

Original Research Article

Efficacy of Herbal Medicines as Remedies against COVID-19

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Article History

Received: 15.07.2020

Accepted: 28.08.2020

Published: 03.03.2023

Journal homepage:

<https://www.easpublisher.com>

Quick Response Code



Abstract: Objective: Coronaviruses belong to the order Nidovirales, family Coronaviridae, and four genera, namely: alpha, beta, gamma, and delta. In December 2019, a novel coronavirus was first officially reported in Wuhan City of China. Consequently, on February 11, 2020, the CSG named the virus severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2); it causes the disease dubbed Covid-19. The virus was officially declared pandemic by WHO, on March 11, 2020. Up till date, no drug, including the existing ones, has been approved for covid-19 treatment. The objective of this work, is to carry out a review on proven herbal extracts and the phyto-compound contents, for possible antiviral properties against SARS-CoV-2, and thus, as potential candidates for Covid-19 vaccine. **Materials and Methods:** Investigation into proven plant species against respiratory tract diseases was carried out between 1st to 30th of July, 2020 via: (a) Conduction of interview with traditional herbal healers and users, in south-western Nigeria on efficacies and history of use of identified plant species; (b) Search to confirm active phyto-compounds in the traditionally identified plant species via: (i). the free ELSEVIER repositories at the 'COVID-19 RESOURCE CENTRE' hosted on ELSEVIER Connect. (ii). Unrestricted resources in the PubMed domain. (iii). Unrestricted publicly funded repositories, such as the WHO COVID-19 database. **Results:** Findings revealed herbal extracts of: (i). *Zingiber officinale*, (ii). *Psidium guayava*, (iii). *Nigella sativa*, and (iv). *Hibiscus sabdariffa*; are highly rich in phyto-compounds with potent antiviral properties, and therefore suit as a potential remedy against Covid-19. **Conclusion:** Identified plant species possess phyto-compounds with antiviral activities, thus projecting them as potential candidates for development of Covi-19 vaccine.

Keywords: Herbal Medicine, Phyto-compounds, Antiviral properties, SARS-CoV-2, Coronaviruses, Covid-19, Vaccines.

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INTRODUCTION

Coronaviruses are a large group of viruses belonging to the order Nidovirales, family Coronaviridae, and four genera, namely: alpha, beta, gamma, and delta. They possess envelopes and are single-stranded Ribonucleic acid (RNA) [1]. Studies revealed they constitute the largest known RNA viruses, with genomes ranging from 25 to 32 kb [2]. Coronaviruses are associated with acute respiratory diseases; they are known to infect respiratory tracts in animals and humans [3]. Over the time, these viruses have been reported to be pandemic, causing deadly diseases at a global scale, examples include: severe

acute respiratory syndrome-related coronavirus (SARS-CoV), Middle East respiratory syndrome-related coronavirus (MERS-CoV) [4], etc.

Recently, in December, 2019, a novel coronavirus was first officially reported in Wuhan City of China. Studies on the new virus revealed it belongs to the coronaviridae family, according to the Coronaviridae Study Group (CSG), which is the International Committee on Taxonomy of Viruses. Consequently, on February 11, 2020, the CSG named the virus "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)." The nomenclature was

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based on molecular phylogeny analysis, taxonomy and established practice by the CSG [5]. Due to the high contagious nature and swift spread of the virus at a global scale, it was officially declared pandemic by world health organization (WHO) on March 11, 2020 [6]. The SARS-CoV-2 is the recent virus in the history of Man, and it is responsible for the disease dubbed Covid-19; this is because it infects the human respiratory tract like other coronaviruses diseases, and became manifested in 2019. The Coronaviruses are so classified based on the crown appearance of the envelope glycoproteins, and on the characteristic features of the chemistry and replication [7]. Currently (July 15, 2020) there have been thirteen million, three hundred and sixty thousand, four hundred and one (13,360,401) confirmed cases; including seven million, four hundred and forty-one thousand, four hundred and forty-six (7,441,446) recovery and five hundred and seventy-nine thousand, five hundred and forty-six (579,546) deaths, globally (<https://coronavirus.jhu.edu/map.html>). The fact that Covid-19 pandemic has ravaged the world is no longer news; it is causing serious threats and tremors among the world populace.

