ejpmr, 2023,10(9), 585-598

SJIF Impact Factor 6.222

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Review Article

ISSN 2394-3211

EJPMR

A REVIEW OF ANTIVIRAL MEDICINAL PLANTS WITH POTENTIAL CONSIDERATIONS FOR THE MANAGEMENT OF VIRAL INFECTIONS AND COVID-19 IN NORTH-CENTRAL NIGERIA

[1]Njoku Moses, [1]Somope Halima, [2*]Ugbabe Grace, [1]Oladosu Peters, [2]Egharevba Henry, [1]Abarike Moses, [3]Danraka Abubakar and [3]Adigwe Peter

[1]Microbiology and Biotechnology (MB & BT), Department.
[2]Medicinal Plant Research and Traditional Medicine (MPR & TM), Department
[3]Office of the Director General/Chief Executive Officer (DG/CEO)
National Institute for Pharmaceutical Research and Development (NIPRD), Abuja Nigeria.

***Corresponding Author: Dr. Ugbabe Grace**
Medicinal Plant Research and Traditional Medicine (MPR & TM), Department, National Institute for Pharmaceutical Research and Development (NIPRD), Abuja Nigeria.

Article Received on 16/07/2023 **Article Revised on 06/08/2023** **Article Accepted on 27/08/2023**

ABSTRACT

This study represents an attempt to document information on the antiviral plants that are found in North-Central Nigeria. A compiled check list of these plants including their local names, families, parts used, medicinal uses, and name in different Nigerian states is the main purpose of this study. The study revealed that traditional medicinal practices adopted through the use of these indigenous plants have a wide acceptability among the Nigerian people, probably because they believe in its effectiveness. The medicinal plant uses are varied, and the plant parts that are used ranged from leaves, roots, stem, bark to fruits only, or a combination of two or more in a species or with those of other species. Enduring and sustainable conservation efforts should be implemented to safeguard these important medicinal plants.Viruses are one of the main hazards for both humans and animals. They enter into the living body and redirect the body's metabolism to produce large copies of their genome and proteins. Diseases caused by these viruses are difficult to tackle with the help of currently available antiviral drugs. The aim of this study is to explore the plants with reported antiviral activity found in North-Central Nigeria, to get a better understanding for better control of these viruses. Prominent modes of action against these viruses were inhibition of viral entry and its replication in host cell. Against RNA viruses' plants mainly targeted their Reverse Transcriptase (RT) enzyme (like HIV) or protease (mostly found against hepatitis C virus). A range of active compounds have been identified which could be the potential antiviral agents for future drug development. Detailed study of their phytochemicals and mode of action against these viruses could be helpful for more effective control of hazardous viruses. Among several other ailments, viral infections, particularly infections associated with human immunodeficiency virus type 1 (HIV-1) and 2 (HIV-2), and newly emerging infectious viruses have challenged mankind's survival. Of importance, a variety of plants have shown promise to treat a number of viral infections, and some of them possess broad-spectrum antiviral activity. Development of vector-based strategies, in which non-infectious molecular clone of a virus could be used for antiviral screening purposes, and advancement in separation technologies offers promise for medicinal plants usage in modern drug discovery.

INTRODUCTION

Virus is "a piece of bad news wrapped in a protein coat" has been defined by Peter Medawar (Oldstone, 1993). It appears as the perfect definition after considering the list of top ten causes of death in low, middle and high-income countries. Lower respiratory infections, diarrhea diseases and HIV/AIDS are the common death causes among low and middle income countries. All of these three health disorders are directly or indirectly caused by viruses. Except lower respiratory infections none of the above mentioned factors are prevalent among high income countries. It clearly indicates that how severely these viral diseases are affecting health in low and middle income anddeveloping countries.

Antiviral agent is an agent that kills a virus or that suppresses its ability to replicate and, hence, inhibits its capability to multiply and reproduce. For example, amantadine (Symmetrel) is a synthetic antiviral. It acts by inhibiting the multiplication of the influenza, a virus. Plants from Northern Central Nigeria with a history of use in both human and veterinary traditional medicine have been investigated for their antiviral activity.Today many synthetic antiviral drugs e.g. moroxydine, ganciclovir, valganciclovir, valaciclovir are used, which inhibit the virus replication via different mechanisms (Biron, 2006; Czeizel *et al*., 2006). But difficulty in drug treatment arises due to their low efficiencies, cytotoxicity and development of viral resistance against them.

Another antiviral treatment like vaccination can be applied but they are still under development, as they often provide incomplete protection against virus and their reliability needs more research (Pervez, 2000b; Subbarao and Joseph, 2007). Thus, the treatment through antiviral synthetic drugs and vaccines need more scientific investigation. Nature provides another, more reliable source of antiviral agents; viz. plants phytochemicals; almost 40% of currently available drugs are direct or indirect derivatives of plants. A number of ethnobotanical studies aiming to identify potential therapeutic plants for more effective control of health issues demonstrate the importance of plant species the application and management of health challenges.

Indigenous medicine is now recognized worldwide both by rural and urban elite as an important healthcare resource. The World Health Organization (WHO) has pointed out that traditional medicine is an important contribution to its health goals. There are considerable economic benefits in the development of indigenous medicine and in the use of medicinal plants for the treatment of various diseases (WHO, 2003).

Medicinal plants have also been of importance in the healthcare system of local communities as the main source of medicine for the majority of the rural population. Plants have not only nutritional value but also, in the eyes of the local people, they have medicinal, ritual and magical values (Adewunmi *et al.,* 2001). According to research, a total of at least 35,000 plants species are widely used for medicinal purposes. The demand for traditional herbs is increasing very rapidly, mainly because of the harmful effects on synthetic chemical drugs. The global clamor for more herbal ingredients creates possibilities for the local cultivation of medicinal and aromatic crops as well as for the regulated and sustainable harvest of wild plants. Nigeria is endowed with an enormous diversity of animals and plants, both domesticated and wild, and an impressive variety of habitats and ecosystems. This heritage sustains the food, medicinal, clothing, shelter, spiritual, recreational, and other needs of her population (Odugbemi and Akinsulire, 2006).

Plants are known to be a rich source of phytochemicals like alkaloids, anthocyanins, carotenoids, flavonoids, isoflavones, lignans, monoterpenes, organosulfides, phenolic acids, saponins and many more (van Rooyen, (2012) Weiss, (1988). These phytochemicals have been proved to be responsible for their antiviral activities (Gyebi *et al.,* 2020; Tamura *et al*., 2010 Chang and But, (1987). Several evidence also abound on the strong activity against viruses like HSV1 and HSV2 in vitro cells by a process called quantitative polymerase chain reaction extract showed (Tan *et al*., 2013; Verma and Awatshi, 1979) and other therapeutic activities.

It is however essential for drugs discovery to preserve and record traditional know-how on medicinal plants and in most cases, this depends on local practitioner and field survey (Anita, 2004). It is no longer news how microorganisms have continued to become resistant to a number of new antiviral drugs in the last three decades. The use of plant extracts and phytochemicals being of great significance in therapeutic treatments can however be explored in ameliorating this problem (Erdogrul, 2002; Acharya and Shrivastava, 2008). The history of medicinal plants dates back to the origin of human civilization on earth. Several of these may have been used to treat viral infections in the past; however, first recognized interest in their development as antiviral agent is the efforts of the Boots drug company (Nottingham, England) to screen 288 plants for anti-influenza activity. Later studies have reported the inhibitory effects of medicinal plants extracts on the replication of several viruses. Particularly herpes simplex virus type 2 (HSV-2) (Debiaggi *et al.,* 1988), HIV (Asres and Bucar, 2005, Vermani and Garg, 2002), hepatitis B virus (HBV) (Huang et al., 2006, Kwon et al., 2005), and emerging viral infections associated with poxvirus and severe acute respiratory syndrome (SARS) virus (Kotwal *et al*., 2005) were strongly inhibited by various plants extracts. Most of these studies have utilized either water soluble or alcoholic extracts of medicinal plants, and limited efforts have been directed toward the identification of active natural ingredient exhibiting antiviral effects. Moreover, recent studies showing antiviral potential of plant extracts against viral strains resistant to conventional antiviral agents (Serkedjieva, 2003, Tolo *et al.,* 2006) have challenged the modern drug discovery practices, and deem a very careful look toward exploring natural antiviral components of medicinal plants.

