

**MEDICINAL PLANTS USED IN THE MANAGEMENT OF ASTHMA: A REVIEW****Omolola Temitope Fatokun\*, Tosin Ejiro Wojuola, Kevwe Benefit Esievo and Oluyemisi Folashade Kunle**

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**ABSTRACT**

Nigeria has a rich tradition of plant-based knowledge on healthcare. A large number of plants/plant extracts, juices or pastes are equally used by different tribes and folklore traditions in Nigeria for management of asthma. The present review thus attempts to analyze the ethno-botanical/ethno-pharmacological knowledge-base for managing asthma in the country from literature, which includes the use of plants, methods employed and prevailing folklore practices. Information was sourced from Hinari, JSTOR, PubMed, Medline, African Journals Online, Google Scholar, SCOPUS, and by reviewing the references of relevant literature. The data search was up-to-date as of May 31, 2016. Pharmacological reports available on medicinal plants employing various anti-asthmatic methods/models and their underlying molecular mechanisms, wherever available, have also been reviewed. The pharmacological validation on medicinal plants is very limited and as such a large number of plants used, with enormous potential have not been validated for their anti-asthmatic activity. Information on the compounds isolated from the medicinal plants, responsible for the observed anti-asthmatic activity is very limited however flavonoids and xanthenes have been implicated. This review therefore attempts to show the loop holes and bridge the gap in the existing literature and thus offers immense scope for researchers engaged in validation of traditional claims and development of safe, effective and globally accepted herbal drugs for asthma.

**KEYWORDS:** Asthma, inflammation, medicinal plants, ethno-pharmacology.**INTRODUCTION**

Asthma is a chronic inflammatory condition, characterized by airway hyper-responsiveness to a variety of stimuli largely of allergic origin with reversible airflow limitation. The major clinical features of asthma are wheezing, shortness of breath and cough.<sup>[1]</sup> It is a major cause of impaired quality of life with impact on work and recreational as well as physical activities and emotions. The goal of treatment is to achieve overall clinical control, which entails the achievement of symptom-free status and to minimize future risks. It primarily involves the achievement of symptom relief, reduction in the use of inhalers, improvement in activity and lung function. Future risk minimization is achieved by ensuring the absence of asthma exacerbations, the prevention of accelerated decline in lung function over time and no side-effects from medications.<sup>[2]</sup>

The prevalence of asthma is variable. It is a disease that has been observed to be more prevalent in developed countries with higher rates seen in Australia, United Kingdom and New Zealand. In Nigeria, the prevalence of asthma ranges from 7% to 18% in the general population, 14.1% of students in the south west, 14.2% of adolescents in the south east and adult in the north central parts.<sup>[3], [4], [5], [6]</sup> Sex ratio varies according to

age.<sup>[5]</sup> In childhood, asthma affects more boys than girls for unknown reasons, but by the third decade, the prevalence becomes equal and subsequently, more women than men are affected.<sup>[5], [6]</sup> Since 1970s, the global prevalence, morbidity, mortality and economic burden of asthma have increased, particularly in children.<sup>[7]</sup>

Asthma affects about 235 million people worldwide.<sup>[8]</sup> The incidence of asthma has been on the increase over the past 30 years due to changing environmental factors, particularly in the low- and middle-income countries that are least able to absorb its impact.<sup>[8]</sup> Asthma causes an estimated 250,000 deaths annually (1 in 250 deaths worldwide). Fifty years ago, asthma was uncommon in Nigeria; however recent reports from different parts of the country have shown a prevalence of adolescent and adult asthma in excess of 10% and a rising trend in the prevalence of the ailment.<sup>[8]</sup> The increase in the burden of asthma has been attributed to environmental factors such as urbanization, industrialization and adoption of western life-style.<sup>[5]</sup>

**Pathology**

Asthma is caused by a complex relationship between environmental and genetic factors that is not fully

understood. It is considered to be a syndrome or complex symptom characterized by three primary abnormalities. 1. Partially reversible airway obstruction. 2. Airway inflammation. 3. Hyper-sensitivity to different stimuli by the airway.<sup>[9], [10]</sup> The major problem in asthma seems however to be immunological. Asthma has been reported to be mediated by reagenic (IgE) antibodies bound to mast cells in the airway mucosa and on re-sensitization to an antigen/trigger factor, interaction between the antigen and antibody on the mast cell surface leads to the release of mediators already present in the cell granules and the production and release of other mediators.<sup>[11]</sup>

Many things often trigger asthmatic attack. Of particular note is inhalation of dust, especially when sweeping an enclosure, of smoke from frying or the burning of dried or wet grass. It has been noted that asthmatic patients suffer more during the wet season in Nigeria and from cough and cold that are the natural twin companions of the ailment.

The orthodox treatment for the management of acute attack and day to day therapy of asthma may involve the use of bronchodilators, expectorants and corticosteroids.

