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# Nigerian medicinal plants with *in vivo* anti diabetic activity: A systematic review and Meta-analysis

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**Abstract**
The aim of this study was to systematically review the literature for scientific information on Nigerian medicinal plants with antidiabetic activity providing researchers with valuable information on the most common plants species and methods used. A search was carried out for studies investigating the antidiabetic activity of Nigerian medicinal plants using the following scientific data bases; science direct, Google scholar, PubMed and Directory of open access journals (DOAJ). The search included articles from January 2014-2019. To assess the quality of the Studies, the Jadad scale was used. The information recorded included; plant name, family, diabetic model used, Intervention, duration of study and Outcome. Randomized controlled trials which evaluated the hypoglycemic effects of plants with significant outcome of decrease in fasting blood glucose (FBG) were included. Most of the plants in this study showed significant glycemic control. There is need for further studies to identify the phytochemicals responsible for the activity.

**Keywords:** medicinal plants, antidiabetic, systematic review, meta-analysis

## 1. Introduction

Worldwide, approximately 422 million people suffer from Diabetes mellitus [1] and by the year 2040, the number of people with Diabetes mellitus is estimated to rise to 642 million globally [2]. Diabetes Mellitus (DM) is a chronic metabolic disorder characterized by inadequate secretion of insulin or development of insulin resistance. The disorder is characterized by hyperglycemia, polyuria, polydipsia and polyphagia. Diabetes mellitus is classified into two main types namely; type 1 and type 2 diabetes mellitus. Type 1 which is also called as insulin dependent diabetes is an autoimmune disorder leading to destruction of pancreatic β-cells which leads to decrease in the secretion of insulin [3].The increase in prevalence of diabetes and the side-effects of current drugs used in management of diabetes mellitus necessitates the need to search for alternatives [4,5]. About 80% of the populations in developing countries rely on medicinal plants as the main source of treatment of diseases [6, 7, 8].

The catalogue of antidiabetic medicinal plants is growing at a high rate especially in Africa. This may be due to the high cost of managing diabetes which forces patients to source for alternative and cheaper options. This overreliance on antidiabetic medicinal plants has probably invoked scientists to bioassay these plants in an effort to identify more hypoglycemic medicinal plants. The antidiabetic potential of some medicinal plants extracts has been demonstrated in human and animal models of type II diabetes [9]. There is an increase in the number of scientific publications on medicinal plants and diabetes [10]. Therefore the aim of this study is to systematically review the literature for scientific information on Nigerian medicinal plants with antidiabetic activity providing researchers with valuable information on the most common plants species and methods used.

## 2. Materials and Method

### 2.1 Sources of information and eligibility criteria

The present meta-analysis was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [11]. A search was carried out for studies investigating the antidiabetic activity of Nigerian medicinal plants using the following scientific data bases; science direct, Google scholar, Science direct, PubMed, Hindawi and Directory of open access journals (DOAJ). The search included articles from January 2014-2019. The Jadad scale was used to evaluate the quality of the studies [12]. The search terms were antidiabetic activity, medicinal plants. The search was limited to Nigerian authors. The information recorded include; name of plant, family, local name(s), diabetic model used, dose used, part of plant used, duration of study and Outcome.

### 2.2 Inclusion Criteria

Randomized controlled trials which evaluated the antidiabetic effects of plants with significant outcome of decrease in blood glucose were included. The search was limited to articles in English language and authors with Nigerian affiliation.

### 2.3 Exclusion Criteria

Articles with Jadad score less than three (3), studies targeting specific mechanism of action, *in vitro studies* and studies on diabetic complications were excluded.

