards for them. A study revealed that 1 out of every 15 African women died from complications of pregnancy, breast cancer, fibroid, diabetes, pre and postnatal care (Abudoulaye et al., 2006). Plants, with their curative values possess the potentials to ameliorate the situation (Akinnibosun and Odiete, 2008; Olanipekun et al., 2013). Nigeria is endowed with diversity of plants and animals that are naturally used as foods, medicine and for clothing and shelter (Odugbemi and Akinsulire, 2006). Plants in particular, have been a major source of medicine for human kind. Although the traditional importance of plants as medicine has been ignored in the time past by many biomedical practitioners because the clarity of the chemical composition, dosages and toxicity level of plants used in ethnomedicine is not clearly defined (Lowel et al., 2001; Balick and Cox, 1996). However, recent initiatives revealed that many resistance developed by disease causing organisms against synthetic drugs are now been overcome through the use of medicinal plants; hence there seems to be a drastic shift of some people from orthodox drugs to herbal products in curing ailments.

The re–emergence of interest in the use of medicinal plants as a solution to health problems has been fuelled by the rising cost of synthetic drugs in the maintenance of personal health as well as the ineffectiveness of some of the synthetic drugs because of the resistance developed against them by some disease causing organisms (Zucker and Campbell, 1992; Sharma, 1997). The documentation and conservation of the available species used in the treatment of diseases is always a good step in good directions. The main objective of this study therefore, is to document plants used in treating women health challenges with a view of identifing how they are used and the level of abundance of the plants in Akoko Region, Ondo-State, Nigeria.

MATERIALS AND METHODS

Study area

The study was conducted in Akoko South Local Government Area (LGA) of Ondo State. The LGA is made up of four communities namely; Iwaro Oka, Ayegunle Oka, Sumerin Oka and Oba Akoko; it is located within latitude 4.60^0N and longitude 3.30^0E. It is bounded in the East by Epinmi and Ipe , in the West by Akungba and Supare, in the North by Ise Iboropa and Ugbe Akoko, while in the South by Oba and Ikun towns. It covers an area of thirty square kilometers and the vegetation is derived from savanna with scattered forests all over the area. The climate of Oka land is equally determined by Southwest Monsoon Winds and North east wind. It has a mean annual rainfall of about 1,270 mm and annual temperature of over 21^oC. Humidity is relatively high for about eight months of the year. The inhabitants are predominantly farmers, engaging in subsistence farming. The major agricultural products from the study area are cassava, palm oil and cola nut.

METHODS OF DATA COLLECTION

An open-ended semi-structured questionnaire was utilized in obtaining information on plants used in the treatment of diseases affecting women in the study area. Interviews were conducted with a fairly open framework that allowed for focused, conversational and two-way communication as suggested by Kayode et al. (2009). A total number of 80 respondents were interviewed. The respondents consisted of men and women particularly herb sellers, community leaders and traditional healers. Secondary Information was also gathered from key informants who included officials from the Ministry of Health, hospitals and other stakeholders. These officials also helped to validate the scientific names of the diseases.

The information collected on the plants was properly documented. Information gathered included diseases affecting women, the name of plants used to cure the diseases, parts of the plants used, methods of preparations and mode of administration. The vouchers specimens of the identified plants were collected and taken to the herbarium of the Department of Plant Science, Ekiti State University, Ado-Ekiti for identification and authentication. Also the abundance status of the plants species was determined using the time taken to physically come in contract with the samples of the plants by the respondents in the communities (Kayode et al., 2015). The samples that were sighted within 20 min walk from the centre of the community were regarded as very abundant, abundant when sighted within 30 to 60 min but scarce when it takes more than 60 min to be sighted.