**Table 1: Some adverse effects of current orthodox treatments used in asthma<sup>[12]</sup>**

| Orthodox Drug    | Common Adverse Effects Encountered   |
|------------------|--|
| Isoprenaline     | Tachycardia  |
| Salbutamol       | Muscle tremors (dose related), palpitation, restlessness, nervousness, throat irritation and ankle edema   |
| Theophylline     | Convulsions, shock, arrhythmias, increased muscle tone, tachapnoea, (dose dependent) flushing, hypotension, restlessness, tremors, vomiting, palpitation, diuresis, dyspepsia, insomnia etc.   |
| Anticholinergics | Dry mouth, difficulty in swallowing and talking, scarlet rash, photophobia, blurring of near (Atropine and its congeners) vision, palpitation, ataxia, delirium, hallucinations, hypotension, weak and rapid pulse, cardiovascular collapse with respiratory depression, convulsions and coma (in severe poisoning).   |
| Ketotifen        | Sedation, dizziness, dry mouth, nausea and weight gain.  |
| Corticosteroids  | Cushing's habitus, fragile skin, purple striae, hyperglycemia, muscular weakness, susceptibility to infection, delayed healing of wounds and surgical incisions, peptic ulceration, osteoporosis, glaucoma, growth retardation, psychiatric disturbances, suppression of hypothalamo-pituitary-adrenal (HPA) axis etc. |

Due to some of the adverse effects brought about by orthodox medicines (Table 1), the search for non-drug strategies that are effective, have low-risk, and provide a useful alternative treatment in asthma management is clinically attractive and relevant. There is growing interest in herbal remedies using medicinal plants and complementary and alternative medicine and its use in the management and treatment of asthma.<sup>[13]</sup> Medicinal plants are those plants, which have constituents implicated in the treatment or prevention of diseases or infections in the human body. From the earliest times, humanity has used plants in an attempt to cure diseases and relieve symptoms of various ailments. The most important of these substances are the alkaloids, flavonoids, terpenes, essential oils, etc. Medicinal plants used for the treatment of asthma should have anti-inflammatory, immune-modulatory, antihistaminic, smooth-muscle relaxant and anti-allergic activities.<sup>[14]</sup> This study describes some plants in Nigeria that have been pharmacologically evaluated for those parameters involved in asthma.

#### **ETHNO-BOTANICAL APPROACHES TO THE MANAGEMENT OF ASTHMA- NIGERIAN PERSPECTIVE**

Many of the medicinal plants used traditionally in the management of asthma are from the families;

Euphorbiaceae, Mimosaceae, Asteraceae, Amarylidaceae amongst others (Table 2). For reasons such as ease in collection and availability, the following plant parts are used in decreasing order: bark>leaf>root>fruit>bulb>whole plant>rhizome>flower>seed. Both absolute ethanol and different concentrations of ethanol: water are commonly used as solvent for preparations. Alcohol is known to extract organic compounds and water extracts polar constituents. The use of herbs in cocktail form is a common practice in the management of Asthma (Table 3). Some herbs may not have direct anti-asthmatic activities but may be present in the recipe to give the preparation an appealing taste. Recipes used for asthma were more in the western part of Nigeria and may be due to the higher prevalence of asthma compared to other parts of the country. There is also a higher recorded use of herbal medicines by people of the West as compared to other parts of Nigeria.<sup>[15]</sup> Though it was not indicated, it is believed that a synergistic effect from the combination of plants used in the management of asthma would be more effective than the individual plants.<sup>[17], [18]</sup>