## 3. Results

A total of 15,283 records were identified through database search; 3,830 entries for PubMed, 9591 from science direct, 121 from

**Table 1:** Animal studies on Nigerian Medicinal Plants

| S/N | Plants | Target | Groups | Intervention | Duration | Drug standard | Author(s) |
|---|---|---|---|---|---|---|---|
| 1 | *Tamarindus Indica* | Alloxan | Diabetic rats | 1000mg/kg 90%methanol stem-bark extract | 24hours | Metformin | Yerima, 2018 [13] |
| 2 | *Clerodendrum volubile* | Streptozocin | normal and diabetic rats | 400mg/kg n-butanol, ethyl acetate, methanol leaf extracts | 21days | glibenclamide | Erukainure *et al*., 2018 [14] |
| 3 | *Dennettia tripetala* | Streptozocin | normal and diabetic rats | 50mg/kg seed methanol extract | 10days | glibenclamide | Innocent *et al*.,2017 [15] |
| 4 | *Ocimum canum* | Streptozocin | diabetic rats | 100mg/kg methanol leaf extract | 15days | glibenclamide | Ononamadu *et al*., 2019 [16] |
| 5 | *Gouania longipetala* | Alloxan | diabetic rats | 150mg/kg methanol leaf extract | 21days | glibenclamide | Maxwell *et al*., 2014 [17] |
| 6 | *Thaumatococcus danielli* | Streptozocin | Normal and diabetic rats | 500mg/kg ethanol leaf extract | 14days | Glibenclamide | Folorunsho *et al*., 2019 [18] |
| 7 | *Balanites aegyptiaca* | Streptozocin | Normal and diabetic | 200mg/kg70% ethanol stem-bark extract | 120minutes | metformin | Mhya *et al*., 2016 [19] |
| 8 | *Cucumis sativus* | Alloxan | Diabetic rats | 400mg/kgAqueous stem-bark extract | 15days | metformin | Ibitoye *et al*., 2017 [20] |
| 9 | *Morinda lucida* | Alloxan | Normal and diabetic rats | 500mg/kg stem-bark aqueous extract | 8days | glibenclamide | Adeneye *et al*., 2017[21] |
| 10 | *Ocimum gratissimum* | Streptozocin | Normal and diabetic rats | 250mg/kg 80% methanol leaf extract | 28days | metformin | Stanley *et al*., 2017[22]] |
| 11 | *Sapium ellipticum* | Streptozocin | Normal and diabetic rats | 800mg/kg ethanol | 21days | metformin | Osasaneng 2017[23] |
| 12 | *Citrus aurantifolia* | Alloxan | normal and diabetic rats | 100mg/kg Aqueous | 14 days | Metformin | Ibrahim *et al*., 2018 [24] |
| 13 | *Ricinus comminus* | alloxan | normal and diabetic rats | 400mg/kgSeed methanol extract | 21days | metformin | Nwodo *et al*., 2016 [25] |
| 14 | *Salacia lehmbachii* | alloxan | normal and diabetic rats | 400mg/kg 96% methanol Stem bark | 21 days | glibenclamide | Joseph *et al*., 2018 [26] |
| 15 | *Uvaria chamae* | Alloxan |  | 400 mg/kg Root ethanol | 15days | glibenclamide and pioglitazone | Jonathan *et al*., 2018 [27] |
| 16 | *Aristolochia ringens* | streptozotocin | diabetic rats | 150mg/kg Methanol leaf and stem bark | 7days | metformin | Sulayman *et al*., 2019 [28] |
| 17 | *Jatropha curcas* | Alloxan | normal and diabetic rats | Methanol leaf | 7days | metformin | Aina *et al*., 2016 [29] |
| 18 | *Massularia acuminata* | alloxan | diabetic rats | 89.44 mg/kg 70% ethanol Stem | 5days | glibenclamide | Emmanuel *et al*., 2018 [30] |
| 19 | *Strophanthus hispidus* | Alloxan | normal and diabetic rats | 200mg/kg Aqueous Root | 28 days | Glibenclamide | Fageyinbo *et al*., 2019 [31] |
| 20 | *Moringa oleifera* | Alloxan | diabetic rats | Ethanol 800mg/kg seeds,leaves, stem, roots | 6hours | acarbose | Idakwoji *et al*., 2016 [32] |
| 21 | *Vernonia amygdalina* | streptozotocin | diabetic rats | 200mg/kg Chloroform Leaves | 28days | metformin | Stanley *et al*., 2019 [33] |