The frequency of citation (Fc) of the species which specifies the fidelity level of awareness and the usage of the species among the respondents was determined according to Kayode et al. (2015) using the formula:

$$Fc = Nr \times 100/N$$

Where Nr =The number of respondents that mentioned the species.
N =The total number of respondents interviewed

RESULTS AND DISSCUSSION

The results obtained revealed that a total of 36 plants species belonging to 29 families are used in the treatment of women diseases in the study area. The parts of the plant used included roots, stems, leaves and stem barks (Table 1). These plants were used in treating various diseases affecting women in the study area. The respondents were observed to possess immense knowledge on the medicinal values of the species. The use and effectiveness of the various parts of the plants is an indication that the bioactive ingredients that are responsible for their activeness are distributed in different parts of the plants. Olanipekun et al. (2013) reported the different bioactive ingredients such as alkaloids, saponins, tannins, cardiac glycoside as natural agents responsible for the effectiveness of some of the identified plants.

It was also observed that most of the plants (72%) were not cultivated; they were wild. Examples of the wild plant species were *Aframomum melegueta, Ageratum conizoides, Alchornia laxiflora, Allium ascalonium, Aspilia africana etc.* The remaining plant species (28%) were cultivated for various purposes other than medicinal. These included *Ananas comosus, Carica papaya* etc. The cultivation of plants ensures its availability and sustainability. Fruits of *Ananas comosus* and *Carica papaya* are good sources of essential micronutrients and

Table 1. List of Plants used in the Treatment of Women's health problems in Oka Akoko, Ondo State.

S/n	Plant name/Propagation	Family name	Local name/ Common name	Part used	Abundance status	Frequency of citation	Diseases treated
1	*Aframomum melegueta* K.Schum (wild)	Zingiberaceae	Atare; Alligator pepper	Fruits, seeds, Leaves	Scarce	85	Malaria, Toothache, Irregular menstrual flow, Wounds, infertility
2	*Ageratunm conyzoides L* (wild)	Asteraceae	Imi esu; Goat weed	Flowers, Leaves and whole plant	Very abundant	70	Wounds, ulcers, management of threatened miscarriage.
3	*Alchornea laxiflora (Benth)* (wild)	Euphorbiaceae	Ijan ,pepe; Bead string ,three veined	Leaves	Very abundant	80	Veneral diseases, promotes fertility.
4	*Allium ascalonicum L. Backer* (wild)	Liliaceae	Alubosa elewe; Leafy onion, Shallot, Wild onion	Bulb ,Leaves	Abundant	60	Infertility, Dysentery,
5	*Allium sativum L* (wild)	Liliaceae	Ayuu; Garlic	Bulb	Very abundant	95	Enhance sexual ability and treatment of hormonal imbalance
6	*Ananas comosus (Linn) Meril* (wild)	Bromeliaceae	Ope oyinbo; Pineapple	Fruits	Abundant	81	Typhoid fever, cough, Digestive problems
7	*Annona senegalensis Pers.* (wild)	Annonaceae	Abo; African custard apple	Root ,Leaves	Scarce	80	Cancer, Dysentery, infertility
8	*Aspilia africana (Pers.)C D.Adams* (wild)	Asteraceae	Yunrinyun; Haemorrhage plant	Leaves, flowers	Abundant	88	Stomach disorder, Skin rashes Management of Threatening Miscarriage
9	*Carica papaya Linn. (*cultivated)	Caricaceae	Ibepe; Pawpaw	Seed sap ,Leaves extract, Fruits	Very abundant	88	Diabetes ,Malaria, Gonorrhea
10	*Citrullus lanatus (Thumb)Matsum and Nakai* (Cultivated)	Cucurbitaceae	Egusi bara; Water melon	Fruit, Pulp ,Seeds	Abundant	81	Stomach disorder, Malaria,
11	*Citrus aurantifolia L* (Cultivated)	Rutaceae	Osan wewe; Lime fruit	Fruit ,Leaves ,Stem	Very abundant	95	Toothache ,Ulcer, Fever, Gonorrhea
12	*Cola acuminata L.* (Cultivated)	Stericuliaceae	Obi abata; Cola	Fruits	Abundant	90	Fever, Brest cancer
13	*Entandrophragma angolense D.C* (wild)	Meliaceae	Ijebo ,Tiama	Bark	Scarce	88	Diabetes ,Black tongue, Cough
14	*Ficus exasperata Vahl* (wild)	Moraceace	Ewe ipin; Sand paper	Leaves ,Seed , Root bark	Abundant	90	Stomach disorder, Fibroids
15	*Garcina kola Heekel* (wild)	Guttiferaceae	Orogbo; Bitter kola	Root ,Bark ,Stem bark, Root bark, Seeds	Abundant	88	Headache, Cancer, Dysentery, Cough, Fever
16	*Gossypium arboreum Linn.*(wild)	Malvaceae	Owu; Cotton plant	Leaves ,Seed	Abundant	90	Dysentery, Asthma, Ulcers, Menstrual disorder
17	*Harungana madagascariensis (Linn,Oxpou)* (wild)	Hyperiaceae	Amuje ,Dragon; Blood tree	Root ,Bark	Abundant	81	Dysentery, Easy delivery
18	*Hybanthus enneaspermus* (wild)	Violaceae	Abiweere ; Hybanthus spafe flower	Leaves, Whole plant	Scarce	70	Easy delivery,
19	*Jatropha curcas L.* (wild)	Euphorbiaceace	Lapalapa funfun ,Physics nut	Leaves, Seed ,Root	Very abundant	92	Fever, Menstrual disorders
20	*Mezoneuron benthamianum (Bailli)Herendand and Za* (wild)	*Caesalpinaceae*	Amuranju ,Senifiran	Leaves	Scarce	81	Breast cancer
21	*Momordica charantia Linn.* (wild)	Cucurbiaceae	Ejinrin were; Bitter leaf	Leaves, Whole plant, Fruits,	Scarce	80	Diabetes, Piles
22	*Parkia biglobosa (Jacq) R. Br* (Cultivated)	Mimosaceace	Irugba; Locust beans	Fruits, Seed ,Fruit pulp	Very abundant	80	Diabetes
23	*Physalis angulata Linn* (wild)	Solanaceace	Koropo;,Wild cape	Leaves, Whole plant	Scarce	68	Fever , Malaria, Infertility