Covid-19: Current Trend on Spread Statistics

According to the world health organization (WHO) coronavirus disease (Covid-19) dashboard, observed on the 15th of July, 2020, as of 9:20am CEST;

there have been thirteen million, three hundred and sixty thousand, four hundred and one (13,360,401) confirmed cases; including seven million, four hundred and forty-one thousand, four hundred and forty-six (7,441,446) recovery and five hundred and seventy-nine thousand, five hundred and forty-six (579,546) deaths, globally (<https://coronavirus.jhu.edu/map.html> searched on the 15th of July, 2020).

The Africa Covid-19 statistics update for Wednesday, 15th July 2020, showed there have been six hundred and twenty-five thousand, five hundred and sixty-two (625,562) confirmed cases; three hundred and thirty thousand, eight hundred and twenty-eight (313,828) recoveries, and thirteen thousand, seven hundred and sixty three (13,763) deaths.

The Nigeria covid-19 situation report for Wednesday 15th of Jul 2020, as at 4:25am, revealed the total number of confirmed cases to be thirty three thousand, six hundred and sixteen (33,616), the active cases rose to nineteen thousand and seventy (19070), the number of discharged reached thirteen thousand seven hundred and ninety two (13792), while number of death increased to seven hundred and fifty four (754) (<https://covid19.ncdc.gov.ng/>). The spread according to states in Nigeria is expressed in the chart below (figure: 1).

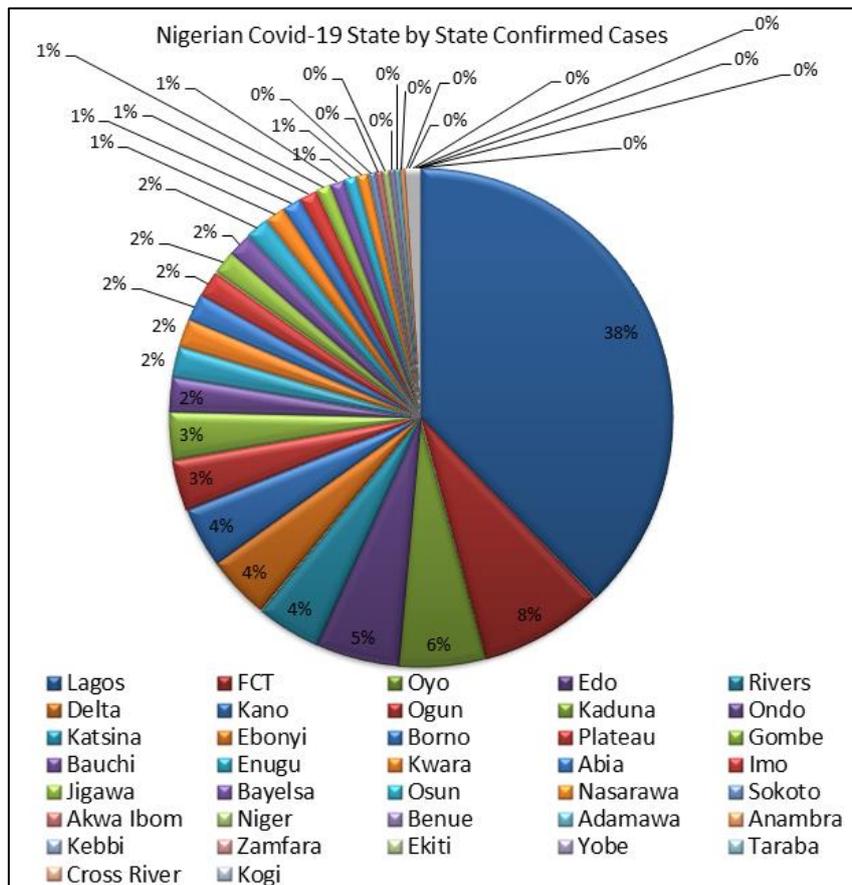


Figure 1: The Covid-19 Case Spread across States in Nigeria

Up till date, no drug has been approved for covid-19 treatment. Some suggested drugs include: chloroquine phosphate, hydroxychloroquine, interferon- α , etc., however, none has shown antiviral potent against the pandemic. As a normal practice, the procedures for unravelling drugs for cure of ailments are laborious, involving several tests under the experimental and clinical stages, thus signifying no immediate rescue is available in the offing. Utilization of herbal medicines for cure of ailments has been a known practice, and accepted norm for over centuries by most of the world populace, largely in developing countries [10]. The use of local herbal medicine for treatment of respiratory tract diseases symptoms such as cough, congestion, catarrh, asthma, and so on; as the preferred method of therapy among a substantial number of world populace is not a strange practice. Phyto-compounds are readily available and extractable from different parts of plant materials. In recent studies, phyto-compounds have shown proven antiviral properties. Investigation into proven plant species against respiratory tract diseases was conducted via two main approaches: (a). Conduction of interview with traditional herbal healers and users in south western Nigeria over efficacies and history of use of identified plant species. (b). Search to confirm the active phyto-compounds in the traditionally identified plant materials: (i). the free ELSEVIER repositories at the 'COVID-19 RESOURCE CENTRE' hosted on ELSEVIER Connect. (ii). Unrestricted resources in the PubMed domain. (iii). Unrestricted publicly funded repositories, such as the WHO COVID- 19 database. Several reports have revealed effective utilization of these compounds in the treatment of ailments of various kinds [11, 12], including viral diseases responsible for respiratory tract infections in humans [13].

