**ORIGINAL PAPER**

**Nig. J. Pharm. Res. 2017, 13 (1) pp 27-35**
**ISSN 0189-8434** **Available online at http://www.nigjpharmres.com**

# A Survey of Plants used in Treatment of Hypertension and Diabetes Mellitus in Ilorin, Kwara State, Nigeria

***Abdulkarim AGUNU[A-F], Bilqis A. LAWAL[C-E] and Azeez A. AKANDE[B-C]**

Department of Pharmaacognosy and Drug Development, Faculty of Pharmaceutical Sciences, University of Ilorin, Ilorin, Nigeria

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation; D – writing the article; E – critical revision of the article; F – final approval of article.

## Abstract

**Background:** Hypertension and Diabetes mellitus have emerged as the leading non-communicable disease worldwide, thus, the increasing need to continuously explore more and better ways of treating these diseases.

**Objectives:** To carry out a survey of plants used in the treatment of hypertension and Diabetes mellitus in Ilorin, Kwara State, Nigeria.

**Materials and methods**: Interview was conducted among respondents using semi-structured questionnaires and asking open-ended questions. Descriptive statistics were used for data analysis.

**Result:** A total of 30 respondents comprising of 60.0% male and 40.0% female with the highest distribution of age range at above 50 years old (50.0%) was reported. Forty (40) medicinal plant species belonging to thirty-one (31) plant families were cited with the Apocynaceae family having the highest number of medicinal plants, followed by Asteraceae. For hypertension, 32 plant species were reported of which the most cited were *Allium sativum* (4) and *Ficus asperifolia* (2) while for Diabetes mellitus, 20 plant species were mentioned, of which the most cited were *Hunteria umbellata* (10) and *Vernonia amygdalina* (9). Of particular interest in this study were the plants that appeared for both hypertension and Diabetes treatment.

**Conclusion:** This survey has helped to increase available medicinal plants knowledge and documentation in the management of hypertension and Diabetes. However, further work on the pharmacological activity of these plants as well as formulation in proper dosage form is recommended.

**Keywords**: Hypertension, Diabetes mellitus, Traditional medicine practitioners, Kwara state

## INTRODUCTION

Non-communicable diseases such as hypertension, diabetes and other cardiovascular diseases are becoming increasingly important as causes of mortality and morbidity in all developing countries (Kegne *et al.*, 2007), with hypertension being the commonest (Akinkugbe, 1990). Hypertension is one of the leading causes of cardiovascular morbidity and mortality throughout the world (Dinicolantonio and Makridakis, 2014). The overall prevalence of hypertension in Nigeria ranges from 8%-46.4% depending on the study target population, type of measurement and cut-off value used for defining hypertension (Okechukwu *et al.*, 2012). In a study carried out by Kamaldeen *et al* ., 2014, the prevalence of hypertension using the Joint National Committee (JNC) classification of hypertension among 270 respondents that resides in Ilorin revealed prevalence of stage 1 and stage 2 hypertension is 16.7% and 11.9% respectively. Likewise, there is a compelling data to show an increasing incidence and

prevalence of diabetes mellitus in the continent. The estimated prevalence of diabetes in Africa is 1% in rural areas, and ranges from 5% to 7% in urban sub-Saharan Africa (Kegne *et al.*, 2005). The economic burden of these cardiovascular diseases comes in form of loss of income from disability and increased cost of healthcare. Reports on the global burden of these diseases indicate that it may likely have more adverse effects on middle-aged less-privileged people. This may relate to their higher risk profile and limited access to health interventions, which ultimately affect national productivity and development (Gaziano, 2007).

The development of natural products that are readily available, safe, effective, cheap, and assessable will improve acceptability of treatment and improve compliances that will greatly improve quality of life of sufferers. The plant kingdom has since time immemorial serves as a treasure house of potential drugs (Yadav and Argawala, 2011). The plant kingdom represent a rich store house of organic compounds many of which have been used for medicinal purposes and could serve as lead for the development of novel agents having good efficacy in various pathological disorders now and the future.