Recently, traditional medicinal practices have become a topic of global relevance. In many developing nations, a significant number of indigenous populations rely on medicinal plants to meet their health care needs. According to Wang *et al.,* 2014, 2015, Kumar *et al.,* 2014, 2010) botanically derived medicines especially antivirals have played a major role in human societies throughout history and prehistory and people have used plants as medicine since the beginning of civilization, as they were believed to have healing powers (Kumar *et al.,* 2014, 2010). The use of plants in the tropical and subtropical regions is diversified and most of the uses are for medicine, source of food, clothing and shelter. But the medicinal uses of plants are rapidly declining among the present generation of local people as a consequence of modernization and civilization (Djakpo and Yao, 2010). The younger generation is showing little interest in learning this valuable science of healing (Ugbabe *et al.,* 2021). All over the world, several ethnobotanical studies focusing on medicinal plants have been documented (Wang *et al.,* 2014, 2015, Kumar *et al.,* 2014, 2010). But in Nigeria, very little information about antiviral studies has been documented (Igoli *et al.,* 2005). Therefore, there is a need for proper documentation of indigenous plants with antiviral properties. A practice

among the people in Nigeria where there has been a dearth of published information is immediately called for and this accounts for the rationale to undertake the present study.

The objectives of this study remain; to find medicinal plants used to treat viral diseases that are cheap and easily accessible since viral infections are so tasking for both practitioners and patients. This study represents an attempt to document information on the antiviral plants found and used in North Central Nigeria. The evidence from extracts and or herbal preparation and use, of these plants showed strong activity against important disease-causing viruses; including human immunodeficiency virus (HIV), hepatitis B virus, herpes virus type 1 (HSV-1 and type 2 (Hassan *et al.,* 2017; Yang *et al*., 2007, Tolo *et al.,* 2006). Still others are known to inhibit activities of respiratory viruses like human Influenza virus and common children associated viruses (Paul *et al.,* 2015; Ojo *et al*., 2009; Chang and But, 1987, 2005).

METHODOLOGY

Ethno-botanical Survey of Antiviral Medicinal Plants

Short field trips were embarked upon in the study areas of the State to herbal homes and traditional medicine practitioners to know medicinal plants used in managing and treating viral infections. The parts of plants used, time of collection and their mode of preparations were documented following prescribed procedure for an ethnobotanical survey of the plant. Information here was derived from oral interviews, records of herbal medicines and field trips.

Study area

The study area consists of Benue, Kogi, Kwara, Kaduna, Nassarawa, Niger, Plateau and Taraba States; as well as the Federal Capital Territory. These states consist of residents that are civil servants, traders, famers, entrepreneurs and students. The North-Central Nigeria is also referred to as the middle belt of Nigeria.

Data analysis

Information obtained from the documentary evidence, field trips, and oral interviews were recorded in terms of species of plants, antiviral effect, viruses involved, states plants were available, local names and references for the documentary evidences.

RESULTS AND DISCUSSION

From this study, 75 species of medicinal plants were identified as potential antiviral medicinal plants popularly used in North-Central region of Nigeria for the management and treatment of various types of viral infections (Table 1). The scentific names, local names, antiviral effects, references of past studies and the state where these plants are available were done (Table1).

Table 1: List of Medicinal Plant species documented for antiviral activity in North-Central Nigeria.

S/No.	Plant Name /Family/Part used	Local Names	Virus	Antiviral effect	Reference	States available
1.	*Carissa edulis* Vahl. (Forssk.)Vahl (Apocynaceae) (Leaves)	Leemun tsuntsuu; Bagozaki (Hausa)	Herpes simplex virus (HSV) CDV, FHV-1	A medicinal plant exhibiting strong anti-HSV 1, and 2 activities both *in-vitro* and *in vivo*	Iwu, 2014 Tolo *et al*., 2006)	Taraba, Plateau, Kaduna,
2.	*Phyllanthus amarus, P. emblica, P. niruri* /	Geeron-Tsuntsaayee (Hausa) Eyin-olobe; Eyin-onubisowo (Yoruba)	Human immune-deficiency virus (HIV)	Inhibits HIV replication both *in vitro* and *in vivo,* Plant geraniin isolated from *Phyllanthus urinaria* inhibited HSV-1 and HSV-2	Yang *et al*. (2007); Notka *et al.* (2004)	Niger, Plateau, Benue, Kogi, Kwara, FCT.
3.	*Polygonum cuspidatum* Sieb. & Zucc. /			Inhibits Hepatitis B Virus in a stable HBV-producing cell line	Chang *et al.* (2005)	
4.	*Carica papaya* /*Caricaceae* Fruts, leaves	Sigun; Syinbo; Senbo; (Yoruba)			Yusuf, 2014	FCT, Benue, Niger, Plateue, Kaduna, Kwara, Nassarawa,
5.	*Geranium sanguineum* L. /		Influenza virus	Treatment for influenza	Pantev *et al.* (2006) and Serkedjieva	

					(1997)	
6.	*Crinum jagus* (J.Thomps) Dandy / Amaryllidaceae	Isu-meri (Ibo) Ogede-odo (Yoruba) Obase; kuku (Yoruba)		Tuberculosis, Epilepsy, Asthma, infections, anti-snake venom and sickle cell diseases	Adesanya *et al.*, 1992	FCT, Benue, Taraba,
7.	*Spondias mombin* L. / Anacardiaceae	Okikan; Iyeye; Olosan (Yoruba) Tsaadar, Masar (Hausa) Ikikla (Idoma)		Stomach ache, abdominal discomfort, diabetes, wound healing, haemorrhoids and vermifuge.	Sabiu *et al.*, 2015	Benue, Plateue, Kogi, Nassarawa
8.	*Boehmeria nivea* L. /Urticaceae (root)		Hepatitis B virus	A root extract of *Boehmeria nivea* reduced HBV production in an *in vitro* and *in vivo* model	Huang *et al.* (2006)	Benue, Plateau
9.	*Saxifraga melanocentra* Engl. & Irmsch./		Hepatitis C virus (HCV)	A compound namely 1,2,3,4,6-penta-O-galloyl-beta-d-glucoside isolated from *Saxifraga melanocentra*	Zuo *et al.* (2005)	
10.	*Guazuma ulmifolia* Lam./ Malvaceae		Poliovirus	Extract inhibited Poliovirus replication, as well as, blocked the synthesis of viral antigens in infected cell cultures	Felipe *et al.* (2006)	
11.	*Olea europeae* L./ Oleaceae (Leaf, stem, root)		Viral haemorrhagic septicaemia virus (VHSV) VHSV, HIV, NDV.	Leaf extract inhibited viral replication	Micol *et al.* (2005)	Plataeu, Adamawa
12.	*Lycoris radiate* (LHer.) Herb./ Amaryllidaceae		Severe acute respiratory syndrome-associated coronavirus (SARS-CoV)	Lycorine, isolated from *Lycoris radiate* possesses anti-SARS-CoV	Li *et al*. (2005)	
13.	*Trichilia glabra* L. / Meliaceae (Leaves)	Goron talaka; Jan saiwa (Hausa)	Vesicular stomatitis virus (VSV)	Leaves extract of *Trichilia glabra* inhibits VSV	Cella *et al.* (2004)	
14.	*Glycine max* L. / Fabaceae Black soybean extract (Seeds)		Human adenovirus type 1	Inhibition of human Adenovirus type 1 and Coxsackie Virus B1 in a dose-dependent manner	Yamai *et al.* (2003)	
15.	*Eleusine indica (L.) Gaertn.*/ Poaceae (Leaves)	Ese-kannakkanna;Gbegi (Yoruba) Kirikiri (Igbira) Ijiabo (Ogori)		Diabetes, anthelminthic, coughs and wound.	Iqbal and Gnanaraj 2012	Kogi, Kwara
16.	*Lagenaria breviflora* Ser. / Cucurbitaceae (Benth.) Roberty (Stem)	Tagiri (Igbo)	chicken pox and skin infections	Female infertility, Measles, Chicken pox and skin infections	Olorunnisola *et al.*, 2015	
17.	*Azadirachta indica* Juss. (Neem) Meliaceae (Leaf, Stem)	Dogo-yaro (Hausa) Odogo-yaro (Idoma)	Dengue virus type-2 (DEN-2) Coxsackie virus B, HSV-1, dengue	The aqueous extract of neem leaves inhibited DEN-2 both *in vitro* and *in*	Parida *et al.* (2002) Iwu, 2014.	Taraba,