Table 1. Cont'd

24	*Piper guineense (Schum and Thonn)* (Cultivated)	Piperaceae	Iyere; Black pepper	Fruits, Stem bark	Scarce	70	Fever, pile,Stomach disorder.
25	*Saccharum officinarum L.*(Cultivated)	Poaceae	Ireke; Sugar cane	Leaves, Stem	Scarce	80	Headache, Joint pains
26	*Secamone afzelii (Schutt)K .Sc* (wild)	Asclepiadaceaae	Aliu; Secamone	Leaves, Whole plant	Scarce	83	Cough, Fibroids
27	*Senna alata L.roxburgh* (wild)	Caesalpinaceae	Asuwon oyinbo; Candle bush	Leaves, Flower	Scarce	68	Skin diseases, Dysentery, Painful menstruation, vaginal discharge
28	*Senna podocarpa (Guilla and Perrs.)* (wild)	Caesalpinaceae	Asuwon ibile	Leaves, Root seed	Scarce	85	Malaria, Veneral diseases, Vaginal discharge
29	*Senna sibreriana D.C* (wild)	Caesalpinaceae	Aidantooro ; West African	Root, Leaves ,Pods	Scarce	86	Fever, Fibroid, Dysentery
30	*Talinum triangulare (Jacq) Wild*	Portulacaceae	Gbure; Water leaf	Leaves, Roots	Very abundant	93	High blood pressure
31	*Tetrapleura tetraptera (Schum and Thonn)Taub* (wild)	Mimosaceae	Aidan	Bark, fruits, Pods	Scarce	90	Inflammation of the bones, Promotes fertility
32	*Uvaria afzelii (jACqum)Desvaux ,Excandoille* (wild)	Papilionaceae	Alupayida	Roots	Scarce	90	Treatment of Fibroids
33	*Vernonia amygdalina Del.* (Cultivated)	Compositaceae	Ewuro; Bitter leaf	Leaves	Very abundant	89	Stomach ache ,Malaria
34	*Xylopia aethiopica (Dunal)A.Rich* (wild)	Annonaceae	Eru , eruje; Ethiopian pepper	Seed, Fruits	Scarce	92	Menstrual disorder, Inflammation of joints
35	*Xylopia quintasii Pierre.*(wild)	Annonaceae	Eru, awoka	Fruits, Seed	Scarce	89	Menstrual pains,
36	*Zea mays L.* (Cultivated)	Poaceae	Agbado; Maize	Fermented maize water, Chalf silk	Very abundant	90	Urinary troubles

