

REVIEW ARTICLE

Anti-HIV Transcriptase Herbs: A Review

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ABSTRACT

To date, combination antiretroviral (ARV) medication is considered the most effective treatment for people infected with the Human Immunodeficiency Virus (HIV). The primary purpose of ARV administration is to reduce the viral load, thereby enhancing HIV patients' immunological condition and minimizing mortality from opportunistic infections. Nowadays, a combination of NRTI (nucleoside analog reverse transcriptase inhibitor) and NNRTI (non-nucleoside analog reverse transcriptase inhibitor) is accepted therapy for HIV patients. Both have a mechanism for inhibiting the reverse transcriptase (RT) enzyme during viral replication. Reverse transcriptase (RT) is an enzyme that plays a role in the reverse transcription stage of the virus reproduction process. HIV RT converts proviral RNA into DNA, and the copy infects the host or target cell. The use of RT inhibitors for HIV-infected patients is becoming more common. Many investigations were conducted on plants that have the potential to operate as anti-HIV RT. In this review, we go over some of the potential herbs that serve as RT inhibitors. In this literature review, a search was carried out with the help of several search engines that matched the criteria, namely reverse transcriptase herbal inhibitors for HIV. The author came to the conclusion that there were 18 plants with relatively high activity as anti-HIV medicines with varied traits and working mechanisms from 162 papers gathered based on keywords. Furthermore, the findings of this study will serve as the foundation for the development of anti-HIV herbs as well as a source of antiretroviral therapy ingredients in the future.

Keyword: Antiretroviral, Herbs, HIV, Reverse Transcriptase, RT Inhibitor.

INTRODUCTION

Antiretroviral (ARV) combination therapy is still the most effective treatment for HIV/AIDS patients. In 2018, 37.9 million people were living with HIV, with approximately 24.5 million receiving ARV treatment.¹ The ARV reduces HIV multiplication activity, resulting in an undetectable viral load. This dosage is successful because there is no risk of HIV transmission from mother to newborn, it improves immune systems, and minimizes deaths from opportunistic infections. It demonstrates that ARV treatment has reduced HIV/AIDS mortality from 1.5 million in 2010 to 1.1 million in 2015.²

ARV therapy is divided into two types: the first consists of a combination of two nucleoside analogue RT inhibitors (NRTIs) and one non-nucleoside analogue RT inhibitor (NNRTI). The second line contains two NRTIs and one protease inhibitor (PI).³ The NRTI and NNRTI are both applied to inhibit the RT during viral replication, impede DNA elongation, and prevent viral RNA from being converted into double-stranded DNA.^{4,5}

The RT, or RNA-directed DNA polymerase, is a retroviral pathogenic enzyme identified in 1970 by Japanese virologist Satoshi Mizutani and American virologists Howard Temin and David Baltimore. Some RNA viruses possess this enzyme. These types of viruses will reverse-transcribe the RNA genome into DNA and use that DNA copy to infect humans or host cells. This enzyme's viruses are a type of retrovirus found in oncoviruses, spumaviruses, and lentiviruses such as HIV.⁶ The pathogenesis of HIV involves the infection of host cells through the use of the reverse transcriptase enzyme. The aforementioned enzyme is responsible for the conversion of RNA from the host into HIV proviral DNA. Hence, the utilisation of RT inhibitors in HIV therapy is highly advantageous due to their ability to impede the aforementioned process through competitive inhibition of RT.⁷ Thus far, the treatment of HIV patients using RT

inhibitors is still under development. Here, studies focused on herbs that carry RT characteristics will be covered.

The utilization of traditional medicines may provide an opportunity to develop effective and socially acceptable HIV treatments for use as adjuvants to antiretroviral regimens. The industry also provides jobs and revenue streams to a large number of small firms. Traditional remedies that are claimed to be useful against serious ailments, on the other hand, should be subjected to some type of empirical investigation to alleviate worries about safety, efficacy, and additional benefits. Because various natural plant compounds have already been demonstrated to have anti-HIV properties, achieving a favorable therapeutic outcome *in vitro* is achievable.