The aim of this work, therefore, is to carry out a review on varying proven herbal extracts and the phyto- compound contents, readily available in plant species under local environment, for possible antiviral properties against SARS-CoV-2, and thus, as potential candidates for Covid-19 vaccine.

MATERIALS AND METHODS

Investigation into proven plant species materials against respiratory tract diseases was carried out via two main approaches between 1st of July to 30th of July, 2020; they are:

- (a) Conduction of interview on local herbal users and traditional healers in south-western part of Nigeria on efficacies and history of use of identified plant species materials being utilized against respiratory tract diseases; in line with ethno-medicinal ethics.
- (b) Furthermore, investigation was conducted on the active phyto-compounds in the traditionally identified plant materials being employed for the treatment of respiratory tract

diseases, through studying published journals/communications:

- i. The freely available ELSEVIER repositories at the 'COVID-19 RESOURCE CENTRE' hosted on ELSEVIER Connect.
- ii. Unrestricted resources available in the PubMed Central.
- iii. Unrestricted publicly funded repositories, such as the WHO COVID database.

The search covered some active herbal materials and phyto-compounds from identified plant species, against different virus-associated respiratory tracts diseases in humans, with special interest on SARS-CoV-2.

RESULTS AND DISCUSSION

Herbal Medicine Healing Effects on Covid-19 Pandemic

The efficacy of herbal or traditional medicine in the treatment or prevention of human ailments is well known and dates back since the inception of human civilization on earth [14]. The traditionalists or herbal healers could identify specific plant species appropriate for the treatment of a particular ailment. This knowledge was obtained over the centuries through experiences gained within and between different traditional and cultural backgrounds of human communities, and sharing of ideas among natives well versed in the field of medicinal plants and applications. Up till date, despite the revolution of chemical synthetic drugs in health care systems over hundred years ago, the majority of the people across the globe still prefer and believe in the use of traditional medicine for cure and prevention of ailments [15]. One of the main reasons attached to the preference for traditional medicine over the allopathic types is that the former has lower side effects as compared to the latter [16]. The role of phyto-compounds in human health care cannot be overestimated. Several active compounds against varying ailments have been derived from plants extracts, and their mechanisms of action against causative agents have been established.

Evidences abound that extracts from plant materials exhibit antiviral activities against several viral strains that have shown resistance to conventional antiviral drugs [12, 17]; these facts are further proofs of the indispensability of herbal medicines in human health care systems.

Extracts from some specific plant species have been reported to interrupt the life cycle of viruses, some exhibit inhibitory effects on the replication of a lot of viruses [12], over the years. Investigations revealed that in 1995, one hundred British Colombian medicinal plants were screened for antiviral activities, and twelve were found to exhibit significant antiviral effects against many viral diseases such as: (i) coronavirus

respiratory syncytial virus (RSV), (ii) para-influenza virus type 3 (PI3), (iii) herpesvirus type 1 (HSV-1) and (iv) rotavirus [18, 19].

Some locally identified plant species that have proven effective against respiratory tract infections, including coronaviruses, are discussed below along with their phytochemical activities in the inhibition and interruption of virus replication and life cycles.

Ginger: The scientific name is *Zingiber officinale*, it is a rhizome and belongs to the family Zingiberaceae. Ginger (Figure 2) is subjected to several uses in Nigeria; the traditional herbal healers utilize it for cure and prevention of ailments including cough, catarrh, chest pain, stomach upsets, etc. It is also been used in the preparation of foods, beverages, and teas; it is also being added to stew and soup for home consumption due to its medicinal values, and characteristic pungent flavor [20].