needed anti-oxidants for the good performance of the body and improve the immune system. Data on the abundance status of the plants (Table 1) showed that 24% of the plants were very abundant. They are readily available because it does not take up to 20 s to come across them when needed. Also, the plants are cultivated because there are other purposes other than medicine they are used for (Table 1). However, 35 % of the plants were abundant, taking about twenty minutes journey before one could come across the plants. The population of these plants has started dwindled.

About 41 % of the plants were scarce and difficult to discover. Some of them take up to two to five days or more journey before coming across them. This could be as a result of pressure on the natural forest. Natural forest that is the home of many plants is now been converted and used for other purposes such as building, industries and road construction. Therefore, it is important to embark on extensive conservation and massive cultivation of the rare species from extinction (Table 3). The primary importance of the identified plants ranges from ornamental, shade, grains as food, leaves as vegetables, erosion control etc. The use as medicine is the secondary purpose (Table 4). The respondents' frequency of citation of the identified species ranged between 60 and 95 (Table 1). This tends to suggest that the level of awareness, importance and acceptability of the medicinal species was high among the respondents (Kayode et al*.,* 2015).

Details of plants preparations and mode of administration for the treatment of the diseases peculiar to women in the study area are shown in Table 2. Roots and the leaves of the plants, such as *Senna podocarpa, Senna alata, Allium ascalonium* were used collectively for the treatment of vaginal discharge and to treat menstrual disorder conditions. The treatment for pre and post natal care is also included. Plants such as *Annona senegalensis*, *Aframomum melegueta, Hybanthus enneaspermus*, *Piper guineense* were reportedly used as plants used to easy difficult labor and infertility in women . Plants used for the treatment of breast cancer include *Cola acuminata* fruits. The traditional use of plants in treating ailments by the rural dwellers is a common practice that has been used and found effective even when the use of orthodox has failed. It was reported by Yakubu et al*.,* (2007) in an Ethnobotanical survey where it was revealed several reasons for using medicinal plants in the management of diseases in Nigeria.

The incidence of various diseases affecting women in the study area has led to the use of orthodox medicine but unfortunately, the options are expensive, not easily available and with a lot of adverse effect. However, the respondents (78%)

Table 2. The recipes and the traditional methods of preparing the medicinal plants for the treatment of various diseases affecting women in the study area.