| 22 | *Anogeissus leiocarpus* | alloxan | diabetic rats | 200mg/kg Ethanol roots | 24hours | glibenclamide | Omeje *et al*., 2016 [34] |
| 23 | *Mitracarpus Scabrum* | Alloxan | normal and diabetic rats | 300mg/kg leaves | 14days | glibenclamide | Abubakar *et al*., 2016 [35] |
| 24 | *Hoslundia opposita* | alloxan | normal and diabetic rats | 220 mg/kg Seed oil | 96hours | metformin | Jubril, *et al*., 2014 [36] |
| 25 | *Senna singueana* | Streptozotocin | normal and diabetic rats | 300mg/kg Acetone Stem-bark | 28days | metformin | Mohammed and Shahidul 2014 [37] |
| 26 | *Parkia biglobosa* | streptozotocin | normal and diabetic rats | 300mg/kg n-butanol leaves | 5days | Metformin | Mohammed *et al*., 2016 [38] |
| 27 | *Blighia sapida* | Alloxan | normal and diabetic rats | 400mg/kg methanol leaves | 28days | glibenclamide | Oloyede *et al*., 2014[39] |
| 28 | *Chrysophyllum albidum* | alloxan | normal and diabetic rats | 200 mg/kg ethanol Seeds | 7days | metformin | Engwa *et al*., 2016[40] |
| 29 | *Anthocleista vogelii* | alloxan | normal and diabetic rats | 200mg/kg Root bark Chloroform | 21days | glibenclamide | Anyanwu *et al*., 2018[41] |
| 30 | *Synsepalum dulcificum* | streptozotocin | normal and diabetic rats | 60 mg/kg 80% methanol Leaves | 21days | glibenclamide | Obafemi, *et al*., 2019[42] |
| 31 | *Cola nitida* | fructose and streptozotocin | normal and diabetic rats | 300 mg/kg aqueous seeds | 42days | Metformin | Ochuko *et al* 2019 [43] |
| 32 | *Curculigo pilosa* | streptozotocin | normal and diabetic rats | methanol, n-butanol Rhizomes | 28days | glibenclamide | Kayode and Charles, 2019 [44] |
| 33 | *Phyllanthus fraternus* | streptozotocin | normal and diabetic rats | 200-300mg/kg leaves | 28days | metformin | Nadro and Elkanah 2017[45] |
| 34 | *Phoenix Dactylifera* | Alloxan | normal and diabetic rats | 400mg/kg ethanol seeds | 14days | glibenclamide | Abiola *et al*., 2018[46] |
| 35 | *Acacia ataxacantha* | streptozotocin | normal and diabetic rats | 125-500mg/kg 95% ethanol Roots | 7days | metformin | Arise *et al*., 2016[47] |
| 36 | *Borassus aethiopum* | Alloxan | normal and diabetic rats | 100-500mg/kg aqeous fruit | 28days | glibenclamide | Issaka *et al*., 2016[48] |
| 37 | *Cnidoscolus aconitifolius* | streptozotocin | normal and diabetic rats | 500 mg/kg | 28days | glibenclamide | Achi *et al*., 2016[49] |
| 38 | *Adansonia digitata* | Alloxan | normal and diabetic rats | 200mg/kg fruit aqueous | 14days | Chlorpropamide | Muhammad *et al*., 2016[50] |
| 39 | *Newbouldia laevis* | alloxan | normal and diabetic rats | 250-1000mg/kg Hydro alcohol leaves | 24hours | glibenclamide | Osigwe *et al*., 2015[51] |
| 40 | *Ceiba pentandra* | Alloxan | normal and diabetic rats | 200-800mg/kg stem-bark methanol | 14days | glibenclamide | Odoh *et al*., 2016[52] |
| 41 | *Tabernaemontana pachysiphon* | alloxan | normal and diabetic rats | 125-1000mg/kg methanolstem bark | 14days | glibenclamide | Osamuyi *et al*., 2017[53] |
| 42 | *Ageratum conyzoides* | streptozotocin | normal and diabetic rats | 200-800mg/kg ethyl acetate, leaves | 14days | metformin | Agbafor *et al*., 2015 [54] |
| 43 | *Myrianthus arboreus* | streptozotocin | normal and diabetic rats | 100-400mg/kg Ethanol stem bark | 28days | glibenclamide | Dickson *et al*., 2016 [55] |
| 44 | *Dioscoreophyllum cumminsii* | alloxan | diabetic rats | 50-300mg/kg leaves | 21days | glibenclamide | Oloyede *et al*., 2015[56] |