Figure 2: Ginger rhizome. The dry preserved form of ginger rhizome

Extracts from fresh ginger have been analysed to contain several bioactive non-volatile phenolic phyto-compounds such as gingerols, paradols, shogaols, and zingerones [21]. In recent research conducted by Rathinavel *et al.*, [22], 6-gingerol, a bioactive phenolic phyto-compound derived from fresh ginger rhizome has been found to exhibit active antiviral potency against SARS-CoV-2 (Covid-19). The phyto-compound interacted with SARS-CoV-2 showing the highest binding affinity with multiple targets including viral proteases, RNA binding protein, and Spike protein. The DFT that was further conducted in the same research confirmed the highest binding affinity between 6-gingerol and SARS-CoV-2 protein targets.

Guava: *Psidium guajava* is the scientific name for Guava (Figure 3). It is a tree plant and belongs to the family myrtaceae. In Nigeria, the fruit is vastly consumed, and researchers have discovered it is highly rich in both organic and inorganic compounds such as secondary metabolites: antioxidants, antiviral compounds, anti-inflammatory compounds, and polyphenols. The leaf and stem bark are often been

boiled in water to extract the contents for herbal use against several ailments including fever, cold, catarrh, diarrhea, oral ulcers, and so on [23].

In a research work conducted by Sriwilaijaroen *et al.*, [24], an infusion method was utilized to prepare Tea from Guava to test for its potential anti-influenza activity against clinical influenza A (H1N1) isolates. The researchers applied a 19-h influenza growth inhibition assay with ST6Gal I-expressing MDCK cells as part of their protocols. Results revealed Guava tea significantly inhibited the growth of several viral strains including amantadine-resistant pandemic 2009 strain, oseltamivir-resistant strain, and so on. The tea extracts also caused the inhibition of viral hemagglutination at varying concentration-dependent levels, similar to those effective in causing viral growth inhibition. The researchers concluded tea infusion of Guava has the efficacy to control influenza viruses. It was further postulated that due to the broad target blockade of the candidate plant against influenza viruses, it could be difficult for the viruses to develop resistance against the plant extract.



Figure 3: A Twig of Guava. The twig bears the leaves and small fruit of guava.

The influenza viruses affect respiratory tract just like the corona viruses; and show some similar symptoms like fever, cough, congestion, runny nose, muscle aches, and so on. The efficacy of the plant tea infusion in marked control of the influenza viruses highly present *Psidium guayava* as a potential candidate plant for control of SARS-CoV-2 and cure for Covid-19.

Black Seed: The Black seed (Figure 4) is scientifically classified as *Nigella sativa*; it belongs to the family Ranunculaceae. In Nigeria, the plant is exotic, but been grown for its marked medicinal value. It is traditionally believed that the seed has the potential to cure all

ailments, except death; thus, typifying the richness of the plant seeds in different phytochemicals responsible for cure and control of ailments. Some few months ago, the present Governor of Oyo state, Nigeria, Mr. Seyi Makinde, tested positively to SARS-CoV-2 there and then he proceeded on self-isolation in line with the regulations of the Presidential Task Force (PTF) on Covid-19. During the isolation, he declared he was engaged in administering the oil extracted from the black seed (*Habbatus sawda* – Arabic name) mixed with honey, as a herbal remedy to boost his immunity against the deadly virus. Subsequently, further tests confirmed he became negative to the virus [25].



Figure 4: The Black Seed (*Nigella sativa*). Dried preserved form of the black seed where the oil is extracted

In one of the latest research work carried out by Bouchentouf and Missoum [12], the researchers aimed to investigate the possible active phyto-

compounds present in selected plant species that could inhibit SARS-CoV-2 by acting on the protease. Molecular docking protocol was utilized in the

methodology. The results revealed two main compounds isolated from *Nigella sativa* (black seed) that could inhibit SARS-CoV-2, these compounds are: Nigellidine and α -hederin. The compounds gave similar or even better energy scores when compared to drugs under clinical tests for SARS-CoV-2 treatment. The efficacies of the two main compounds isolated from the Black seed, as they compare favourably or even better to drugs under clinical tests, showcased their high potency as correct drug candidates to control SARS-CoV-2.

Roselle: *Hibiscus sabdariffa* is the scientific name for roselle (Figure 5); it is a member of the family Malvaceae. It is commonly called *Isapa* (Yoruba language); the leaf is used in making local soup; while the calyx is used in making juice extract known as Zobo. Herbal medicine practitioners and users say the calyx juice extract are a remedy to hypertension, as it brings about dilation of blood vessels. The phyto-activity of *Hibiscus sabdariffa* as anti-hypertension herb is also affirmed in the published research work by Mary [26]. Recently, local herbalists believe Zobo has the potential to remedy symptoms of coronaviruses such as cough, congestion, chest pain, and so on.