				vivo		
18.	*Bambusa vulgaris* Schrad. Ex J.C. Wendl. / Poaceae	Oparun; Idae (Yoruba) Ochacho (Idoma)	Measles virus	Aquaous extracts of B. vulgaris leaf inhibited measles virus	Ojo *et al*., 2009	Benue, Niger, Plateue, Nassarawa
19.	*Aframomum meleguata* K. Schum. / Zingiberaceae	Ata-ire; Ata-isa; Ata-rere; Itaye (Yoruba) Citta; Kumfa; Kumfan-allah; Goriya (Hausa), Otuta (Idoma)	Human Measles and Yellow fever viruses. Cholera, smallpox and chicken pox viruses	Extracts of the seeds of A. meleguata inhibited Measles and Yellow fever Virus. Cholera, Mmallpox and Chicken pox Viruses	Ojo *et al*., 2009	Benue, Kwara,
20.	*Picralima nitida* (Stapf) T. Durand & H. Durand /Apocynaceae (Stem bark)	Erin (Yoruba)		Hypertension, Fever, Jaundice, Dysmenorrhea, Malaria and Abdominal discomfort.	Erharuyi *et al*., 2014	
21.	*Ageratum conyzoides* L. / Asteraceae (Leaves)	Apasa; Arunsansan; Imi-esu (Yoruba)		Purgative, Ulcers, Mental illness, Infections, Skin diseases, Wound healing, Febrifuge, Pneumonia, Toothache and Rheumatism.	Okunade, (2002)	Kwara, Kogi, Benue, Nassarawa
22.	*Heliotropium indicum* L. / Boraginaceae (Leaves)	Apari-igun; Ori-ugun; Ogbe-akuko; Olojo-gburu (Yoruba) Kalkashin korama (Hausa)		Wounds, Flatulence, inflammation, Skin ulcers and Conjunctivitis.	Paul *et al.*, 2015	Kwara, Kogi, Benue
23.	*Ipomoea asarifolia* (Desr.) Roem. & Schult. / Convolvulaceae (Leaves)	Gboro-ayaba (Yoruba) Duman-kadaa; Dumanraefii (Hausa)		Skin infections, Abdominal Cramps and Anadens.	Meira *et al.*, 2012	FCT, Niger, Plateue
24.	*Lagenaria breviflora* (Benth.) Roberty / Cucurbitaceae (Stem bark)	Tagiri		Female infertility, Measles, Chicken pox and Skin infections.	Ogbole *et al.*, 2018.	
25.	*Macaranga barteri Mull. Arg* / Euphorbiaceae (Leaves)	Agbaasa; Awasu; Araasa; Aragasa (Yoruba)		Gonorrhoea, Syphilis, skin infections, Cancer and Burns.	Ogbole *et al.*, 2018	Benue, Kogi, Nassarawa
26.	*Hoslundia anadens Vahl* / Lamiaceae (Leaves)	Efirin-oso; Oghagha; Ana-mi-ole; Efirin odan (Yoruba)		Burns, Skin infections, Cough and Malaria.	Achenbach *et al.*, 1992	
27.	*Calliandra portoricensis* (Jacq.) Benth / Fabaceae Leguminosae (Root)	Tude (Igbo) Ule; Oye-ekiti (Yoruba); Firin odan		Prostate Cancer, Inflammations, Cough and Haemorrhoids.	Adaramoye *et al.*, 2015	FCT, Plateau,
28.	*Entandrophragma utile* (Dawe & Sprague) Sprague /	Jebo; Ijebo (Yoruba)		Leg ulcer, anthelmintic, wound, abdominal pain.	John and Onabanjo, 1990	Kwara,

	Meliaceae (Stem Bark)					
29.	*Mimosa pudica L.* / Fabaceae//Mimosaceae (Leaves)	Patanmo (Yoruba) Dan-kunya (Hausa)		Fevers, piles, jaundice, leprosy and dysentery.	Ahmad *et al.*, (2012),	FCT, Benue, Kogi, Niger
30.	*Boerhavia diffusa L.* / Nyctaginaceae (Root)	Etipase-erinla (Yoruba) Babba jibji; Halshen-saaniyaa; Sarkin jibjii (Hausa)		Diabetes, cancer, inflammation, infections and epilepsy.	Rawat *et al.*, 1997,	
31.	*Petiveria alliacea L.* / Phytolaccaceae (Leaves)	Awogba (Yoruba)		Pain, influenza, cold, diabetes, malaria and skin infections.	Williams *et al.*, 2007.	
32.	*Sarcocephalus latifolius (Sm.) E. A. Bruce* / Rubiaceae (Roots & leaves)	Egbesi (Yoruba) Tafaashiyaa; Igiyaa (Hausa)		Epilepsy, 590anadens, dysentery, malaria and fever.	Amos *et al.*, 2005.	FCT, Kogi, Benue, Plateue
33.	*Lippia multiflora Moldenke* / Verbenaceae (Leaves)	Efirin-gogoro; Efirin-foromaba (Yoruba) Isirigun		Fever, constipation, ear infections, eye troubles, and diabetes.	Abena *et al.*, 2003	FCT, Niger, Benue, Kwara, Nassarawa
34.	*Parquentina nigrescens (Afzel) Bullock* / Periplocaceae	Ogbo (Yoruba) Kwankwanin tsaatsumbe (Hausa)		Abdominal cramps, Anadensi, Rickets and Asthma.	Imaga *et al.*, 2010,	Kaduna, Kogi, Benue, Niger
35.	*Sambucus ebulus* / Adoxaceae (Fruits Elderberry extract)	Ayo; Ayuu (Yoruba)			Zakay-Rones *et al.* (2004)	Plateau
36.	*Olea europaea* Linn / Oleaceae (Fruits)			Inhibits acute infection and cell-to-cell transmission of HIV-1	Lee-Huang *et al.* (2003)	Plateau
37.	*Allium sativum Linn.* / Amaryllidaceae; (Bulbs)	*Ayu* (Yoruba) Tafarnuwaa (Hausa)	Influenza virus, cytomegalovirus, rhinovirus, HIV, viral pneumonia, herpes simplex I & II, rotavirus.	Commonly used for conditions related to the heart and blood system as well as bronchitis		All North Central Nigeria
38.	*Zingiber officinale* Ros. / Zingiberaceae (Rhizome)	Cittar ahoo; Cittar-mai-yaatsaa (Hausa) Ata-ile; Ata; Atale (Yoruba)	Herpes, Hepatitis C		Abolaji *et al.*, 2017	Kaduna, Taraba, Plateau, Benue, Niger.
39.	*Curcuma longa* Linn. (Zingiberaceae) (Rhizome & leaves)		HIV, herpes			Taraba, Benue, Plateau
40.	*Camellia sinensis* (L.) O. Kuntz / Theaceae (Leaves)		Anti-oxidant and anticancer Human influenza	Its anti-carcinogenic, antibacterial, anti-diabetic, anti-tumor and anti-hypertensive	Ukwubile *et al.*, 2018; Aslam, 2014).	Taraba, Plateue, Benue
41.	*Hibiscus sabdariffa* Linn. /Malvaceae (Calyx)	So'barodo (Hausa); Isapa; Amukan-an; Isakun; Ilayoo (Yoruba)	Avian flu, adenovirus, Norovirus. HSV-2, hepatitis A,	Anti-oxidative, anti-viral, anti-hypertensive, and anti-inflammation	Takeda *et al.*, 2020, Umaru *et al.*, 2007; Chen *et al.*, 2013;	All states in North central