**Table 2: Ethnobotanical Distribution of some common medicinal plants used in the management of asthma in Nigeria**

| Botanical Name (family)  | Common Name                          | Local name  | Parts used        | Preparation And Administration                       |
|--|--------------------------------------|---|-------------------|--|
| <b>Western Part of Nigeria</b> <sup>[13], [18], [19], [20]</sup> |                                      |   |                   |  |
| <i>Abrus precatorius</i> (Papilionaceae)                         | Jequirity, crabs eye                 | Empo (E), iwerejeje (Y), anya nnu (I), Da marzaya (H) | Leaf              | Leaf extract is chewed                               |
| <i>Acacia nilotica</i> (Mimosaceae)                              | Babul, prickly acacia                | Booni (Y), Bagaruwa (H)                               | Fruit             | ***  |
| <i>Adansonia digitata</i> (Bombaceae)                            | Baobab                               | Ose (Y), Igi-ose (I), kukaa (H)                       | Fruit pulp, Fruit | ***  |
| <i>Aframomum melegueta</i> (Zingiberaceae)                       | Grains of paradise, alligator pepper | Atare (Y), Gyandamaryaji (H)                          | Rhizome           | ***  |
| <i>Agave sisalana</i> (Agavaceae)                                | Sisal, sisal hemp                    | Godengoal,  | Leaves            | ***  |
| <i>Allium ascalonicum</i> (Liliaceae)                            | Shallot                              | Alubosa elewe (Y), Alubasa maigo (H)                  | Leaf              | ***  |
| <i>Allium cepa</i> (Liliaceae)                                   | Bulb onion, common onion             | Alubasa (H), Alubosa (Y), Yabosi (I)                  | Bulb              | Decoction is taken orally                            |
| <i>Allium sativum</i> (Liliaceae)                                | Garlic                               | Nikhere (E), aayu (Y), Ayo-ishi (I), Tafarunua (H)    | Bulb              | Decoction is taken orally                            |
| <i>Amaranthus spinosus</i> (Amaranthaceae)                       | Green                                | Obiwhne(E), Tete (Y), Opotoko (I)                     | Roots             | Roots are mashed, soaked in ethanol and taken orally |
| <i>Anacardium occidentale</i> (Anacardiaceae)                    | Cashew nut tree                      | Kaju (Y), Sas-hu (I), Kanju (H)                       | Bark              | Decoction is taken orally                            |
| <i>Ananas comosus</i> (Bromeliaceae)                             | Pineapple                            | Edin-ebo(E), ope oyinbo (Y), Akwu-olu (I), Abara (H)  | Fruit             | Ripe fruit is eaten                                  |
| <i>Anogeissus leiocarpus</i> (Combretaceae)                      | Axlewood                             | Ayin (Y), Atara (H)                                   | Stem-bark         | Decoction is taken orally                            |
| <i>Anthocleista djalonensis</i> (Loganiaceae)                    | Cabbage tree                         | Sapo (Y), Kwari (H)                                   | Bark              | Decoction is taken orally                            |
| <i>Antigonon leptopus</i> (Polygonaceae)                         | Coral vine                           | ***   | Root              | Decoction is taken orally                            |
| <i>Aristolochia ringens</i> (Aristolochiaceae)                   | Dutchman's pipe, snake work          | Ako-igun (Y)  | Root              | Decoction is taken orally                            |
| <i>Bridelia ferruginea</i> (Euphorbiaceae)                       | Ira                                  | Ira (Y), kirni  | Stem-bark         | Decoction is taken orally                            |
| <i>Calliandra portoricensis</i> (Mimosaceae)                     | Corpse awakener                      | Tude (Y), oga, ule                                    | Root              | Decoction is taken orally                            |
| <i>Carica papaya</i> (Caricaceae)                                | Pawpaw                               | Ibepe (Y), ojo (Y), Abara (H)                         | Dry leaf          | The smoke of burnt leaf is inhaled                   |
| <i>Chasmanthera dependens</i> (Menispermaceae)                   | Chasmanthera                         | Ato (Y)   | Stem              | Decoction is taken orally                            |
| <i>Chrysophyllum albidum</i> (Sapotaceae)                        | African star apple                   | Agbalumo (Y), Agwaliba (H), Udala (I)                 | Stem-bark         | Decoction is taken orally                            |
| <i>Cocos nucifera</i> (Arecaceae)                                | Coconut palm                         | Agbon (Y), kwakwar (H)                                | Fruit             | ***  |
| <i>Conyza sumatrensis</i> (Compositae)                           | Conyza                               | Olowonjeja (Y)  | whole plant       | ***  |
| <i>Crassocephalum rubens</i> (Asteraceae)                        | Ebire                                | Ebolo (Y), Ebire (E)                                  | Leaf              | ***  |
| <i>Crinum jagus</i> (Amaryllidaceae)                             | Poison bulb, frest crinum            | Ogede-odo (Y), Albasar Kwadi (H)                      | Bulb              | ***  |
| <i>Dioclea reflexa</i> (Leguminosae)                             | Dioclea, bull's eye                  | Agbarin(Y)  | Seed              | ***  |
| <i>Dissotis rotundifolia</i> (Melastomataceae)                   | Chickweed, starwort, star weed,      | Ajagunmorasin (Y)                                     | Whole plant       | ***  |
| <i>Drypetes chevalieri</i> (Euphorbiaceae)                       | Drypetes                             | Osunsun-iro (Y)                                       | Leaves            | ***  |
| <i>Elaeophorbia drupifera</i>                                    | Asthma plant                         | Oroigi (Y), Oroonigi (Y)                              | Leaves, stem      | ***  |