Medicinal plants are widely used by many people in Ilorin, Kwara State to treat/manage hypertension and Diabetes mellitus, however, there is no proper documentation of these medicinal plants. This research therefore seeks to collect and document information on the medicinal plants used in treatment of hypertension and diabetes mellitus in Ilorin, Kwara State, Nigeria which can provide a very good lead towards the development of new, more potent and cost effective anti-diabetic and antihypertensive drugs.

## METHODOLOGY

The study was conducted in three major Local Government Areas of Ilorin, the capital city of Kwara State, namely, Ilorin-East, Ilorin-South and Ilorin West Local Government Areas (Figure 1). Ilorin is located at 8.50 latitude and 4.54 longitude and it is situated at elevation 320 meters above sea level. Ilorin has a population of 814,192 making it the biggest city in Kwara State. The most predominant ethnic group in this area is the Yoruba.

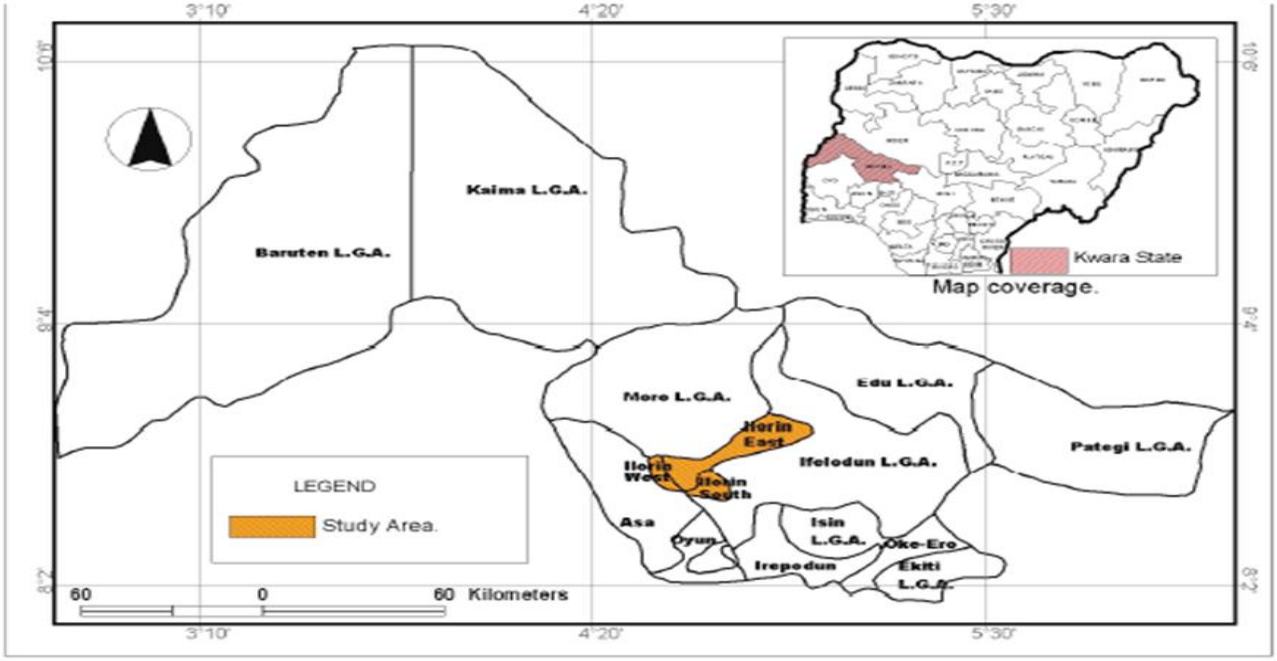


**Figure 1: Map of Kwara State showing the study area (Raheem, 2011)**

***Data collection***

Information was collected between June 2016 and January 2017 with the aid of semi-structured questionnaires and open-ended conversation to thirty respondents who are majorly traditional medicine practitioners, herb sellers and individuals with knowledge about medicinal plants used in treatment of hypertension and Diabetes mellitus. This population of study is chosen based on a pilot study carried out in Ilorin, Kwara State. Participation of the survey is voluntary.