			Murine norovirus, Human influenza		Zhen *et al.*, 2016	Nigeria including FCT
42.	*Haematostaphis barteri* / Hook.f. Anacardiaceae;	Jar-danyaa; Tsaaymiyar-lamarundu (Hausa)			Dalziel, 1955; Busson, 1965	Dry savannah of North Central Nigeria
43.	*Citrus limon* (L.) Burm.f / (Rutaceae) (Leaf, fruits, roots)	Lemun-magaajiyaa (Hausa) Osan lakuregba; Jaganyin (Yoruba)	NDV, Influenza	Anti-scorbutic, being almost a specific in scurvy	Iwu, 2014; Yusuf, 2014	All states in North-Central Nigeria
44.	*Vitellaria paradoxa* C.F. Gaertn. (Sapotaceae); (Fruits)		HSV-1			Niger, Nassarawa, Benue, Plateau
45.	*Euphorbia hirta* Linn. (Euphorbiaceae) (Whole plant)		HIV-1, HIV-2, SIVmac251		Kumar, 2010	Niger, Benue, Nassarawa, Plateau,
46.	*Mondia whitei (*Hook.f.) Skeels./ Periplocaceae (Leaves, root, bark,)	Isirigun (Yoruba)	Anthelmintic, Aphrodisiac, Anti-depressant	Malaria, diabetes, infertility and erectile dysfunction, Stomach pain, gastrointestinal disorder, gonorrhea and post-partum bleeding,	Watcho *et al.*, 2001, Oketch-Rabah et al., 2020	Kwara, Kogi,
47.	*Andrographis paniculata* (Burm.f.)Nees/ Acanthaceae (Leaves)		HSV-1		Hamidi *et al.*, 1996 Pongtuluram and Rofaani 2015	FCT, Kwara
48.	*Combretum migrantum* G.Don/ Combretacea*e*		HSV-1 HSV-2 HIV-2		Farrea *et al.*, 1993; Welch, 2010	
49.	*Macanga barteri* Mull. Arg./ Euphorbiaceae	Agbaasa; Awasu; Araasa; Aragasa (Yoruba)		Gonorrhoea, Syphilis, skin infections, Cancer and Burns.	Segun *et al.*, 2019; Ogbole *et al.*, 2018	Benue, Plateue
50.	*Musa acuminata* L. /Musaceae (Fruits and leaves)		Anti-HIV		Peumans *et al.*, 2000; Swanson *et al.*, 2010.	Kaduna, Taraba, Benue, Niger, Plateue,
51.	*Papaver somniferum* L. / Papaveraceae (Seeds)		HIV-1		Vlietinck *et al.*, 1997, Ibrahim *et al.*, 2011	FCT, Kaduna, Kogi, Benue
52.	*Amaranthus tricolor* L. / Amaranthaceae (Seedling)		SARS-CoV-2 3Clpro		Kaur *et al.*, 2006	Kwara, Benue, Plateue
53.	*Hyptis atroruben* Poit. / Lamiaceae (Leaves and stem)		SARS-CoV-2 3Clpro			
54.	*Phaseolus vulgaris* L. / Fabaceae (Roots)		SARS-CoV-2 3Clpro		Rao, 1990	Plateue, Niger, Benue, kogi, Kaduna, FCT,

55.	*Phyllanthus emblica* L. / Phyllanthaceae (Leaves and stem)		SARS-CoV-2 3 Clpro		Qamar *et al.*, 2020	
56.	*Momordica charantia* L. / Cucurbitaceae (Fruits, leaves)	Ejinrin, ejinrin were, Awara, ejinrin dudu, (Yoruba)	Anti-diabetic, anti-HIV, and antitumor activities	A potent inhibitor of HIV-1 replication	Bot *et al*, 2007	FCT, Niger, Benue, Nassarawa
57.	*Garcinia kola* / Clusiaceae Bitter Kola (Seeds)		Measles Virus (MV), Polio Virus (PV), Herpes Simplex Virus-1 (HSV-1), and Yellow Fever Virus (YFV).		Iwu, 2014 Yusuf, 2014	Benue, Taraba
58.	*Taraxacum officinale* (L.) ex F.H. Wigg. / Asteraceae (Leaves, flowers & roots) Dandelion		Anti-cancer Virus causing dengue fever	Dengue, a mosquito-borne virus that causes dengue fever. With symptoms like high fever, vomiting, and muscle pain.	Di Napoli & Zucchetti, 2021	Niger, Benue, Plateau, Kogi, FCT
59.	*Capsicum annuum* L. / Solanaceae (Fruits),				Yusuf, 2014	Benue, Plateue, Niger,
60.	*Combretum mole* (R. Br. Ex. G. Don.) Engl & Diels Combretaceae (stem bark)	Goga jiki; Googen-damoo; wuyan damo (Hausa)	anti-HIV activity	For the treatment of liver diseases, malaria and tuberculosis and against human Imnmuuno Deficiency Virus type 1 (HIV-1) and type 2 (HIV-2).	Rashed, *et al*, 2012.	Benue, Nassarawa
61.	*Momordica balsamina* L. Cucurbitacae Fruits and leaves		inhibitor of HIV-1 replication	Anti-viral Efficacy in Poultry	Eldeen *et al*, 2011	FCT, Niger, plateau, Taraba, Nassarawa,
62.	*Tapinanthus dodoneifolius* (DC.) Daner Loranthaceae (Leaves)	Kauchi (Hausa);		Remedy for stomach ache, diarrhea, dysentery, wound and cancer	Deeni & Sadiq, 2002 Yusuf, 2014.	Niger, Kogi, Kwara, Benue, Nassarawa
63.	*Dolichos lablab* / Fabaceae (Seeds, fruits, flowers)		Cholera, diarrhea, nausea, leucorrhoea, rheumatism,	Anti-inflammatory Aphrodiasiac, anti-spasmodiac Anti-diabetic, bilirous, stomachic & phlegmatic disorders.	Ali-Esmail Al-Snafi (2017)	Kwara, Benue, Nassarawa Niger, Kogi
64.	*Bryophyllum pinnata* L./Crassulaceae (Leaves)	Abamoda (Yoruba)	Ear pain with pus; treatment of urinary stone; rheumatism, cough; asthma, skin ulcer, microbial infections	Measels virus (MV); Polio virus (PV); Yellow fever; herpes virus; CNS depressant; analgesic; anti-tumor; anti-diabetic.	Ugbabe *et al*., 2021; Mahendra *et al.*, 2016; Olufunke , 2021 Olugbuyiro and, Akinbohun 2012.	Benue, Niger, Kaduna, Kogi, FCT, Plateau
65.	*Hoslundia anadens Vahl* / Lamiaceae (Leaves)	Efirin-oso; Oghagha; Ana-mi-ole; Efirin odan (Yoruba)		Burns, Skin infections, Cough and Malaria.	Achenbach *et al.*, 1992	