|   |                                      |   |   |   |
|---|--------------------------------------|---|---|---|
| (Euphorbiaceae)                                   |                                      |   | bark, roots, latex                      |   |
| <i>Eugenia aromatic</i> (Myrtaceae)               | ***                                  | Kanafuru (H)                              | Flower                                  | ***   |
| <i>Euphorbia hirta</i> (Euphorbiaceae)            | Asthma plant, asthma weed            | Ba ala (I), Akun esan (Y), Asin uloko (E) | Fresh leaf, Flower                      | Decoction is taken orally, It is prepared as soup which is taken orally |
| <i>Euphorbia lateriflora</i> (Euphorbiaceae)      | Little cactus, Scutellann            | Enu-opiri (Y)                             | Stem                                    | ***   |
| <i>Flacourtia flavescens</i> (Flacourtiaceae)     | Flacourtia                           | Osere (Y)                                 | Leaves, root                            | ***   |
| <i>Gambeya africana</i> (Sapotaceae)              | African breadfruit                   | Baaka (Y), Ekpiro (E)                     | Fruit                                   | ***   |
| <i>Garcinia kola</i> (Clusiaceae)                 | Bitter kola                          | Orogbo (Y), Adu (I), Namiji goro (H)      | Root, seed, bark                        | Decoction is taken orally after food                                    |
| <i>Gongronema latifolia</i> (Asclepiadaceae)      | Amaranth globe                       | Madunmaro (Y), Utazi (I)                  | Root                                    | ***   |
| <i>Gossypium barbadense</i> (Malvaceae)           | West indian cotton                   | Owu (Y), gwandi                           | Seed                                    | ***   |
| <i>Harungana madagascariens</i> (Hypericaceae)    | Dragon's blood tree                  | Amuje (Y), Alililibar (H) Uturu (I)       | Bark                                    | Decoction is taken orally   |
| <i>Khaya ivorensis</i> (Meliaceae)                | African mahogany                     | Oganwo (Y), Madachi (H)                   | Bark                                    | Decoction is taken orally   |
| <i>Kigelia Africana</i> (Bignoniaceae)            | Sausage tree                         | Pandoro (Y), Rawuya (H)                   | Stem-bark                               | ***   |
| <i>Lactuca taraxifolia</i> (Asteraceae)           | Lettuce                              | Yanrin (Y), Namijin dayi (H)              | Leaf                                    | ***   |
| <i>Lannea nigritana</i> (Anacardaceae)            | Wodier wood                          | Orita (Y)                                 | Leaves, root bark, exudate.             | ***   |
| <i>Leersia hexrandra</i> (Poaceae)                | Leersia                              | Abeko (Y)                                 | Leaves                                  | ***   |
| <i>Mimosa pigra</i> (Mimosaceae)                  | Catclaw Mimosa                       | Ewon agogo (Y), Gumbi (H)                 | Stem                                    | ***   |
| <i>Musa sapientum</i> (Musaceae)                  | Banana                               | Ogede were (Y),                           | Fruit                                   | ***   |
| <i>Musanga cecropioides</i> (Moraceae)            | Corkwood, Umbrella tree              | Agbawo (Y)                                | Bark                                    | ***   |
| <i>Napoleona vogelii</i> (Lecythidaceae)          | Napoleona                            | Gbogbori (Y)                              | Leaves, bark, seeds, twigs, fruit, root | ***   |
| <i>Nauclea africana</i> (Rubiaceae)               | African Peach, Nauclea               | Egbesi (Y), Tafashiya rkura (H)           | Root                                    | ***   |
| <i>Nicotiana tabacum</i> (Solanaceae)             | Tobacco                              | Taba (H), Otaba (Y)                       | Leaf                                    | ***   |
| <i>Olax subscorpioidea</i> (Olacaceae)            | Olax, Stink ant forest               | Ifon (Y)                                  | Root                                    | ***   |
| <i>Opuntia dillenii</i> (Cactaceae)               | Prickly pear                         | Oro-agogo (Y)                             | Stem, fruits, exudate.                  | ***   |
| <i>Oxytenanthera abyssinica</i> (Gramineae)       | Savanah bamboo                       | Aparun (Y), Kawu (H)                      | Root                                    | ***   |
| <i>Picralima nitida</i> (Apocynaceae)             | Picralima                            | Erin (Y), Osu igwe (I)                    | Fruit                                   | ***   |
| <i>Piliostigma reticulatum</i> (Leguminosae)      | Kargo, Piliostigma                   | Abafe (Y), Abafin (Y), Kargoo (H)         | Bark                                    | Decoction is taken orally   |
| <i>Pterygota macrocarpa</i> (Sterculiaceae)       | Trade pterygota, African pterygota   | Opoporo (Y)                               | Root, stem bark                         | Decoction is taken orally   |
| <i>Saccharum officinarum</i> (Gramineae)          | Sugar cane                           | Ireke (Y), Rakee (H)                      | Stem                                    | The stem is chewed and the juice extracted                              |
| <i>Sansevieria liberica</i> (Agavaceae)           | Bowstring hemp                       | Mooda, Ebube age, Oja-ikoko               | Leaves, Root                            | ***   |
| <i>Securidaca longepedunculata</i> (Polygalaceae) | Violet tree, mother of all medicines | Ipeta (Y), Sanya Umar (H)                 | Root                                    | ***   |
| <i>Strophanthus hispidus</i> (Apocynaceae)        | Strophantus, arrow poison plant      | Sagere (Y), Kaguru (H)                    | Bark                                    | ***   |