The contents of the semi-structured questionnaires were organized using a standard protocol (Namsa *et al.,* 2009). Basic information about plants used in treatment of hypertension and diabetes mellitus, part(s) of the plants used, local name of the plant, botanical name of the plant, form in which the plant is used, method preparation of the plant and their dosage forms, and source of collection of the plant, sources of funding and record keeping of patients' information. Most respondents including the herb sellers and traditional healers were interviewed in the local language for clarity. Informed consent was obtained orally from all participants before the administration of the questionnaires and commencement of interview. The questionnaire was divided into three sections; the first section was demographic information, the second section was in their area of practice while the third section was the plants used the management of the diseases of interest. Frequency and percentage were employed for data analysis.

The Use of Mention Index (UMI) was calculated by dividing the number of use of each mentioned plant by the number of respondents.

## RESULTS AND DISCUSSION

Hypertension and Diabetes mellitus are two cardiovascular diseases that are projected to triple by 2030 and majority expected to come from developing countries with sub-Sahara Africa leading (Laslett *et al.,* 2012). It is also known that early detection and management can lead to improved quality of life with increased economy. Documentation and development of medicinal plants is a major step in healthcare development. Scientific evaluation of these plants can improve access and acceptability and provide new drugs or templates for new drugs.

### Information on Demography of Respondents

This study reveals a total of thirty (30) respondents, with the highest percentage coming from Ilorin-South followed by Ilorin-West and then Ilorin-East Local Government Areas of Kwara State at 46.7, 30.0 and 23.3% respectively. The population of respondents consisted of 60.0% male and 40.0% female with the highest distribution of age range at above 50 years old (50.0%). This was in support of the result of Faleyimu and Oluwalana (2008) who reported that, the older the people, the more active and experienced they are in the use and sourcing of medicinal plants. The educational status of the respondents reveals that only a small fraction (3.3%) of them are graduates, while majority have the secondary education (43.3%). Some others had primary education (10.0%), other forms of education (23.3%) while some were not exposed to any form of formal education (20.0%) (See Table 1).

**Table 1: Demographic Information of respondents**

| Parameter | Description | Frequency | Percentage (%) |
|---|---|---|---|
| Location | Ilorin-East | 7 | 23.3 |
| | Ilorin-West | 9 | 30.0 |
| | Ilorin-South | 14 | 46.7 |
| Age | 25-35 | 4 | 13.3 |
| | 36-50 | 11 | 36.7 |
| | 51 and above | 15 | 50.0 |
| Sex | Male | 18 | 60.0 |
| | Female | 12 | 40.0 |
| Educational status | Graduate | 1 | 3.3 |
| | Secondary education | 13 | 43.3 |
| | Primary Education | 3 | 10.0 |
| | Other forms of education | 7 | 23.3 |
| | None | 6 | 20.0 |

**Information on Practice of Respondents**

Majority of the respondents (80.0%) were Traditional medicine practitioners (TMP) with specialty on herbal medicine only, while others combine the herbal medicine with bone settings, traditional birth attendance with a spice of spiritual elements. The others were herb sellers and knowledgeable individuals at 13.3 and 6.7% respectively. A high percentage of the respondents (40.0%) claim to have been practicing for more than 30 years while majority of them (76.7%) acquire their knowledge through their family ancestry and only 6.7% of them acquired their knowledge through apprenticeship. However, some had the opportunity to experience both forms of knowledge acquisition (6.7%) while others (6.7%) acquire their knowledge through other means such as personal research. Some of the respondents (50%) keep records of their patients using of notebooks, cards and files.

It was also revealed that apart from plants, other raw materials such as animal parts, aquatic organisms and minerals are incorporated in preparation of recipes used for patients.

The result of this study has also shown cultivation of medicinal plants is an important tool in the practice of TMPs and that medicinal plant conservation is important in the plant usage as 100.0% and 86.7% of the respondents claim to be aware of the importance of cultivation of medicinal plants and conservation methods for medicinal plants (See table 2). Also, more than half (53.3%) fund from their pockets (personal funding) with no support from the government. Source of funding for traditional medicine practice is very important for the success of the practice.