ANTI-HIV TRANSCRIPTASE

Reverse transcriptase is an enzymatic protein that is present in retroviruses, a specific class of viruses that employ RNA as their genetic material. The process involves the conversion of the viral RNA genome into DNA, which is subsequently integrated into the genome of the host cell. Reverse transcription is a crucial process in the replication of retroviruses. Reverse transcriptase is an enzyme that catalyses the synthesis of DNA using an RNA template. The enzyme exhibits two distinct enzymatic functions, namely a polymerase activity responsible for the synthesis of DNA using an RNA template and a ribonuclease H activity that facilitates the removal of the RNA strand from an RNA-DNA hybrid structure.⁸ The enzyme in question is characterised by a propensity for errors, leading to the generation of a substantial number of errors during the process of DNA synthesis. Consequently, this phenomenon contributes to the emergence of genetic diversity among populations of retroviruses. This enzyme plays a critical role in the replication of retroviruses and serves as the primary target for a number of antiviral medications.

Reverse transcriptase is utilised in a multitude of molecular biology applications, encompassing the production of complementary DNA (cDNA) from RNA templates for the purpose of gene expression analysis, the identification of RNA viruses using reverse transcription PCR (RT-PCR), and the replication and determination of the sequence of RNA molecules.^{8,9}

AIDS (acquired immunodeficiency syndrome) is caused by the retrovirus HIV (human immunodeficiency virus). HIV also has a rapid mutation rate, which helps it adapt and avoid detection by immune systems. Antiretroviral medicines that target reverse transcriptase are essential components of HIV treatment because they can reduce virus replication and slow the course of AIDS.⁷

ANTI-HIV TRANSCRIPTASE HERBS

Allium sativum

A. sativum, or garlic, is a highly aromatic bulb crop from the Alliaceae family.¹⁰ Garlic contains more than 30 organosulfur compounds, of which two are considered essential. They are alliin, ACSO (S-allyl-L-cysteine sulfoxide), and GGC (γ -glutamyl-L-cysteine) peptides.¹¹ Garlic also contains lectin, phenolic, alkaloid, flavonoid, steroid, glycoside, saponin, tannin, several reasonably abundant minerals (K>P>Mg>Ca>Zn>Al), polysaccharides (fructans), vitamins (A, C, B-complex), enzymes (alliinase, peroxidase, myrosinase), and others.¹²

A recent study reported that allicin from garlic can inhibit HIV-1 RT. Silprasit K. (2011) was the first to report on a research study with garlic that showed the n-hexane extract of fresh garlic has been reported to have inhibitory activity against HIV-1 RT with an EC₅₀ 0.06 mg/ml, ultimately inhibiting the replication of HIV in host cells.¹³

Aloe chabaudii

Aloe chabaudii originates from Africa's Peninsula, Socotra, Madagascar,

and the Mascarene Islands.¹⁴ *A. chabaudii* phytochemicals and nutrients consist of many vitamins, minerals, simple and complex carbohydrates, enzymes, phenolic compounds, fatty acids, alkanes, aldehydes, ketones, phytosterols, indoles, pyrimidines, dicarboxylic acids, and alkaloids, all of which have potential biological and pharmacological activities as medicines. This herb's aqueous preparations exhibit RT inhibitory action. The aqueous extracts of *A. chabaudii* were entirely analyzed using a nonradioactive colorimetric assay kit obtained from Roche Diagnostics (Germany) for HIV-1 RT inhibitory activity (IC₅₀), which was 0.6 ± 0.06 mg/mL.¹⁵

Amphipterygium glaucum

A. glaucum is a small to medium-sized deciduous tree endemic to Mexico and parts of Central America. It is a member of the Anacardiaceae family, which includes mangoes and cashews. It contains anti-inflammatory, anti-ulcer, and antioxidant qualities and has been used to treat a variety of maladies, such as stomach ulcers, diarrhea, and skin diseases.¹⁶