Directory of open access journals (DOAJ), 1051 from Hindawi and 690 from Google scholar. After duplicate papers were discarded and filters applied a selection of 5,986 studies remain. 5, 714 studies were screened out by reading the title paper, abstract and full paper for the following reasons; 5,535 did not meet the inclusion criteria, 123 studies had a Jadad Scale less than three (3), 35 studies were *in vitro* studies and 33 studies were on diabetic complications. A total of 44 articles were included in this study.

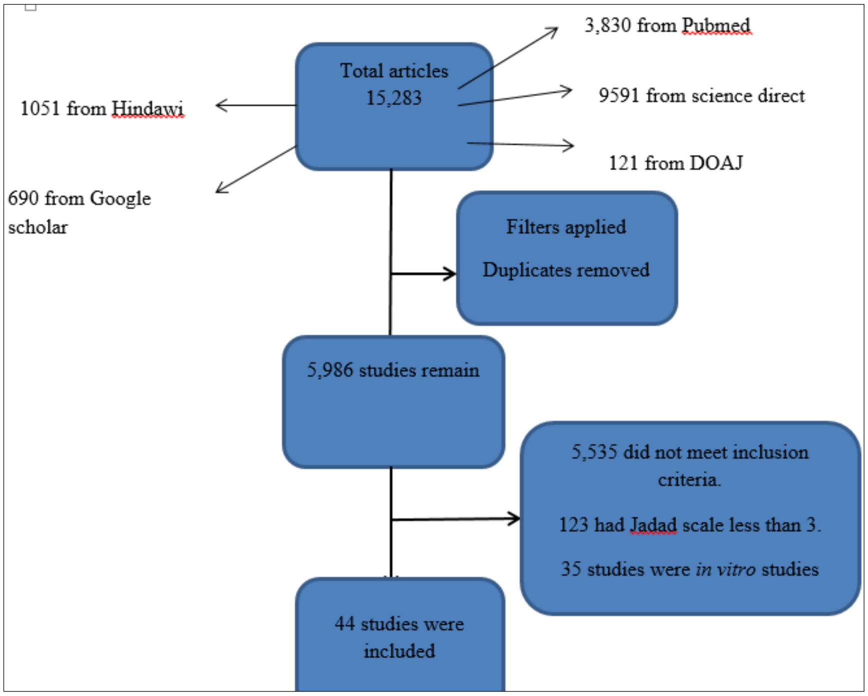


**Fig 1:** Flowchart of the selection of the articles

Plant parts used as material for the extraction and biological activity should be based on the ethnopharmacological use of the plants. This will direct researchers interested in isolation and characterization of active phytochemicals as well as researchers interested in clinical studies [57]. In the present study, 35.56% used leaves, 17.78% used stem bark, 11.11% seeds, 4.44% rhizomes, 11.11% fruit, 13.33% roots and 6.67% used mixed plant parts. Among the plants, 60% were trees, 31.11% shrubs and 8.89% herbs.

Chemical methods for the induction of diabetes provide a simple and cost effective model of diabetes in animals [58]. In the articles reviewed, 55.56% used alloxan to induce diabetes, 42.22% used Streptozocin while 2.22% used combination of Streptozocin and fructose. 88.89% of studies chose the oral route to administer plant extracts, while 11.11% chose the intraperitoneal route.

## Conclusion

The systematic review and meta-analysis on Nigerian medicinal plants with antidiabetic activity will provide researchers with valuable information on the most common plants species and methods used.

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