|   |                                     |  |                                 |   |
|---|-------------------------------------|--|---------------------------------|---|
| <i>Terminalia glaucescens</i><br>(Combretaceae)                   | ***                                 | Idi-odan (Y), Baushe (H)                     | Stem-bark                       | ***   |
| <i>Terminalia ivorensis</i><br>(Combretaceae)                     | Black afara,                        | Awun-shin (Y)                                | Stem-bark                       | ***   |
| <i>Tetrapleura tetraptera</i><br>(Mimosaceae)                     | Aridan                              | Aidan (Y), Alangon daji (H)                  | Fruit                           | ***   |
| <i>Uvaria chammae</i><br>(Annonaceae)                             | Cluster pear                        | Gbogbonse (Y), Mmimiohia (I)                 | Root-bark                       | ***   |
| <i>Vitex doniana</i> (Verbenaceae)                                | Black plum                          | Oori (Y), Uchakoro (I), Dinyar (H)           | Bark                            | ***   |
| <i>Xylopiya aethiopica</i><br>(Annonaceae)                        | Ethiopian pepper                    | Eeru (Y), Kimba (H)                          | Fruit                           | ***   |
| <i>Zingiber officinale</i><br>(Zingiberaceae)                     | Ginger                              | Tsita maiyatsu(H), Atare (Y)                 | Rhizome                         | ***   |
| <b>Eastern Part of Nigeria</b> <sup>[14], [20], [21], [22]</sup>  |                                     |  |                                 |   |
| <i>Acalypha godseffiana</i><br>(Euphorbiaceae)                    | Acalypha                            | Jinwinini (Y), Kandiri (H)                   | Leaf                            | ***   |
| <i>Asystasia gangetica</i><br>(Acanthaceae)                       | Chinese violet                      | ***  | Leaves                          | Chew 7 fresh leaves   |
| <i>Borassus aethiopum</i><br>(Palmae)                             | African fan Palm                    | Agbon-olodu (Y), Agbon-onidu (Y), Ubiri (I). | Roots, juice of nut             | ***   |
| <i>Caesalpinia cristata</i><br>(Caesalpinaceae)                   | Bonduc nut, fever nut               | ***  | Leaves, roots, seeds            | ***   |
| <i>Ceiba pentandra</i><br>(Bombacaceae)                           | White silk cotton tree, kapok, fuma | Araba (H), Egungun (Y)                       | Flowers, leaves, bark, exudate. | ***   |
| <i>Deinbollia pinnata</i><br>(Sapindaceae)                        | Water willow                        | Ekusi-oloko (H), Ogiri-egba (Y),             | Leaf                            | ***   |
| <i>Desmodium adscendens</i><br>(Leguminosae)                      | Desmodium                           | Epa-ile (Y), Nbasioku (I)                    | Leaves, whole plant             | ***   |
| <i>Europhorbia convolvuloides</i><br>(Euphorbiaceae)              | Asthma herb                         | Egele (Y), Udani (I), Nonan kurdiya (H)      | Leaves                          | ***   |
| <i>Hibiscus rosasinensis</i><br>(Malvaceae)                       | Garden hibiscus                     | Ireagu (I)                                   | Leaves, stem, flower buds       | ***   |
| <i>Ipomoea mauritiana</i><br>(Convolvulaceae)                     | Bush morning glory                  | Atewogba (Y),                                | Whole plant                     | ***   |
| <i>Morinda morindoides</i><br>(Rubiaceae)                         | Morinda                             | Oju-ologbo (I)                               | Root, bark, leaf                | ***   |
| <i>Neuboldia laevis</i><br>(Bignoniaceae)                         | African tylop tree                  | Akoko (Y), Ogilisi/ogirisi (I), Aduruku (H)  | Leaves                          | ***   |
| <i>Picalima nitida</i><br>(Apocynaceae)                           | Picalima                            | Erin (Y), Osu igwe (I)                       | Fruit                           | ***   |
| <i>Pterocarpus osun</i><br>(Leguminosae)                          | Bloodwood                           | Osun (Y), Ubie (I)                           | Root, stem bark                 | ***   |
| <i>Spathodea cumpanulata</i><br>(Bignoniaceae)                    | African tulip                       | Adumku (H), Akoko (Y), Ogili-si (I)          | Leaf                            | Leaf extract is chewed  |
| <b>Northern Part of Nigeria</b> <sup>[20], [23], [24], [25]</sup> |                                     |  |                                 |   |
| <i>Acalypha fimbriata</i><br>(Euphorbiaceae)                      | Acalypha                            | Jinwinini, kandiri (H)                       | Leaves                          | ***   |
| <i>Adansonia digitata</i><br>(Bombacaceae)                        | African baobab                      | Ose (Y), Igiöse (I), Kukaa (H)               | Leaves                          | Young leaves are dried very well, then ground and added to hot pap. |
| <i>Amorphophallus dracantioides</i><br>(Anacardiaceae)            | ***                                 | Gwazar (H), gaadali (H)                      | Tubers                          | ***   |
| <i>Calotropis procera</i><br>(Asclepiadaceae)                     | Giant milk weed, sodom apple        | Tumfatiya (H)                                | Leaves, root, bark, latex.      | ***   |
| <i>Canna indica</i><br>(Cannaceae)                                | Indian shot                         | Idodo (Y), Gwangwama (H)                     | Leaves                          | ***   |
| <i>Carica papaya</i><br>(Caricaceae)                              | Pawpaw                              | Ibepe (Y), Ojo (Y), Abara (H)                | Leaves                          | The leaves squeezed in cold water sieved and                        |

|  |  |  |                      | drunk, first in the morning and last in the evening |
|--|--|--|----------------------|---|
| <i>Cocos nucifera</i><br>(Arecaceae)                 | Coconut palm                               | Agbon (Y), Kwakwar (H)                                 | Fruit                | ***   |
| <i>Crinum jagus</i><br>(Amaryllidaceae)              | Poison bulb, frest crinum                  | Ogede-odo (Y), Albasar Kwadi (H)                       | Bulb                 | ***   |
| <i>Datura metel</i><br>(Solanaceae)                  | Devil's trumpet, hairy thorn apple         | Apikan (Y), Ajegunee (Y), alkanjado (H), Furenjuji (I) | Leaves               | ***   |
| <i>Gossypium barbadense</i><br>(Malvaceae)           | West indian Cotton                         | Gwandi (H)   | Leaves, roots, seeds | ***   |
| <i>Ipomoea batatas</i><br>(Convolvulaceae)           | Sweet potato                               | Odunkun, anamo (Y) kunkundukun, Dankali (H), Ekomako   | Leaves, tuber.       | ***   |
| <i>Ipomoea involucrata</i><br>(Convolvulaceae)       | Morning glory, moonflower                  | Duman kwadii (H)                                       | Leaf                 | Decoction is used.                                  |
| <i>Lactuca taraxifolia</i><br>(Asteraceae)           | Lettuce                                    | Yanrin (Y), Namijin dayi (H)                           | Leaf                 | ***   |
| <i>Moringa oleifera</i><br>(Moringaceae)             | Moringa, drumstick                         | Zogale (H), Ewe-ile (Y), Okweoyeibe (I)                | Leaf                 | ***   |
| <i>Phoenix dactylifera</i><br>(Palmae)               | Date palm                                  | Okun (Y), Kijinjiri (H)                                | Fruits, sap, leaves  | ***   |
| <i>Physalis angulata</i><br>(Solanaceae)             | Ground angular cherry                      | Matsarmana (H)   | Whole plant          | ***   |
| <i>Senna Arabica</i><br>(Leguminosae/Caesalpinaceae) | Gum arabic                                 | Kashia (H)   | Leaves, bark         | ***   |
| <i>Urginea altissima</i><br>(Liliaceae)              | Tall squill, spider's onion, hyena's onion | Esinsin-uroro (Y), Albasar gizo (H)                    | Bulb                 | ***   |
| <i>Zingiber officinale</i><br>(Zingiberaceae)        | Ginger                                     | Tsita maiyatsu (H), Atare (Y)                          | Rhizome, additives   | ***   |

E=Edo, Y=Yoruba, H=Hausa, I=Igbo.