The RT inhibitory activity of *A. glaucum* was assessed using a nonradioactive immunocolorimetric test (Lenty RT Activity Assay, Cavid Tech). *A. glaucum* extract ranging from 3.125 to 200 g/mL was used and examined in the presence of 0.5% (v/v). As a positive control, nevirapine, an NNRTI, was administered at concentrations ranging from 0.01 M to 1 mM. *A. glaucum* inhibited HIV-RT activity with IC₅₀ values of 97.83 ± 2.03 g/mL.¹⁶

Andrographis paniculate

A. paniculata, often known as the King of Bitters in English and Sambiloto in Indonesian, is a nonwoody annual in the Acanthaceae family.¹⁷ This herb is reported to have anti-cancer, anti-malarial, anti-diarrheal, anti-hepatitis, antioxidant, and anti-inflammatory properties. As a result, Sambiloto would be a promising novel approach to therapy for numerous diseases

caused by immunological disorders such as AIDS.^{18,19}

The leaves of *A. paniculata* contain a few biological activities, including the diterpene lactones (deoxyandrographolide, andrographolide, neoandrographolide, 14-deoxy-11, 12-didehydroandrographolide), diterpene glucoside (deoxyandrographolide 19 β -d-glucoside), flavonoids (5,7,20,30-tetramethoxyflavanone and 5-hydroxy-7,20,30-trimethoxyflavone), and also the paniculide, farnesol, arabinogalactan protein, saponins, alkaloids, and phenols. Tannins are also present in Sambiloto leaf extract.^{20,21}

Gurrapu and coworkers successfully isolated and validated andrographolide, an active component of *A. paniculata* crude extract, as an HIV RT inhibitor. According to the findings, andrographolide inhibited HIV-1 RT by 92% at 125 g/mL with an IC₅₀ of 772 g/mL, while conventional medication did so by 93% at 250 g/mL with an IC₅₀ of 31.2 g/mL.¹⁹

Hemidesmus indicus

H. indicus, often known as Indian Sarsaparilla, is a plant used in Ayurvedic medicine for various treatments. *H. indicus* has anti-cancer, chemopreventive, immunomodulatory, anti-inflammatory, antivenom, antileprotic, antimicrobial, antiarthritis, and antiviral properties.^{22,23} Essential oil, which comprises 80% 2-hydroxy, 4-methoxy benzaldehyde, fatty acids, tannins, resin acids, ketone, saponin, resinal fractions, stigmasterol, sterols, β -sitosterol, and sarsapic acid, is all found in the roots of *H. indicus*. It also contains hemidesmin 1, hemidesmin 2, alpha-amyrin, beta-amyrin, lupeol, and 2-hydroxy-4-methoxy benzoic acid, all of which have been identified in *H. indicus* roots.²⁴

H. indicus can block RT-associated RNase H function and HIV-1 RT via its various active metabolites. Reverse transcriptase-related RNA requires the

activity of DNA polymerase and the cellular α -glucosidase. Esposito and coworkers investigated the pentacyclic triterpene Lupeol derived from the roots of *H. indicus*. The results showed that Lupeol acetate inhibited and suppressed the HIV-1 reverse transcriptase-related RNase H work with IC₅₀ estimates of 6.3 and 11.6 M, respectively, whereas it did not affect the RT-related RDDP work or the α -glucosidase. In addition, blind docking simulations revealed that Lupeol binds to an HIV-1 RT allosteric region.²⁵

Justicia gendarussa

J. gendarussa leaves contain aromatic amines, flavonoid glycosides (Gendarusin A and B), and the alkaloids Justidrusamide A, B, C, and D. Its flavonoid components are also recognized to act as natural anti-HIV therapies²⁶. The abundance segment of Gendarussin A is the expansion of minor components of various flavonoids. After 60 minutes of incubation, extracts of *J. gendarussa* exhibited an HIV-1 RT inhibition ratio (% IR) greater than 90%²⁷. Anti-HIV testing also revealed that 70% EtOH extricates *J. gendarussa* and reduces HIV development restraint (viral burden) after an hour of hatching²⁶. Leaf extracts of *J. gendarussa* were tested on HIV-infected MOLT-4 cell cultures and shown to limit HIV replication by lowering the amount of p24 and inhibiting the formation of syncytia.²⁸