66.	*Combretum migrantum* G.Don/ Combretaceae		HSV-1 HSV-2, HIV-2		Farrea *et al*., 1993; Welch, 2010	
67.	*Guazuma ulmifolia* Lam./ Malvaceae		Poliovirus	Extract inhibited Poliovirus replication, as well as, blocked the synthesis of viral antigens in infected cell cultures	Felipe *et al*. (2006)	
68.	*Melastomastrum capitatum* (Vahl) A. & R. Fern. Melastomataceae*)* (Leaves)	Belkon (Fulani)	Herpes antioxidant, antiviral, anti-cancer, anti-inflammatory and anti-allergic	Bird flu, human influenza virus, infectious bronchitis virus (a type of coronavirus), herpes virus, hepatitis C virus and HIV		Mambila Plateau, Ughelli North LGA, Mambilla Plateau, Sardauna LGA, Taraba.
69.	*Macanga barteri* Mull. Arg./ Euphorbiaceae				Segun *et al*., 2019; Ogbole et al., 2018	Benue, Plateue
70.	*Phyllanthus emblica* L. / Phyllanthaceae (Leaves and stem)		SARS-CoV- 2 3 Clpro		Qamar *et al*., 2020	
71.	*Taraxacum officinale* (L.) ex F.H. Wigg. /Asteraceae (Leaves, flowers & roots) Dandelion	Dandelion plant plant is also called "efo yanrin" or "yanrin oko" (Yoruba).	Aqueous *T. officinale* extract influenza virus *T. officinale* extract has antiviral activity against HBV, DENV2 and HCV	Dengue, a mosquito-borne virus that causes dengue fever. With symptoms like high fever, vomiting, and muscle pain.	Di Napoli & Zucchetti, 2021 Han *et al*., 2011; Rehman *et al*. 2016; He *et al*, 2011; Flores-Ocelotl *et al*, 2018; Yang *et al*., 2020	Niger, Benue, Plateau, Kogi, Kwara
72.	*Geranium sanguineum* L. /		Influenza virus	Treatment for influenza	Pantev *et al*. (2006) and Serkedjieva (1997)	
73.	*Vitellaria paradoxa* C.F. Gaertn. (Sapotaceae); (Fruits)	It is used to make a cream. Dan ka'raye, k'awara, ka'danya, mai ka'dai or mai ka' danya (Hausa). aku malapa (Yoruba), emi-emi, Okwuma (Igbo)	Anti-HSV-1, HIV-1	Anti-HSV-1, HIV-1		Niger, Nassarawa, Benue, Plateau, FCT
74.	*Spondias venulosa (*Engl).Mart. ex Engl. (Anacardiaceae) (Leaves)		Anti-oxidant, anti-inflammatory, anti-canser; anti- diabetic.		Ukwubile, *et al*., 2023.	Benue, Taraba
75.	*Adansonia digitata* L. / Malvaceae (Leaves, fruits, stem)		HIV-1		Amrish and Vinod Rangari (2016)	Benue, Kogi Kaduna, Nassarawa, Niger

KEY:
NDV=Newcastle Disease Virus; CDV= Canine Distemper Virus; FHV= Feline Herpes Virus; VHSV=Viral Hemorrhagic Septicaemia Virus; RV=Rhabdo Virus; HSV=Herpes Simplex Virus; HIV=Human Immune Deficiency Virus; YFV=Yellow

Fever Virus; MV=Measles Virus; PV = Polio Virus; HBV= Hepatitis B Virus; HCV= Hepatitis C Virus; HAV= Hepatitis A Virus; DEN-2=Dengue Virus; VSV=Vesicular Stomatitis Virus; CPV=Chicken Pox Viruses ; SPV=Smallpox Pox Viruses; CMV= Cytomegalo Virus; SARS-CoV=Severe Acute Respiratory Syndrome-Associated Coronavirus; RT= Reverse Transcriptase; CXV=Coxsackie Virus; ADV=Adenovirus**; HPV=**Human Papilloma Virus; HRSV=Human Respiratory Syncytial Virus ; CHIKV=Chikungunya virus; SIV: Simian immune deficiency virus.

CONCLUSION

Plants have been used as natural remedies since ancient times. Common plants such as basil, sage, and oregano, as well as Astragalus and Sambucus, have powerful antiviral effects against numerous viruses that cause infections in humans. It is easy to add these powerful plans to your diet by using them in your favorite recipes or making them into teas. However, we keep in mind that most research has been conducted in test tubes and animals using concentrated extracts. Therefore, it is unclear whether small doses of these herbs would have the same effects.

In addition, different studies revealed that there was high diversity of medicinal plants and traditional knowledge about the use, preparation, and application in this geopolitical zone. There is need for validation and standardization of phytomedicines and traditional medical practices so that this sector can be accorded its rightful place in the health care system.

In conclusion, terrestrial plants produce secondary metabolites for their chemical defense, which possess unique chemical structures and have played pivotal roles in human health. There is continuous need to introduce new drug candidates to treat diseases and the drug discovery process can be realized using both ancient and modern research methodologies in a complementary manner.

ACKNOWLEDGEMENT

We acknowledge the DG and all members of TMC NIPRD for providing the enabling environment for the research work.

REFERENCES

1. Abena AA, Diatewa M, Gakosso G, Gbeassor M, Hondi-Assah T, Ouamba JM. Analgesic, antipyretic and anti-inflammatory effects of essential oil of *Lippia multiflora*. Fitoterapia, 2003; 74(3): 231–6.
2. Abolaji AO, Ojo M, Afolabi TT, Arowoogun MD, Nwawolor D and Farombi EO. Protective properties of 6-gingerol-rich fraction from *Zingiber officinale* (Ginger) on chlorpyrifos-induced oxidative damage and inflammation in the brain, ovary and uterus of rats. *Chemico-Biological Interactions*, 2017; 270: 15-23.
3. Acharya D, Shrivastava A. 'Indigenous herbal medicines; Tribal formulations and traditional herbal practices', Aavishkar Publishers Distributor, Jaipur-India, 2008; 440.
4. Achenbach H, Waibel R, Nkunya MH and Weenen H. Antimalarial compounds from *Hoslundia opposita*. *Phytochemistry*, 1992; 31(11): 3781–4.
5. Adaramoye O, Erguen B, Oyebode O, Nitzsche B, Höpfner M, Jung K, Rabien A. Antioxidant, antiangiogenic and antiproliferative activities of root methanol extract of *Calliandra portoricensis* in human prostate cancer cells. *J. Integr Med*., 2015; 13(3): 185–93.
6. Adefule-Ositelu A, Adefule A, Omilabu S. "Clinical evaluation of ocular antiviral effect of *Garcinia* kolanut water extract in epidemic haemorrhagic keratoconjunctivitis in Lagos," *Nigerian Quarterly Journal of Hospital Medicine*, 2004; *14(3*): 270–276.
7. Adegbehingbe OO, Adesanya SA, Idowu TO, Okimi OC, Oyelami OA and Iwalewa EO, "Clinical effects of *Garcinia kola* in knee osteoarthritis," *Journal of Orthopaedic Surgery and Research*, 2008; 3(1): 34–10.
8. Adewunmi CO, Agbedahunsi AC, Adebajo AJ, Aladesanmi N, Wando J. Ethnoveterinary medicine: Screening of African medicinal plants for trypanocidal activity', *J. Ethnopharmacol*., 2001; 77; 19-24.
9. Adoho ACC, Zinsou FTA, Olounlade PA, Azando EVB, Adote MSH and Gbangboche AB. Review of the literature of *Eleusine indica*: phytochemical, toxicity, pharmacological and zootechnical studies. *Journal of Pharmacognosy and Phytochemistry*, 2021; 10(3): 29-33.
10. Ahmad H, Sehgal S, Mishra A, Gupta R. *Mimosa pudica* L. (Laajvanti): an overview. *Pharmacogn Rev*., 2012; 6(12): 115–30.
11. Amos, S., Abbah, J., Chindo, B., Edmond, I., Binda, L. and Adzu, B. (2005). Neuropharmacological effects of the aqueous extract of *Nauclea latifolia* root bark in rats and mice. *Journal of Ethnopharmacology*, 1979; 97: 53-57.
12. Ampofo O. The practice of phytotherapy in Ghana. In E.A. Sofowora (Ed.), African Medicinal Plants. Ife, Nigeria: University of Ife Press, 67.
13. Bot Y, Mgbojikwe L, Nwosu C, Abimiku A, Dadik J, Damshak D. 2007. Screening of the fruit pulp extract of *Momordica balsamina* for anti HIV property. *Afr. J. Biotechnol*, 2007; 6: 47–52.
14. Amrish and Vinod Rangari (2016). HIV1 Reverse transcriptase and protease assey of methanolic extract of Adansonia digitata L. international Journal of Pharmacy and Pharmaceutical Sciences, 8: 9.
15. Anita M (2004). 'Medicinal and aromatic plants; Monitoring the effectiveness of biological conservation', www.confound.org/global/global.html.
16. Aslam, A. (2014). Evaluation of antiviral effect of *Epigallocatechin gallate, Epigallocatechin,*