\*\*\*=no information available

**Table 3: Some common recipes (multi plant combination) commonly used in Nigeria for the management of asthma**

| Recipe  | Preparation   |
|---|---|
| <b>Western part of Nigeria</b> <sup>[17], [51]</sup>  |   |
| <i>Olox subscorpioidea</i> , <i>Euphorbia hirta</i> , <i>Euphorbia lateriflora</i> , <i>Securidaca longipedunculata</i> , <i>Crinum jagus</i> , <i>Allium sativum</i> , <i>Tetrapleura tetraptera</i>   | Wash and cut all the plants into pieces, soak in water in a covered glass jar and leave for three days.<br>Adult: a small tumbler-ful, three times daily.<br>Children: a small tumbler-ful daily.   |
| <i>Olox subscorpioidea</i> , <i>Chasmanthera dependens</i> , <i>Calliandra portoricensis</i> , <i>Mimosa pigra</i> , <i>Securidaca longipedunculata</i> , <i>Crinum jagus</i> , <i>Allium ascalonicum</i> , <i>Tetrapleura tetraptera</i>   | Wash and cut all the plants into pieces, soak in water in a covered glass jar and leave for three days.<br>Adult: a small tumbler-ful, three times daily.<br>Children: a small tumbler-ful daily.   |
| <i>Chasmanthera dependens</i> , <i>Picalima nitida</i> , <i>Crinum jagus</i> , <i>Allium ascalonicum</i> , <i>Tetrapleura tetraptera</i> , Alum   | Wash <i>Crinum jagus</i> and cut into pieces, mix with the scraped portion of <i>Tetrapleura tetraptera</i> in a mortar. The mixed herbs are soaked in water with alum. The liquid extract is administered.<br>Adult: one tablespoon-ful daily.<br>Children: (diluted form of the extract), a small spoon-full daily. |
| <i>Olox subscorpioidea</i> , <i>Crinum jagus</i> , <i>Tetrapleura tetraptera</i> , <i>Chasmanthera dependens</i> , <i>Gongronema latifolium</i> , <i>Xylopia aethiopica</i> , <i>Euphorbia lateriflora</i> , <i>Nauclea latifolia</i> , <i>Gossypium barbadense</i> , <i>Allium ascalonicum</i> . | Wash and cut into pieces all the herbs. A cold maceration of the ingredients is administered.<br>Adult: a small tumbler-ful once in three days. Children: one tablespoon-ful once in three days.  |
| <i>Tetrapleura tetraptera</i> , <i>Chasmanthera dependens</i> , <i>Crinum jagus</i> , <i>Allium ascalonicum</i> .   | A concoction of the ingredients is made. The concoction is left for about ten hours for effective extraction.<br>Adult: three tablespoons-ful twice daily. Children: 1 tablespoon-ful twice per day.  |

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| <i>Tetrapleura tetraptera, Crinum jagus, Xylopi aethiopica, Gossypium barbadens, Olax subscorpioidea, Securidaca longepedunculata</i>  | Wash, cut into pieces and soak in water for three days, then administer.<br>Adult: one small tumbler-full daily.<br>Children: a small teaspoon-full daily.  |
| <i>Crinum jagus, Chasmanthera dependens, Olax subscorpioidea, Tetrapleura tetraptera, Allium ascalonicum.</i>  | Wash, cut into pieces and soak in water for a day, then administer.<br>Adult: two tablespoon-full daily.<br>Children: one teaspoon-full daily.  |
| <i>Crinum jagus, Allium ascalonicum, Gossypium barbadense, Chasmanthera dependens, Olax subscorpioidea, Xylopi aethiopica, Tetrapleura tetraptera, Calliandra portoricensis.</i> | Wash, cut into pieces and soak in water for a day, then administer.<br>Adult: a small tumbler-full once a day. Children: a tablespoon-full daily.   |
| <i>Crinum jagus, Eugenia aromatic</i>  | Wash and chop ingredients then soak in local gin. The preparation is left for a day before administering.<br>Adult: 1 tablespoon-full twice daily.<br>Children: 1 teaspoon-full once in three days.                           |
| <i>Olax subscorpioidea, Calliandra portoricensis, Aristolochia ringens, Allium ascalonicum.</i>  | Wash and cut the ingredients into pieces, soak in water for three days.<br>Adult: 1 tablespoon daily.<br>Children: a small teaspoon-full daily.   |
| <i>Anacardium occidentale, Garcinia kola</i>   | Extract the cashew juice and mix with sugar, cut the <i>Garcinia kola</i> into pieces and soak in the juice.<br>Administer after a day.<br>Adult: 1 tablespoon-full daily<br>Children: 1 teaspoon once in three days.         |
| <i>Olax subscorpioidea, Mimosa pigra, Calliandra portoricensis</i>   | The ingredients are chopped into pieces and soaked in water for three days.<br>Adult: a small tumbler-full daily<br>Children: a small teaspoonful once in three days  |
| <i>Khaya ivorensis, Terminalia ivorensis, Piliostigma reticulatum, Xylopi aethiopica, Uvaria chamae, Allium sativum</i>  | The ingredients are chopped into pieces and soaked in water for three days.<br>Adult: a glass cupful daily<br>Children: half a glass cupful daily.  |
| <i>Strophanthus hispidus, Kigelia Africana</i>   | The ingredients are chopped into pieces and soaked in warm water for three days.<br>Adult: 1 tablespoon thrice a day<br>Children: 1 teaspoonful once a day.   |
| <i>Olax subscorpioidea, Calliandra portoricensis, Securidaca longepedunculata, Tetrapleura tetraptera, Allium ascalonicum.</i>   | Chop the ingredients in pieces and soak in water.<br>Adult: 1 tablespoon thrice a day.<br>Children: a small teaspoon once daily.  |
| <i>Chrysophyllum abidum, Allium ascalonicum, Harungana madagascariensis, Oxytenanthera abyssinia, Aframmomum melegueta, Garcinia kola, Acacia nilotica, Picralima nitida</i>     | Wash and cut into pieces the ingredients, soak in water for two days.<br>Adult: 1 tablespoon twice daily<br>Children: a teaspoonful daily.  |
| <i>Abrus precatorious, Vitex doniana</i>   | An infusion of <i>Abrus precatorious</i> is administered while the <i>Vitex doniana</i> is used as a rubifacient applied to the patient's chest. Adult: 1 tablespoon-full thrice daily<br>Children: a teaspoonful twice daily |
| <i>Bridelia ferruginea, Anogeissus leiocarpus, Anacardium occidentale</i>  | Cut the ingredients into pieces and boil. Adult: a small tumbler-full thrice daily.<br>Children: a small teaspoon-full thrice daily.  |
| <i>Zingiber officinale, Anacardium occidentale, Bridelia ferruginea, Allium ascalonicum, Terminalia glaucescens, Anogeissus leiocarpus</i>                                       | Boil the ingredients for 30 minutes.<br>Adult: a tumbler twice daily.<br>Children: a teaspoon twice daily.  |
| <i>Olax subscorpioidea, Calliandra pororicensis</i>  | Cut into pieces the ingredients and soak in sugar water for three days.<br>Adult: 1 tablespoonful once daily<br>Children: a small teaspoonful once daily.   |
| <i>Ananas comosus, unripe Carica papaya fruit and Palm nut.</i>  | Concoction mixed with pap water and honey   |