Baatartsogt *et al.*, [27], screened 11 different plant extracts in search for potential phyto-compounds against the deadly avian influenza viruses, which had

spread like wild fire across many countries of the world, causing cough, congestion, catarrh and so on. Prior to the research, viral neuraminidase inhibitors are available and mostly recognized synthetic anti-influenza drugs for its prevention and cure. However, due to emergent drug-resistant variants of the viruses—the H5N1, highly pathogenic influenza viruses (HPAIVs); and AIVs, low pathogenic (LPAIVs); the need to search for an effective alternative therapy became inevitable. The methodology employed included screening of the following herbal tea extracts: hibiscus, black tea, tencha, rosehip tea, burdock tea, green tea, jasmine tea, ginger tea, lavender tea, rose tea and oak tea, against H5N1 and AIV *in viro*. The two viruses were propagated in 10 day-old embryonated chicken eggs. The result obtained by the researchers revealed only the hibiscus extract and its fractionated extract (frHibis), among all, acted effectively and promptly too, against the two strains of the virus.

The findings in this research not only showcased the efficacy of *Hibiscus sabdariffa* in remedying the diseases due to avian influenza viruses, but also present the plant as a potential candidate to remedy SARS-CoV-2, more so, because the latter and former viruses both affect respiratory tract and exhibit similar symptoms such as cough, congestion, catarrh and so on.



Figure 5: The Calyx of Roselle (*Hibiscus sabdariffa*). The dried preserved from the calyx, used in the preparation of the juice extract, Zobo

Bitter Kola: Bitter kola is generally known as *Orogbo* among the Yoruba tribe in Nigeria. Scientifically, it called *Garcinia kola*, while the common name is Bitter kola (Figure 6). Bitter kola is often used for the treatment of several bronchial related ailments such as asthma, cough [28], congestion, voice seizures, and so on. Researchers on the field have equally documented one of the phyto-medicinal use of *Garcinia kola* to

include bronchodilator for the treatment of asthma [29, 30].

In a research conducted by Ofusori, *et al.*, [31], they aimed to evaluate the potential effect of ethanolic extracts of *Garcinia kola* seeds on the lung tissue in Swiss albino mice. The mice were subjected to 21 days consecutive treatment with 10 and 20 mg/kg of the

extracts for two groups 'B' and 'C', respectively, while the 'A' group was administered with equal volume of normal saline to serve as the control. Histological analysis was then carried out to study the effects of the extracts. The result revealed that *Garcinia kola* extracts exhibited dilatory effect on alveolar ducts and sacs in mice, consequently bringing about improvement in the respiratory activities [26, 29].

With the outcome of the above study revealing the efficacy of *Garcinia kola* in the management of respiratory system in Swiss albino mice, a mammal; then, it will not be out of place to present the bitter kola as a potential candidate to treat covid-19 disease. Moreover, one of the symptoms observed in covid-19 patients is difficulty in breathing, and then it becomes highly essential to investigate the phyto-compound potentials of *Garcinia kola* in combating SARS-CoV-2 and remedying the covid-19 pandemic.



Figure 6: Bitter kola (*Garcinia kola*). The seeds of Bitter kola contain phytochemicals useful for treatment of many ailments. The whole plant parts have one beneficial Phytochemicals or the other

CONCLUSIONS

Investigated plant species: (i). *Zingiber officinale*, (ii). *Psidium guajava*, (iii). *Nigella sativa*, and (iv). *Hibiscus sabdariffa*; constitute effective herbal remedy potentials against Covid-19. The derivable phyto-compounds from varying extracts of the plant materials possess potent antiviral activities, and therefore suit as a possible remedy for SARS-CoV-2. Therefore, for further experimental and clinical tests, attentions of seasoned researchers in this field are drawn to focus on the above plant species as potential candidates for possible unravelling of Covid-19 drugs.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

FUNDING STATEMENT

The current review work has not been funded by any research grant.

ACKNOWLEDGMENTS

The authors acknowledge the EAS Journal of Pharmacy and Pharmacology for its interest in the waiver and quick publication of review work on Covid-19.

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Cite This Article: Abdullateef A. Raji, Ruqayyah Abdullateef, Raliat A. Aladodo, Muhammed M. Abdul- Lateef, Hassanat T. Jimoh (2023). Efficacy of Herbal Medicines as Remedies against COVID-19. *EAS J Pharm Pharmacol*, 5(2), 14-22