Name of plants	Methods of preparation/Mode of administration	Disease treated/Conditions
Senna alata, Senna podocarpa, Allium ascalonium, Allium sativum	Hot water is poured on the recipes and kept in a closed container for twenty four hours. /100ml is taken orally every morning for 3 days.	Vaginal discharge, Enhance sexual ability and treatment of hormonal imbalance
Myopia quintasii Xylopia aethiopica	Leaves Extract prepared by boiling in water./100 ml is taken orally for 3 days	Menstrual disorder
Aframomum melegueta, Ananas comosus, Carica papaya, Jatropha curcas, Physalis angulata	The rhizome is ground and soaked in alcoholic for 24 h. /100 ml taken 3 times daily before meal for 5 days.	Post natal care, Malaria, Irregular menstrual flow, infertility
Aframomum melegueta, Ageratum conyzoides, Alchonea laxiflora Ficus exasperata, Secamone afzelii, Talinum triangulare, Uvaria afzelii, Momordica charantia	Dried and burnt powdered plants. The usage starts from the second day of the menstrual	Infertility, Fibroid
Cola acuminata, Garcina cola,	The Ground recipes mixed with native soap/Bath the breast with the herbal mixtures with a new sponge for four days.	Breast cancer
Senna alata, Senna sibreriana, Allium ascalonium, Piper guineese, Aspilia africana,	The plants are soaked in fermented corn water, Placed under hot sun and covered for 4 days. /250 ml is taken orally for 2days.	Painful menstruation, Vaginal discharge, Fibroid
Saccharum officinale, Xylopia aethiopica, Citrus aurantifolia, Tetrapleura tetraptera	The recipes are boiled in *Citrus aurantifolia* fruit juice/100 ml, 3times daily and part of it used to bathe the breast	Breast pains, Inflammation of joints
Hybanthus enneaspermus, Mezoneuron benthhammianum , Piper guinnese, Parkiabiglobosa,	Ground and mixed together with one cat fish and cook for the woman to sustain the pregnancy	Ante natal care, Diabetes, Cancer
Harunganamadag ascariensis, Hybanthus enneaspermus, Vernonia amygdalina	Blend all the plant parts and mix a portion with Sheabutter for navel rubbing and other part with native soap for bathing to ensure safe delivery	Difficulty in delivery

perceived the plants as being effective, while 12.5% of the respondents observed the treatments as being highly effective and it cannot be compared to the use of orthodox medicine (Table 5). Similarly, Ariba et al. (2007) reported that42.3% of the 79 Nigerian clinicians agreed that many patients preferred native medication to modern drugs. The study areas was urban-rural, the respondents have the traditional knowledge of preparing plants and need not skilled personnel for its preparation. The respondents have gathered experience through trial and error over several years. They observed plants as highly effective, holistic in action, rarely toxic or harmful.

Also, plants have few or no side effect, readily available, easier to obtain, cheaper (Tables 6 and 7) and cure permanently than orthodox medicine and could save the nation huge foreign exchange that can be converted for other uses which will help in further national development (Arowosegbe et al., 2015, Kayode et al; 2015; Lewis, 2003 and Olapade, 2002).

Conclusion

The results obtained revealed that the study area consisted of various plant species suitable as medicinal remedies for the treatment of various health challenges affecting women in the study area. The frequency of citation indicated that the use of these plants is reliable, effective and culturally acceptable. However, plants are not abundantly available as expected to sustain the needs of the users, hence conservation measures

Table 3. The recipes and the traditional methods of preparing the medicinal plants for various diseases affecting women in the study area.

Name of plants	Methods of preparation/Mode of administration	Disease treated/ Conditions
Glyphea brevis, Senna alata, Senna podocarpa, Allium ascalonium,	Hot water is poured on the recipes and kept in a closed container for twenty four hours /100 ml is taken orally every morning for 3 days.	Vaginal discharge
Dalbergiella welwitschii,	Leaves extract plus potash is mixed and taken/100ml is taken orally for 3 days	Menstrual disorder
Aframomum melegueta	Ground and alcoholic soaked plants rhizome /100ml 3 times daily before meal form5days.	Post natal care
Mimosa pudica, pupilia lappacea, Aframomum melegueta	Dried and burnt powdered plants. The usage starts from the second day of the menstrual	Infertility
Cola acuminata, Garcina kola,	The Ground recipes mixed with native soap/Bath the breast with the herbal mixtures with a new sponge for four days.	Breast cancer
Senna sibreriana, Allium ascalonium, Piper guineese	The plants are soaked in fermented corn water, Place under hot sun and cover it for 4 days/ 250 ml is taken orally for 2days.	Fibroid
Euphorbia convolvuloides, Saccharum officinale, Unripe Musa nana, Xylopia aethiopica seeds, Eleais guinensis, Citrus aurantifolia	The recipes are boiled in *Citrus aurantifolia* fruit juice/100 ml, 3times daily and part of it used to bathe the breast	Breast pains
Hybanthus enneaspermus, Piper guinnese, Parkia biglobosa,	Ground and mixed together with one cat fish and cook for the woman to sustain the pregnancy	Ante natal care
Entandrophragma angolense, Vernonia amygdalina	Blend all the plant parts and mix a portion with Sheabutter for navel rubbing and other part with native soap for bathing to ensure safe delivery	Easy delivery