**Information on the diagnosis and the dosage forms used by respondents**

The management/treatment of hypertension and Diabetes mellitus with medicinal plants is an acceptable practice in Kwara State, but there is still a growing need for proper documentation and development. According to this study, majority of the respondents (80.0%) claim to diagnosis hypertension in their patients by observing signs of sleeplessness, persistent headache, inactivity or reduced activity of a body part, increased heartbeat, fever, inability to stand up immediately from sitting position, inability to talk properly, excessive fluid intake, trembling of the hand, vomiting, inability to eat well, body pain, loss of weight, pain in the leg, loss of sight and stomach ache, while 93.7% of the respondents diagnose diabetes by identifying signs such as excessive urination, sugary taste of urine, insects on urine after urination, body ache, sleeplessness, loss of weight, body weakness, general body illness, wound not healing or delayed wound healing, roughness of skin, urine not drying up quickly, fever and irritation in mouth causing increased salivation.

Majority (43.3%) of the respondents have loose powder and liquid as the dosage form of medicines they administer to their clients, 30% of the respondents administer or give drugs to their clients in loose powder, liquid and tea bag dosage forms. 3% of respondents administer or give medicines in liquid only dosage form to their clients.

**Information on medicinal plants mentioned by respondents in the treatment of hypertension and Diabetes mellitus**

A total of forty (40) medicinal plant species belonging to thirty-one (31) plant families were mentioned by respondents for treatment of hypertension and Diabetes mellitus (See Table 3). For hypertension, 32 plant species were cited (Table 3), of which the most cited were *Allium sativum* (13.3%) and *Ficus asperifolia* (6.7%), while the other plants mentioned were only cited once. For diabetes mellitus, 20 plant species were listed, of which the most cited were *Hunteria umbellata* (33.3%), Vernonia *amygdalina* (30.0%), *Cocos nucifera* (20.0%), *Aristolochia rigens* (16.7%), *Securidaca longepedunculata* (10.0%) and *Ocimum gratissimum* (10.0%) (See Table 3). Of particular interest in this study were the plants that appeared for both hypertension and Diabetes treatment, which includes: *Allium sativum, Anthocleista djalonensis, Carica papaya, Cassia alata, Citrus aurantifolia, Ficus*

*asperifolia, Heliotropium indicum, Hunteria umbellata, Nauclea laterifolia, Ocimum gratissimum and Vernonia amygdalina.* There have been previous reports on the antihypertensive and anti-diabetic activities of majority of these plants, such as *Hunteria umbellata* (Adeneye and Adeyemi, (2009); Gbolade, (2012); *Carica papaya* (Juarez-Rojop *et al.*, *(*2012); Yasmeen and Prabhu, (2012) *Allium sativum* (Suetsuna, (1998), Thomson *et al.*, (2007) *Anthocleista djalonensis* (Olubomehin *et al.*, (2013) and *Heliotropium indicum* (Kuffour *et al.*, (2012), to mention a few. However, the mechanisms of action of these plants as well as the therapeutic profile are yet to be identified.

**Table 2: Information on Practice of Respondents**

| Parameter | Description | Frequency | Percentage (%) |
|---|---|---|---|
| Area of practice | Traditional medicine practitioners | 24 | 80.0 |
| | Herbal sellers | 4 | 13.3 |
| | Knowledgeable individuals | 2 | 6.7 |
| Years of practice | 1-10 | 5 | 16.7 |
| | 11-20 | 6 | 20 |
| | 21-30 | 7 | 23.3 |
| | 31 and above | 12 | 40.0 |
| Knowledge acquisition | Family | 23 | 76.7 |
| | Apprenticeship | 2 | 6.7 |
| | Both | 2 | 6.7 |
| | Others | 3 | 10 |
| Number of staff | 1-5 | 21 | 70 |
| | 6-10 | 4 | 13.3 |
| | 11 and above | 1 | 6.6 |
| | None | 3 | 10 |
| Awareness about cultivation of plants | Yes | 30 | 100 |
| | No | 0 | 0 |
| Cultivation of medicinal plants | Yes | 17 | 56.7 |
| | No | 13 | 43.3 |
| Source of funding | Personal funds | 16 | 53.3 |
| | Family and friends | 4 | 13.3 |
| | Loans and Co-operatives & Contributions | 10 | 33.3 |
| | Government | 0 | 0.0 |
| Knowledge of patient | Yes | 20 | 66.7 |
| | No | 9 | 30.0 |
| | Not sure | 1 | 30.0 |
| Keeping records of clients | Yes | 15 | 50.0 |
| | No | 15 | 50.0 |
| Use of preservatives | Yes | 19 | 63.3 |
| | No | 11 | 36.7 |
| Conservation methods for plants used | Yes | 26 | 86.7 |
| | No | 4 | 13.3 |
| Medicinal plants being used as food also | Yes | 25 | 83.3 |
| | No | 5 | 16.7 |
| The medicinal plants going into extinction | Yes | 13 | 43.3 |
| | No | 17 | 56.7 |
| Plants as source of some orthodox medicines | Yes | 26 | 86.7 |
| | No | 4 | 13.3 |
| Room for improvement in practice | Yes | 30 | 100 |
| | No | 0 | 0 |