Epicatechin gallate and green tea extract against fowl Adenovirus-4 (Doctoral dissertation, University of Agriculture Faisalabad, Pakistan).
17. Asres K, Bucar F. 2005.Anti-HIV activity against immunodeficiency virus type 1 (HIV-I) and type II (HIV-II) of compounds isolated from the stem bark of *Combtetum molle*. *Ethiop. Med. J.*, 2005; 43: 15–20.
18. Biron KK, 2006. Antiviral drugs for cytomegalovirus diseases. *Antiviral Res., 2006;* 71: 154-163.
19. Busson, F. 1965. Food Plants of West Africa. A Botanical, Biological and Chemical Study. Food Plants of West Africa. A Botanical, Biological and Chemical Study.
20. Cella M, Riva DA, Coulombie FC., Mersich SE. Virucidal activity presence in Trichilia glabra leaves. *Rev. Argent Microbiol*, 2004; 36(3): 136–138.
21. Chang HM, and But PPH. Pharmacology and Applications of Chinese Materia Medica. English translation by Shem Chang-Shing Yeung, Sih Cheng-Yao, and Lai-Ling Wang (Chinese Medicinal Material Research Centre, Te Chinese University of Hong Kong). *World Scientific, Singapore*, 1987; 2: 918–928.
22. Chang JS, Liu HW, Wang KC, Chen MC, Chiang LC, Hua YC, Lin CC. Ethanol extract of *Polygonum cuspidatum* inhibits hepatitis B virus in a stable HBV-producing cell line. *Antiviral Res.*, 2005; 66(1): 29–34.
23. Chang, Y.S.; Woo, E.R. 2003. Korean medicinal plants inhibiting to human immunodeficiency virus type 1 (HIV-1) fusion. *Phytother. Res.*, 2003; 17: 426–429.
24. Cheng Y-Y, Chen H, He H-P, Zhang Y, Li S-F, Tang G-H, Guo L-L, Yang W, Zhu F, Zheng Y-T *et al*. 2013. Anti-HIV active daphnane diterpenoids from *Trigonostemon thyrsoideum*. *Phytochemistry*, 2013, 96: 360–369.
25. Dalziel JM. 1955. The useful plants of West Tropical Africă. (Being an appendix to "The flora of West Tropical Africa."). Crown Agents for the Colonies, London.
26. Debiaggi M, Pagani L, Cereda PM, Landini P, Romero E. 1988. Antiviral activity of *Chamaecyparis lawsoniana* extract: study with herpes simplex virus type 2. *Microbiologica*, 1988; 11(1): 55–61.
27. Deeni YY, Sadiq NM. 2003. Antimicrobial properties and phytochemical constituents of the leaves of African mistletoe (Tapinanthus dodoneifolius (DC) Danser) (Loranthaceae): An ethnomedicinal plant of Hausaland, Northern Nigeria Journal *of Ethnopharmacology*, 2003; 83(3): 235-40. DOI:10.1016/S0378-8741(02)00244-1
28. Napoli A and Zucchetti P.A. A comprehensive review of the benefits of *Taraxacum officinale* on human health. *Bulletin of the National Research Center*, 2021; 45: 110.
29. Djakpo O, Yao W. 2010. *Rhus chinensis* and *Galla chinensis*—Folklore to modern evidence: *Review. Phytother. Res*., 2010; 24: 1739–1747.
30. Eldeen I, Seow E, Abdullah R, Sulaiman S. In vitro antibacterial, antioxidant, total phenolic contents and anti-HIV-1 reverse transcriptase activities of extracts of seven *Phyllanthus* sp. *S. Afr. J. Bot.*, 2011; 77: 75–79.
31. Erdogrul OT. 'Antibacterial activities of some plant extracts used in folk medicine'. *Pharma. Biol*., 2002; 40: 269-27.
32. Erharuyi O, Falodun A, Langer P. 2014. Medicinal uses, phytochemistry and pharmacology of *Picralima nitida* (Apocynaceae) in tropical diseases: A review. *Asian Pacific journal of tropical medicine*, 2014; 7(1): 1-8.
33. Gnabre JN, Brady JN, Clanton DJ, Ito Y, Dittmer J, Bates RB. Huang, R.C.C. 1995. Inhibition of human immunodeficiency virus type 1 transcription and replication by DNA sequence-selective plant lignans. *Proc. Natl. Acad. Sci. USA*, 1995, 92: 11239–11243.
34. Hassan ST, Švajdlenka, E and Berchová-Bímová K. *Hibiscus sabdariffa* L. and its bioactive constituents exhibit antiviral activity against HSV-2 and anti-enzymatic properties against urease by an ESI-MS based assay. *Molecules*, 2017; 22(5): 722.
35. Huang KL, Lai YK, Lin CC, Chang J.M. 2006. Inhibition of hepatitis B virus production by *Boehmeria nivea* root extract in HepG2 2.2.15 cells. *World J. Gastroenterol*, 2006; 12(35): 5721–5725.
36. Iberahim R, Yaacob WA and Ibrahim N. 2015. Phytochemistry, cytotoxicity and antiviral activity of *Eleusine indica* (sambau). *AIP Conference Proceedings, 1678(11678)*, Published Online, 25 September 2015. 030013 (2015); https://doi.org/10.1063/1.4931234
37. Igoli JO, Ogali OG, Tor-Anyiin TA, Igoli PN. Traditional medicine practice amongst the Igede people of Nigeria Part II. *Afri J Trad CAM*., 2005; 2(2): 134–152.
38. Imaga N, Gbenle G, Okochi V, Adenekan S, Edeoghon S, Kehinde M, Bamiro S, Ajiboye A, Obinna A. 2010. Antisickling and toxicological profiles of leaf and stem of *Parquetina nigrescens* L. *J Med Plants Res*., 2010; 4(8): 639–43.
39. Iqbal M, Gnanaraj C. 2012. *Eleusine indica* L. possesses antioxidant activity and precludes carbon tetrachloride (CCl 4)-mediated oxidative hepatic damage in rats. *Environ Health Prev Med*., 2012; 17(4): 307–15.
40. Iwu MM. 2014. Handbook of African medicinal plants. CRC press. DOI: https://doi.org/10.1201/b16292.
41. Jadaun P, Khopkar P, Kulkarni S. 2016. Repurposing phytochemicals as Anti-HIV agents. *J. Antivir. Antiretrovir*, 2016; 8: 139–141. .
42. John TA and Onabanjo A. 1990. Gastroprotective effects of an aqueous extract of Entandrophragma utile bark in experimental ethanol-induced peptic