Table 4. The abundance status of the identified species in the study area.

Abundance Status	Species	Proportion (%) of the species
Very Abundant	*A. conizoides*, *A. laxiflora, A. sativum, C. papaya, C. aurantifolia, C.nucifera, J. curcus, M. paradisiaca, O. grattissium, Sida acuta, S. bicolour, S. mombin, V. amygalina, Z. mays.*	24
Abundant	*A. melegueta, A. ascalonium, B. orellana, C. acuminate, C. Prostrate , E. angolense, E. convolvuloides , G. cola H. madagascarensis, K. africana, M. paradisiaca, O.abyssinica, P. biglobosa, P. zeylanica, S. stipitata, T. triangulare*, *U. picta, T. subcordata, S. acuta, S. mombin.*	35
Scarce	*A. senegalensis, A. mexicana , A. africana, C. ensiformis, C. lonatus, D. deblis, F. exasperate, G. latifolium, G. hirstum, H. enneaspermus, L. inermis, M.charantia, M. lucida, M. sloanei, N. lotus, P. angulata*, *P. guineese, P. osun, P. lappaceae, Q. undullata, R. communis, S. ahumfzelli, S. alata, S. fistula), S. podocarpa, S.sibreriana, T. tetrapleura*	41

are inevitable. Domestication strategies, appropriate methods of exploitation and further studies to ensure a sustainable utilization and availability of the rare species are recommended. Also the scientific reliability of the identified plant is advocated for, to validate the uses of the plants for the cure of various diseases and conditions.

Table 5. Other uses of some of the cultivated medicinal plants in the study area.

S/N	Botanical name	Other uses
1	Ananas comosus	Fruits, Ornamental purpose
2	Basella alba	Vegetable leaf, shade
3	Carica papaya	Edible fruits
4	Citrillus lonatus	Edible Fruit, Shade
5	*Citrus aurantifolia*	Fruit, Shade
6	*Cocos nucifera*	Shade
7	*Cola acuminata*	Fruit
8	*Musa paradisia*	Fruit
9	*Occimum gratissimum*	Leaves as vegetable
10	*Parkia biglobosa*	Seed
11	*Piper guineese*	Fruit
12	*Saccharum officinale*	Leaves as vegetable, Grains
13	*Sorghum bicolour*	Grains as food
14	*Talinum triangulare*	Leaves as vegetable
15	*Vernonia amygdalina*	Roots
16	*Zea mays*	Silk Styles, Grains as food

Table 6. Effectiveness of the use of identified species according to the respondents in the study area.

Feature	Frequency	Proportion (%) of respondents
Highly effective	10	12.5
Effective	63	78
Poorly effective	5	6.25
Not effective	2	2.5
Total	80	100

Table 7. Cost of getting the identified plant species by the respondents in the study area.

Access to source and cost	Frequency	Proportion (%) of respondents
Easy and cheap	48	60
Difficult but cheap	28	35
Difficult and expensive	4	5
Total	80	100

Conflict of Interests

The authors have not declared any conflict of interests.

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