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| <i>Zingiber officinale</i> , <i>Garcinia kola</i> , <i>Allium sativum</i> and <i>Allium cepa</i> and Honey   | Mixture of ingredients in honey                                     |
| <i>Carica papaya</i> seeds   | ***   |
| <i>Garcinia kola</i> root bark   | Decoction with a pinch of salt after food                           |
| <i>Corchorus olitorus</i>  | Taken with honey  |
| <i>Crudia klainei</i> leaves or bark   | Decoction taken orally  |
| <b>Eastern part of Nigeria</b> <sup>[25]</sup>   |   |
| <i>Calotropis procera</i> , <i>Dennettia tripetala</i> , <i>Carica papaya</i> , <i>Allium sativum</i> , <i>Cymbopogon citratus</i> , <i>Chrysophyllum albidum</i> and <i>Zingiber officinale</i> . | ***   |
| <i>Sansevieria liberica</i> and <i>Piper guineense</i>   | Boil fresh leaves in water, cool and filtrate.<br>Give twice daily. |

\*\*\* information not available.

#### ETHNO-PHARMACOLOGICAL VALIDATION

##### Models for screening anti-asthmatic activity

- Isolated goat tracheal chain preparation with clonidine-induced catalepsy<sup>[26]</sup>
- Mast cell stabilizing and anti-allergic activity using egg albumin induced mast cell degranulation in mice and passive cutaneous anaphylaxis in rats<sup>[27]</sup>
- Antihistaminic activity using clonidine and haloperidol induced catalepsy in mice<sup>[28]</sup>
- Milk induced leucocytosis and eosinophilia.
- Histamine induced bronchoconstriction in guinea pigs<sup>[29]</sup>
- Suppression of ovalbumin-induced airway inflammatory responses in a mouse model<sup>[30]</sup>
- Histamine-induced contraction of the guinea pig trachea and pre-contracted trachea (pathological tissue)<sup>[31]</sup>
- Isolated organ bath method using guinea pig isolated ileum and tracheal chain<sup>[32]</sup>

Table 4: Some scientifically tested Medicinal Plants used in the management of Asthma