This study also revealed that leaves formed the most frequently used plant part, followed by root, fruit and seed at 40.4%, 23.4%, 14.9% and 6.4% respectively (See Figure 2). The bulb, rhizome and juice accounted for 4.3% each of the plant part used while the stem is the least occurring at 2.1%. The plant leaves are important ingredient in traditional treatment of various diseases as it occurred as a component in many herbal preparations. This finding was in line with other studies such as Adekunle (2008) and Ayodele (2005). The plant families with the highest number of plants cited by the respondents in the management of hypertension and Diabetes mellitus is Apocynaceae (10%), followed by Fabaceae (8%), Asteraceae (5%), Liliaceae (5%) and Rubiaceae (5%) (See figure 4). The Apocynaceae plant family has been reported to be predominant in the mention of plants used in the management of various ailments (Rahman and Akter, 2016). Other plant families cited can be seen as represented on Table 3.

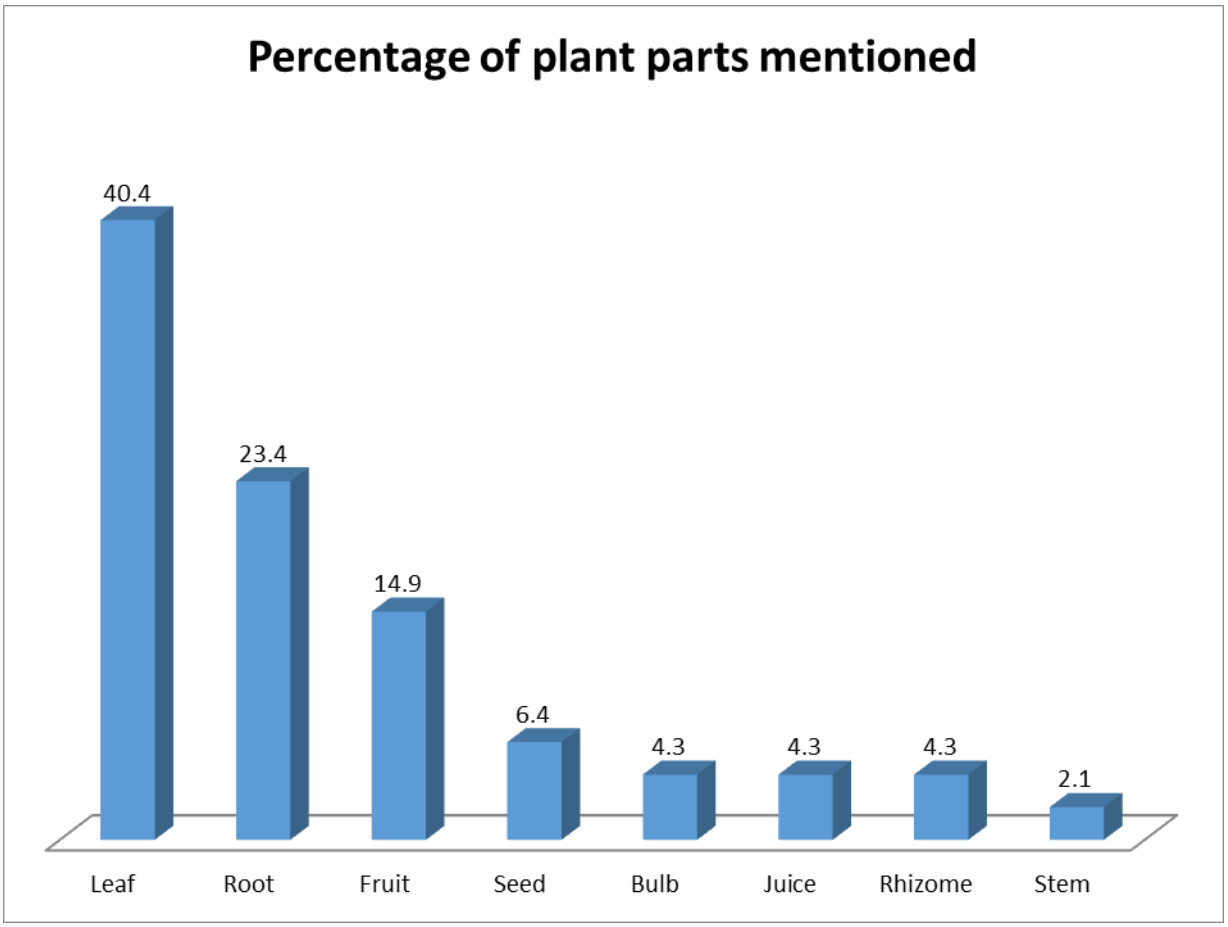


**Figure 2: Percentage distribution of plant parts mentioned by respondents**

**Table 3: Plants mentioned by respondents in the treatment of Hypertension and Diabetes mellitus**

| Botanical Name | Family | Local name | Plant part used | Disease | Use Mention Index (%) |
|---|---|---|---|---|---|
| *Acanthospermum hispidum* DC. | Asteraceae | Egun-igba | Leaf | DM | 3.3 |
| *Allium ascalonicum* L. | Liliaceae | Alubosa elewe | Leaf | HT | 3.3 |
| *Allium sativum* L. | Liliaceae | Ayu | Bulb | HT, DM | 13.3, 3.3 |
| *Anthocleista djalonensis* A.Chev. | Loganiaceae | Sapo | Leaf, Root | HT, DM | 6.7 |
| *Aristolochia ringens* Vahl. | Aristolochiaceae | Akogun | Root | HT, DM | 16.7, 3.3 |
| *Blighia sapida* K.D.Koenig | Sapindaceae | Isin | Fruit | HT | 3.3 |
| *Calotropis procera* Ait R.Br | Apocynaceae | Bomubomu | Leaf | HT | 3.3 |
| *Carica papaya* L. | Caricaceae | Ibepe | Leaf, Fruit, Root | HT, DM | 3.3, 3.3 |
| *Cassia alata* L. | Fabaceae | Kasia | Fruit | HT, DM | 3.3, 3.3 |
| *Citrus aurantifolia* (Christm.) Swingle | Rutaceae | Osan wewe | Leaf, Juice | HT, DM | 3.3, 3.3 |
| *Cocos nucifera* L. | Arecaceae | Agbon | Juice | DM | 20.0 |