ulceration in mice and rats. *J Ethnopharmacol*, 1990; 29(1): 87–93.
43. Kmolafe O, Olusori D, Adewole S, Ayoka A, Abiodun A, *Momodica charantia* protects against the cardiac damage of STZ induced domestic Winstar rats. *J Pharm. Sci*. *Innov*, 2012; 1(3): 32-36.
44. Kotwal GJ, Kaczmarek JN, Leivers S, Ghebremariam YT, Kulkarni AP, Bauer G, Preiser W, Mohamed AR. 2005. Anti-HIV, anti-Poxvirus, and anti-SARS activity of a nontoxic, acidic plant extract from the *Trifollium* Species Secomet-V/anti-Vac suggests that it contains a novel broad-spectrum antiviral. *Ann. NY Acad. Sci.*, 2005; 1056: 293–302
45. Kumar S, Malhotra R and Kumar D. 2010. *Euphorbia hirta*: Its chemistry, traditional and medicinal uses, and pharmacological activities. *Pharmacognosy Reviews, 2010;* 4(7): 58.
46. Kumar S; Pandey AK. 2014. Medicinal attributes of *Solanum xanthocarpum* fruit consumed by several tribal communities as food: An in vitro antioxidant, anticancer and anti HIV perspective. *BMC Complement. Altern. Med*., 2014; 14: 112.
47. Kwon DH, Kwon HY, Kim HJ, Chang EJ, Kim MB, Yoon SK, Song EY, Yoon DY, Lee YH, Choi IS, Choi YK. 2005. Inhibition of hepatitis B virus by an aqueous extract of *Agrimonia eupatoria* L. Phytother. *Res., 2005;* 19(4): 355–358.
48. Lee-Huang S, Zhang L, Huang PL, Chang YT, Huang PL. 2003. Anti-HIV activity of olive leaf-extract (OLE) and modulation of host cell gene expression by HIV-1 infection and OLE treatment. *Biochem. Biophys. Res. Commun*, 2003; 307(4): 1029–1037.
49. Li SY, Chen C, Zhang HQ, Guo HY, Wang H, Wang L, Zhang X, Hua SN, Yu J, Xiao PG, Li RS, Tan X. Identification of natural compounds with antiviral activities against SARS-associated coronavirus. Antiviral Res., 2005; 67(1): 18–23.
50. Mahendra Yadey; Dligay D Gulkori and Manish M. Wanjari. Bryophyllum pinnatum leaf extract prevent formation of renal calculi in Lithiatic rats. Ancient Science of Life, 2016; 36(2): 90-97.
51. Md-Mustafa ND, Khalid, N, Gao, H, Peng Z, Alimin, MF, Bujang N, Ming WS, Mohd-Yusuf, Y, Harikrishna JA, Othman RY. 2014. Transcriptome profiling shows gene regulation patterns in a flavonoid pathway in response to exogenous phenylalanine in *Boesenbergia rotunda* cell culture. *BMC Genom*, 2014; 15. DOI: 10.1007/s11240-015-0813-4
52. Meira M, Silva EP, David JM, David JP. 2012. Review of the genus Ipomea*:* traditional uses, chemistry and biological activities. *Brazilian J Pharmacogn*, 2012; 22(3): 682-713.
53. Mensah JK, Okoli RI, Ohaju-Obodo JO and Eifediyi K Phytochemical, nutritional and medical properties of some leafy vegetables consumed by Edo people of Nigeria. *Afr J Biotechnol*, 2008; 7: 2304-2309.
54. Micol V, Caturla N, Perez-Fons L, Mas V, Perez L, Estepa A. 2005. The olive leaf extract exhibits antiviral activity against viral haemorrhagic septicaemia rhabdovirus (VHSV) *Antiviral Res*., 2005; 66(2/3): 129–136.
55. Notka F, Meier G, Wagner R. Concerted inhibitory activities of *Phyllanthus amarus* on HIV replication in vitro and ex vivo. *Antiviral Res.*, 2004; 64(2): 93–102.
56. Odugbemi T, Akinsulire O. 'Medicinal plants by species names' in; Odugbemi T, editor: 'Outlines and pictures of medicinal plants from Nigeria', University of Lagos, 2018; 95-156.
57. Ogbole Omonike O. Ogbole, Toluwanimi E. Akinleye, Peter A. Segun, Temitope C. Faleye and Adekunle J. Adeniji. In vitro antiviral activity of twenty-seven medicinal plant extracts from Southwest Nigeria against three serotypes of echoviruses, *Virology Journal*, 2018; 15. https://doi.org/10.1186/s12985-018-1022-7
58. Ojo OO, Oluyege JO. & Famurewa O. (2009). Antiviral properties of two Nigerian plants. *African Journal of Plant Science*, 3(7): 157-159, July, 2009 Available online at http://www.academicjournals.org/AJPS ISSN 1996-0824 © 2009 Academic Journals
59. Oketch-Rabah HA, Roe AL, Rider CV, Bonkovsky HL, Gioncaspro GI, Navarro V, Paine MF, Betz JM, Marles RJ, Casper S, Gurley B, Jordan SA, He K, Kapoor MP, Rao TP, Sherker AH, Fontana RJ, Rossi S, Vuppalanchi R, Seef LB, Stolz A, Ahmad J, Serrano J, Low Dog T, Ko R. United state Pharmacopaeia (USP) . Comprhensive review of the hepatoxicity of green tea extracts. Toxicol Rep., 2020.
60. Okunade AL. 2002. Ageratum conyzoides L. (Asteraceae). Fitoterapia, 2002; 73: 1-16.
61. Oldstone MB. Rous-whipple Award Lecture. Viruses and diseases of the twenty-first century. Am. J. Pathol., 1993; 143: 1241-1249.
62. Oliver B. Medicinal Plants of Nigeria. Nigeria College of Arts, In Science and Aworh, OC. 2014. Lesser-known Nigerian fruits and vegetables: Post-harvest handling, utilization and nutritional value. Ibadan University Press Publishing House, University of Ibadan, Nigeria, 1960; 7-8.
63. Olorunnisola OS, Afolayan AJ, Adetutu A. 2015Sub-chronic administration of methanolic whole fruit extract of Lagenaria breviflora (Benth.) Roberty induces mild toxicity in rats. *Pharmacogn Mag*., 2015; 11(4): S516–21.
64. Olufunke Faluyi (2021). Healthy Living with Olukunke. Punch News papers, 4th January, 2021.
65. Oyewale, MB, Seidu, KTT, Ogunbusola EM., Osundahunsi OF, Ogunwa TH, Akele O. and Adejoro DO. Nutritional composition and sensory quality of packaged Ofe-Owerri: A major traditional soup in Nigeria; *Current Nutrition and Food Science*, 2020; 16: 1-10.
66. Parida MM, Upadhyay C, Pandya G, Jana AM. 2002. Inhibitory potential of neem (*Azadirachta indica* Juss) leaves on dengue virus type-2