| Botanical Name (Family)                             | Common Name                         | Extract/ compound  | Model     | Reference |
|---|-------------------------------------|--|-----------|-----------|
| <i>Aerva lanta</i> (Amaranthaceae)                  | Mountain knotgrass                  | Ethanol  | a         | [18]      |
| <i>Abrus precatorius</i> (Papilionaceae)            | Love pea                            | Ethanol  | b,c       | [27][28]  |
| <i>Ageratum conyzoides</i> (Compositae)             | Billy- goatweed                     | Hydroalcoholic   | c         | [26]      |
| <i>Asystasia gangetica</i> (Acanthaceae)            | Chinese violet                      | n-Hexane, ethylacetate, and methanol extracts of the leaves  | a,f,g     | [31]      |
| <i>Aegle marmelos</i> (Rutaceae)                    | Golden apple                        | Alcoholic extract of the leaves  | h         | [32]      |
| <i>Alstonia scholaris</i> (Apocynaceae)             | Black board tree, Indian devil tree | Ethanol extracts of leaves   | g         | [33]      |
| <i>Bacopa monnieri</i> (Scrophulariaceae)           | Water hyssop                        | Petroleum ether, chloroform, methanol and water extracts   | b         | [34]      |
| <i>Cassia sophera</i> (Caesalpiniaceae)             | Kasundi                             | Chloroform, ethylacetate and ethanol fractions isolated from ethanol extract of leaves                 | c,e       | [33]      |
| <i>Casuarina equisetifolia</i> (Casuarinaceae)      | Australian pine                     | Methanol extract of extracts of wood and bark  | a,b,g     | [35]      |
| <i>Clerodendrum serratum</i> (Verbenaceae)          | Glory bower, bag flower             | Ethanol extract of roots   | a,d       | [36]      |
| <i>Crinum glaucum</i> (Amaryllidaceae)              | Poison bulb                         | Aqueous extract  | b,e       | [26]      |
| <i>Curculigo orchioides Gaertn</i> (Amaryllidaceae) | Golden eye grass                    | Alcoholic extract of rhizome   | a,b,d,e,f | [27]      |
| <i>Camellia sinensis</i> (Theaceae)                 | Tea plant, tea shrub                | Tea-leaf saponins  | b,f       | [28]      |
| <i>Eclipta alba</i> (Asteraceae)                    | False daisy                         | Ethanol extract  | b,f       | [39]      |
| <i>Euphorbia hirta</i> (Euphorbiaceae)              | Asthma plant                        | Ethanol extract of aerial part of the plant  | b         | [26]      |
| <i>Ficus bengalensis</i> (Moraceae)                 | Banyan tree                         | Ethyl acetate, ethanol and aqueous extracts as well as fractions isolated from aqueous extract of bark | a         | [26]      |
| <i>Garcinia kola</i> (Guttiferae)                   | Bitter kola                         | Phenols, alkaloids, xanthenes and flavonoids   |           | [29]      |
| <i>Hemidesmus indicus</i> (Asclepiadaceae)          | Nannari                             | Ethanol extract  | a         | [36]      |
| <i>Mimosa pudica</i> (leguminosae)                  | Sensitive plant                     | Ethanol extract  | f         | [30]      |
| <i>Momordica dioica</i> (Curcubitaceae)             | Balsam pear                         | Aqueous and methanol of fruit  | a         | [37]      |
| <i>Mucuna pruriens</i> (Fabaceae)                   | Cattle's bean                       | L-Dopa   | a         | [38]      |
| <i>Solanum melongena</i>                            | Eggplant                            | methanol extract of fresh leaves   | g         | [39]      |



|  |                  |   |   |      |
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| (Solanaceae)                                       |                  |   |   |      |
| <i>Striga orobanchioides</i><br>(Scrophulariaceae) | Cowpea witchweed | Ethanol and aqueous extracts of whole plant | h | [26] |

### PHYTOCHEMICAL VALIDATION

The pharmacological activities exhibited by medicinal plants have been attributed to secondary metabolites which in turn, represent an enormously rich reserve for the discovery of new and innovative medicines. Two classes of secondary metabolites implicated in the management of asthma are flavonoids and xanthenes.

Flavonoids have been reported to have anti-asthmatic activity by inhibiting platelet-activating factor (PAF), phospholipase A<sub>2</sub> (PLA<sub>2</sub>) and phosphodiesterase (PDE)<sup>[40], [41]</sup> thereby preventing platelet aggregation. Flavonoids protect against allergies, inflammation, free radicals, inhibit anti-spasmodic and anti-inflammatory properties induced by acetylcholine, histamine, noradrenaline and barium chloride in four different smooth muscles, prevent antigen-induced release of histamine from mast cells, basophils and also inhibit contractions induced by histamine, acetylcholine and prostaglandin E<sub>2</sub> (PGE<sub>2</sub>)<sup>[42], [43], [44], [45]</sup>. Flavonoids have been shown to preferentially inhibit histamine release stimulated by IgE-dependent ligands and inhibit the degranulation of mast cells. Degranulation of mast cells has been implicated in the release of histamine and other mediators of the allergy response.<sup>[46]</sup> Xanthenes have anti-asthmatic activity by dependently inhibiting the Ca<sup>2+</sup> influx induced by either norepinephrine or high K<sup>+</sup>, suggesting that xanthone might act as a blocker of both receptor-operated and voltage-dependent Ca<sup>2+</sup> channels.<sup>[46]</sup> Phenols have been reported to modify prostaglandin pathways and inhibit platelet aggregation; other properties are anti-inflammatory, anti-oxidant and immune boosting activities. Medicinal plants such as *Garcinia kola*, rich in phenolics, flavonoids and xanthenes might be of great importance in the management of asthma. Other secondary metabolites such as alkaloids, terpenes, essential oils having anti-inflammatory activity, immune-modulatory, smooth-muscle relaxant have been reported to be present in many of the plants; such as *Tetrapleura tetraptera*, *Euphorbia lateriflora*, *Euphorbia hirta*, *Olex subscorpioidea* and *Crinum jagus*.<sup>[14]</sup> Essential oils and glycosides have been isolated from the root, bark leaves and fruits of *Picralima nitida*.<sup>[47]</sup> Alkaloids and tannins have been isolated from the leaves of *X. aethiopica*, *P. nitida*.<sup>[48], [49], [51]</sup> Many of the compounds responsible for the anti-asthmatic activities have not been isolated and characterized.

### CONCLUSION

A good number of contemporary medicines have evolved from traditional medicines thus in the present circumstances, our traditional system must be given an objective and critical examination. Further research should be carried out to determine the fraction(s)/compounds that are mainly responsible for the

observed anti-asthmatic activity as this will lead to drug development. Also, the potency of plants used in combination as against being used individually should be further researched on. It is recommended that further research is carried out on these anti-asthmatic plants and standardization of herbal formulations/preparations should be carried out to address the problem of irregular dosing, unwanted excipients and inclusion of pure active compounds.

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