| *Crinum jagus* (J. Thomps.) Dandy | Liliaceae | Ogede odo | Bulb | DM | 3.3 |
| *Curculigo pilosa* (Schumach. & Thonn.) Engl | Hypoxidaceae | Epakun | Rhizome | HT | 3.3 |
| *Cymbopogon citratus* L. | Poaceae | Tea oyinbo | Leaf | HT | 3.3 |
| *Daniellia oliveri* (Rolfe) Hutch. & Dalziel | Fabaceae | Iya | Leaf | HT | 3.3 |
| *Diospyros monbuttensis* Gurke | Ebenaceae | Eguneja | Leaf | DM | 3.3 |
| *Ficus asperifolia* Miq. | Moraceae | Ipin | Leaf | HT, DM | 6.7, 3.3 |
| *Gingko biloba* L. | Ginkgoaceae | Gbogbo | Root | HT | 3.3 |
| *Heliotropium indicum* L. | Boraginaceae | Agogo-igun | Leaf | HT, DM | 3.3, 3.3 |
| *Hunteria umbellata* K. Schum | Apocynaceae | Abeere | Fruit, Seed | HT, DM | 3.3, 33.3 |
| *Jatropha curcas* L. | Euphorbiaceae | Lapalapa | Root | DM | 3.3 |
| *Kigelia Africana* (Lam.) Benth. | Bignoniaceae | Pandoro | Fruit | DM | 3.3 |
| *Morinda lucida* Benth. | Rubiaceae | Oruwo | Leaf, root | HT | 3.3 |
| *Musa paradisiaca* L. | Musaceae | Ogede | Stem | DM | 3.3 |
| *Nauclea latifolia* Smith | Rubiaceae | Egbesi | Root | HT, DM | 3.3, 3.3 |
| *Ocimum grattisimum* L. | Lamiaceae | Efinrin | Leaf | HT, DM | 3.3, 10.0 |
| *Paquentina nigrescens* (Afzel.) Bullock | Apocynaceae | Ogbo | Leaf | HT | 3.3 |
| *Piper nigrum* L. | Piperaceae | Iyere | Fruit | HT | 3.3 |
| *Piptadeniastrum africanum* (Hook. f.) Brenan | Fabaceae | Agboin | Root | HT | 3.3 |
| *Pseudocedrela kotschyi* (Schweinf.) Harms | Meliaceae | Emigbegi | Leaf | HT | 3.3 |
| *Psidium guajava* L. | Myrtaceae | Guava | Leaf | HT | 3.3 |
| *Psorospermum febrifugum* Spach. | Hypericaceae | Legun oko | Root | HT | 3.3 |
| *Pyrus communis* L. | Rosaceae | Pear | Seed | HT | 3.3 |
| *Rauwolfia vomitoria* Afzel | Apocynaceae | Asofeyeje | Root | HT | 3.3 |
| *Securidaca longepedunculata* Fresen. | Polygalaceae | Ipeta | Root, seed | DM | 10.0 |
| *Talinum triangulare* (Jacq.) Willd. | Portulacaceae | Gbure | Leaf | HT | 3.3 |
| *Vernonia amygdalina* L. | Aster44aceae | Ewuro | Leaf | HT, DM | 3.3, 30.0 |
| *Viscum album* L. | Santalaceae | Afomo | Leaf | HT | 3.3 |
| *Xylopia aethiopica* (Dunal) A. Rich. | Annonaceae | Eeru | Fruit | HT | 3.3 |
| *Zingiber officinale* Roscoe | Zingiberaceae | Ataale | Rhizome | HT | 3.3 |