replication. *J. Ethnopharmacol*, 2002; 79(2): 273–278.
67. Paul S, Chakraborty S, Mukherjee A, Kundu R. 2015. Evaluation of cytotoxicity and DNA damaging activity of three plant extracts on cervical cancer cell lines. *Int J Pharm Sci Rev Res*., 2015; 31(1): 183–9
68. Pervez K, Effect of combination chemotherapy on hepatitis C virus in hepatic patients. *Pak. J. Biol. Sci*., 2000; 3: 969-970.
69. Rashed K, Zhang XJ, Luo MT, Zheng YT. 2012. Anti-HIV-1 activity of phenolic compounds isolated from *Diospyros lotus* fruits. *Phytopharmacology*, 2012, 3: 199–207.
70. Rawat A, Mehrotra S, Tripathi S, Shome U. 1997. Hepatoprotective activity of Boerhaavia diffusa L. roots—a popular Indian ethnomedicine. *Journal of Ethnopharmacol*, 1997; 56(1): 61–66.
71. Schröder HC, Merz, H Steffen R, Müller WEG, Sarin PS, Trumm S, Schulz J, Eich E. Differential in vitro anti-HIV activity of natural lignans. Z. Naturforsch C., 1990; 45: 1215–1221.
72. Serkedjieva J. 2003. Influenza virus variants with reduced susceptibility to inhibition by a polyphenol extract from *Geranium sanguineum* L. *Pharmazie*, 2003; 58(1): 53–57.
73. Silprasit K, Seetaha S, Pongsanarakul P, Hannongbua S, Choowongkomon K, Anti-HIV-1 reverse transcriptase activities of hexane extracts from some Asian medicinal plants. *J. Med. Plants Res.*, 2011; 5: 4194–4201.
74. Swanson MD, Winter H.C, Goldstein IJ, Markovitz DM. 2010. A lectin isolated from bananas is a potent inhibitor of HIV replication. *J. Biol. Chem*., 2010; 285: 8646–8655.
75. Tahir MM, Ibrahim N, Yaacob WA. 2014. Cytotoxicity and antiviral activities of *Asplenium nidus, Phaleria macrocarpa* and *Eleusine indica.* The 2014 UKM FST Postgraduate Colloquium AIP Conf. Proc., 2014; 1614: 549-552. doi: 10.1063/1.4895259
76. Tan EC, Karsani SA, Foo GT, Wong SM, Abdulrhman N, Khalid N, Othman S, Yusof R. 2012. Proteomic analysis of cell suspension cultures of *Boesenbergia rotunda* induced by phenylalanine: Identification of proteins involved in flavonoid and phenylpropanoid biosynthesis pathways. *Plant Cell. Tissue Organ Cult.*, 2012; 111: 219–229.
77. Tolo FM, Rukunga GW, Muli FW, Ochora JM, Irungu BN, Muthaura CN and Asakawa, Y. The antiviral activity of compounds isolated from Kenyan *Carissa edulis* (Forssk.) Vahl. *Journal of Medicinal Plants Research*, 2010; *4(15*): 1517-1522.
78. Tolo FM., Rukunga GM, Muli FW, Njagi EN, Njue W, Kumon K and Oishi E. Anti-viral activity of the extracts of a Kenyan medicinal plant *Carissa edulis* against herpes simplex virus. *Journal of Ethnopharmacology*, 2006; 104(1-2): 92-99.
79. Ugbabe, G. E; Ibrahim J.A.; Egharevba, H.O.; Kunle, F.O. and Adigwe, P.O. Medicinal Plants Used in Treating Diseases in Benue State, North-Central Zone-Nigeria. International Journal of Scientific & Engineering Research, October, 2021; 12(10): 692-733. ISSN 2229-5518.
80. Ukponu AA. 1985. Phytochemical Investigation of *Azadirachta indica* A. Juss, B. Pharm. Project, Report, Nsukka, University of Nigeria.
81. Ukwubile CA, Malgwi TS, Angyu AE, Otalu O, Bingari MS. 2020. Review of Antiviral Medicinal Plants Used in Taraba State Nigeria: A Possible Source for COVID-19 Drug Discovery. *J. Sci. Res. Med. Biol. Sci.*, 2020; 1(2): 2709-0159 (Print) and 2709-1511http://bcsdjournals.com/index.php/jsrmbsISSN 2709-0159 (Print) and 2709-1511 (Online) DOI: 10.47631/jsrmbs.v1i2.50
82. Ukwubile CA, Samagoro CT, and Nuhu A. 2018. Preliminary phytochemical screening and Acute Toxicity Determination of *Camellia Sinensis* L. (Theaceae) leaf methanol extract in Swiss Albino Mice. *Inter.l J. Biolo. Sci Res*, 2018; 1(1): 1-17.
83. Ukwubile, Cletus Anes Emmanuel Oise Ikpefan, Babagana Modu, Troy Silvia Malgwi, Vivia Amarachuckwu Umea (2023). Evaluation of Physicochemical parameters, acute toxicities and anti-diabetic activities of Pondias venulosa (Engl.) Mart. Ex Engl. Leaf extract on alloxan-induced diabetic rats. Journal of Enthnopharmacology.
84. Umaru HA, Adamu, R, Dahiru D and Nadro MS. Level of antinutritional factors in some wild edible fruits of Northern Nigeria. *African Journal of Biotechnology*, 2007; *6(6): 1935–1938.*
85. Van Rooyen, J. In R. Watson and V. Preedy (Eds.), Bioactive Food as Dietary Interventions for Cardiovascular Disease. New York: Elsevier, 2012; 22: 345.
86. Vermani K., Garg S. 2002. Herbal medicines for sexually transmitted diseases and AIDS. *J. Ethnopharmacol*, 2002; 80(1): 49–66.
87. Wang WX, Qian JY, Wang XJ, Jiang AP, Jia AQ. 2014. Anti-HIV-1 activities of extracts and phenolics from Smilax china L. *Pakistan J. Pharm. Sci*., 2014; 27: 147–151.
88. Wang X, Shen Y, Wang S, Li S, Zhang W, Liu X, L ai L, Pei J, Li H. 2015. Herb-drug interaction between an anti-HIV Chinese herbal formula and atazanavir *In Vitro* and *In Vivo*. *J. Ethnopharmacol*, 2015; 162: 369–376.
89. Watcho P, Kamtchouing P, Sokeng S, Moundipa PF, Tantchou J, Essame JL and Koueta N. 2001. Reversible antispermatogenic and antifertility activities of *Mondia whitei* Linn. in male albino rat. *Phytother Res.*, 2001; 15(3): 26-29.
90. WHO Director-General's opening remarks at the media briefing on COVID-19". World Health Organization (WHO) (Press release). 11 March, 2020. Archived from the original on 11 March, 2020. Retrieved 12 March, 2020. www.cdc.gov/coronavirus.

91. WHO. 1989a. *In Vitro* screening of traditional medicines for anti-HIV activity: Memorandum from a WHO meeting. Bull. World Health Organ, 1989a; 87: 613–618.
92. WHO. 1989b. Report of a Who Informal Consultation on Traditional Medicine and AIDS: *In Vitro* Screening for Anti-HIV activity; WHO: Geneva, Switzerland
93. Williams LA, Rosner H, Levy HG, Barton EN. A critical review of the therapeutic potential of dibenzyl trisulphide isolated from *Petiveria alliacea* L (Guinea hen weed, anamu). *West Indian Med J.*, 2007; 567: 53–7.
94. Woradulayapinij W, Soonthornchareonnon N, Wiwat C. 2005. In vitro HIV type 1 reverse transcriptase inhibitory activities of Thai medicinal plants and *Canna indica* L. rhizomes. *J. Ethnopharmacol*, 2005; 101: 84–89.
95. World Health Organization (WHO). 2017. Available online: http://www.who.int/hiv/ data/epi_plhiv_2016_regions.png?ua=1 (accessed on 1 December 2017).
96. Xu H-X, Wan M, Loh B-N, Kon O-L, Chow P-W, Sim K-Y. 1996. Screening of traditional medicines for their inhibitory activity against HIV-1 protease. *Phytother. Res*., 1996; 10: 207–210.
97. Yamai M., Tsumura K, Kimura M, Fukuda S, Murakami T, Kimura Y. 2003. Antiviral activity of a hot water extract of black soybean against a human respiratory illness virus. *Biosci. Biotechnol. Biochem.*, 2003; 67(5): 1071–1079.
98. Yang CM, Cheng HY, Lin TC, Chiang LC, Lin CC. 2007. The *In Vitro* activity of geraniin and 1, 3, 4,6-tetra-O-galloyl-beta-d-glucose isolated from *Phyllanthus urinaria* against herpes simplex virus type 1 and type 2 Infection. *J. Ethnopharmacol*, 2007; 110(3): 555–558.
99. Yet´e P, Ndayishimiye V, Agbangnan P, Dj´enontin S, Wotto V, Sohounhloue D. 2014. "Chemical composition of ´ the seeds and the defatted meal of Garcinia kola Heckel (Guttifferae) from Benin," *Chemistry Journal, 2014; 4(5*): 13–19.
100. Yu YB, Park JC, Lee JH, Kim GE, Jo SK, Byun MW, Miyashiro H, Hattori M. 1998. Screening of some plant extracts for inhibitory effects on HIV-1 and its essential enzymes. *Korean J. Pharmacogn*, 1998; 29: 338–346.
101. Zakay-Rones Z, Thom E, Wollan T, Wadstein J. 2004. Randomized study of the efficacy and safety of oral elderberry extract in the treatment of influenza A and B virus infections. *J. Int. Med. Res*., 2004; 32(2): 132–140.
102. Zhen J, Villani TS, Guo Y, Qi Y, Chin K, Pan M, Ho C, Simon JE and Wu Q. Phytochemistry, antioxidant capacity, total phenolic content and anti-inflammatory activity of *Hibiscuss sabdariffa* leaves; *Food Chemistry*, 2016; 190: 673-680.