HT = Hypertension; DM = Diabetes mellitus

## CONCLUSION

Cadiovascular diseases are serious health challenges in Sub-Sahara Africa and the use of medicinal plants and traditional medicine should continuously be developed. Documentation of traditional practice is the first step in traditional medicine development, especially, using ethnomedicinal survey.

This survey has helped to increase available medicinal plants knowledge and document or source for further development and has revealed that traditional medical practitioners (TMPs) and herb sellers are becoming more aware of the need for cultivation of medicinal plants.

## REFERENCES


Adeneye, A.A. and Adeyemi, O.A. (2009). Further evaluation of antihyperglycaemic activity of *Hunteria umbellata* (K. Schum) Hallier f. seed extract in experimental diabetes J. of Ethnopharmacol. 126(2):238-243

Akinkugbe, O. (1990). Epidemiology of cardiovascular diseases in developing countries. J. hypertens. 8; 233 – 238.

DiNicolantonio, J. and Makridakis, S. (2014). Hypertension: Empirical evidence and implications in 2014. Open heart 1(1):e000048.

Faleyimu, O.I., Mohammed A. A. and Akinyemi, O. (2010). Efficacy of forest plants in the treatment of diabetes in Birnin Gwari Local Government Area, Kaduna State, Nigeria Int. J. Biomed. & Hlth. Sci. 6(1): 83-90

Gaziano, T. (2007). Reducing the growing burden of cardiovascular disease in the developing world. Health Aff. 26:13-24

Gbolade, A. (2012) Ethnobotanical study of plants used in treating hypertension in Edo State of Nigeria J. of Ethnopharmacol. 144 (1):1-10

Juárez-Rojop, I.E., Díaz-Zagoya, J.C., Ble-Castillo, J.L., Miranda-Osorio, P,H., Castell-Rodríguez, A.E., Tovilla-Zárate, C.A., Rodríguez-Hernández, A., Aguilar-Mariscal, H., Ramón-Frías, T. and Bermúdez-Ocaña, D.Y. (2012). Hypoglycemic effect of *Carica papaya* leaves in streptozotocin-induced diabetic rats BMC Complement. Altern. Med. 12:236-246

Kamaldeen A., Valentine, U.O, and Jamiu, O.M (2014). High Prevalence of Hypertension among Residents of Ilorin. J. of Sci. and Pract. Pharm. 1 (1): 54-58.

Kengne, A.P., Awah, P.K., Fezeu, L. and Mbanya, J.C. (2007). The burden of high blood pressure and related risk factors in urban Sub-Saharan Africa: Evidences from Douala in Cameroon, Afr Health Sci. 7(1): 38–44.

Kengne. A.P, Amoah, A.G. and Mbanya, J.C. (2005). Cardiovascular complications of diabetes mellitus in sub-Saharan Africa. Circulation 112:3592–3601.

Laslett, L.J., Alagona, P., Clark, B.A., Drosda, J.P., Saldivar, F., Wilson, S.R., Poe, C. and Hart, M. (2012). The Worldwide Environment of Cardiovascular Disease: Prevalence, Diagnosis, Therapy, and Policy Issues: A Report From the American College of Cardiology. Journal of the American College of Cardiology 60(25): 1-49

Namsa, N.D., Hui, T., Mandal, M., Das, A.K. and Kalita, P. (2009). An ethnobotanical study of traditional anti-inflammatory plants used by the Lohit community of Arunachal Pradesh, India. J. Ethnopharmacol. 125:234-245.

Okechukwu S Ogah, IkechiOkpechi, Innocent I Chukwuonye, Joshua O Akinyemi, Basden JC Onwubere, Ayodele O Falase, Simon Stewart, and Karen Sliwa, (2012). Blood pressure, prevalence of hypertension and hypertension related complications in Nigerian Africans: A review World J. Cardiol. 4(12): 327-340.

Olubomehin, O.O., Abo, K.A. and Ajaiyeoba, E.O. (2013). Alpha-amylase inhibitory activity of two *Anthocleista* species and *in vivo* rat model anti-diabetic activities of *Anthocleista djalonensis* extracts and fractions. J. of Ethnopharmacol. 146(3): 811-814

Raheem, U.A. (2011). Climate Change Related Disasters and Vulnerability: An Appraisal of the Nigerian Policy Environment. Environ. Res. J. 5(3): 97-103

Rahman, A.H.M. and Akter, M. (2016). Taxonomy and traditional medicinal uses of Apocynaceae (Dogbane) family of Rajshahi District, Int. J. Botany Stud. 1(2): 05-13

Suetsuna, K. (1998). Isolation and characterization of angiotensin I-converting enzyme inhibitor dipeptides derived from *Allium sativum* L (garlic), The J. Nutr. Biochem. 9(7): 415-419

Thomson, Al-Amin, Z.M. Al-Qattan, K.K., Shaban, L.H. and Ali, M. (2007). Anti-diabetic and hypolipidaemic properties of garlic (Allium sativum) in streptozotocin-induced diabetic rats, Int J. Diabetes and Metabol. 15: 108-115

Yadav, R.N.S, and Agarwala, M. (2011). Phytochemical analysis of some medicinal plants. J. Phytol. 3(12):10-14.
Yasmeen, M. and Prabhu, B. (2012). Antihyperglycemic and hypolipidemic activities of aqueous extract of Carica papaya Linn. leaves in alloxan-induced diabetic rats, J. Ayurveda Integr. Med. 70-74.

*Address for correspondence: Abdulkarim Agunu
Department of Pharmaacognosy and Drug Development, Faculty of Pharmaceutical Sciences, University of Ilorin, Ilorin, Nigeria
Telephone: +234-8033735843

E-mails: **agunu.a@unilorin.edu.ng**

Conflict of Interest: None declared

Received: 23 May, 2017

Accepted: 22 June, 2017