An in silico test to predict the absorption, distribution, metabolism, excretion, and toxicity (ADMET) and the anti-HIV activity of Gendarussin A via inhibition of the HIV protease was applied. According to the findings of the in silico study, Gendarusins A, B, C, D, and E have activity as HIV-1 protease inhibitors, with Gendarusin B having the highest activity. The Gendarusin molecules have oral bioavailability and are not toxic; therefore, they have the potential to be anti-HIV.²⁹

Calophyllum brasiliense

Calanolides are a key component of *C. brasiliense*. *Calophyllum* is a notable reservoir of bioactive secondary metabolites belonging to the classes of xanthenes, coumarins, and chromanones. The genus *Calophyllum* exhibits a diverse array of secondary metabolites, such as triterpenoids and glycosides, which have demonstrated a broad spectrum of biological activities. These activities include antiviral, anticancer, antimalarial, antibacterial, and anti-proliferative effects, as well as the inhibition of P-glycoprotein, a key player in the multidrug transport process, and sulfotransferases. Calanolide A, which is derived from the *Calophyllum* genus, has demonstrated promising anti-HIV properties and remains under active clinical development.³⁰ *C. brasiliense* hexane extract significantly inhibited (> or =70%) HIV-1 RT and was less hazardous to human lymphocytic MT2 cells. It was then tested in a cell framework as an HIV-1 IIIb/LAV inhibitory mimic.³¹

Curcuma longa

C. longa, or turmeric, a naturally occurring phytochemical, is the most common source of curcumin. Curcumin demonstrates diverse organic effects and possible therapeutic benefits. Noteworthy studies revealed that curcumin inhibited reverse transcriptase in vitro in a dose-dependent manner, suppressed HIV-1 RT in cell culture in a dose-dependent manner, and inhibited the production of HIV-1 p24 antigen, a protein required for HIV-1 replication.³²

Terminalia catappa

T. catappa contains phytochemicals that suppress the human immunodeficiency virus. Many studies have shown that extracts of *T. catappa* leaves, bark, and fruits exhibit RT inhibitor properties. The phytochemical content of the leaves, barks, seeds, and fruits of *T. catappa* includes flavonoids (like cyanidins, proanthocyanidins, flavonols,

and flavononols), tannins, gallotannins, and ellagitannins (like 3,5-di-O-galloylshikimic acid, 1,3,4-tri-O-galloylquinic acid, 3,4,5-tri-O-galloylshikimic acid, punicalin, and punicalagin), and gallic acid (its derivatives like ethyl and methyl gallate, chebulagic and chebulinic acid, tetra and penta-galloylglucos).³³ Many phytochemicals from *T. catappa* reduce HIV imitation in infected H9 cells with minimal damage. For instance, punicalin and punicalcorlein C inhibit pure HIV RT with ID50 values of 8 M and 5 M, respectively. Also, tannins can suppress virus-cell interactions by inhibiting RT. However, the mechanism of inhibition remains unknown.³³

Momordica charantia

Momordica charantia, sometimes known as bitter melon, has been documented to have diverse inhibitory properties against viruses, bacteria, and parasites. The anti-HIV activity of *Momordica* anti-HIV protein (MAP30), a ribosome-inactivating protein (RIP) derived predominantly from the seeds of *Momordica charantia*, has been demonstrated. Ribosome - inactivating proteins (RIPs) are a class of enzymes known as N-glycosidases, which catalyse the removal of the N-glycosidic bond between the base and the sugar moiety of ribosomal ribonucleic acid (rRNA), resulting in depurination. The process of depurination leads to the irreversible inactivation of the ribosome, hence impeding the synthesis of proteins. The antiviral effect of ribosome-inactivating proteins (RIPs) has been ascribed to their ability to bind to viral nucleic acid and interfere with a specific stage of replication following reverse transcription.³⁴

The active constituent included in water extracts derived from the leaves of *Momordica balsamina* has been characterised as a 30 kilodalton (kDa) protein, referred to as MoMo30-plant. The genetic sequence responsible for the

production of MoMo30 exhibits homology with a cluster of plant lectins referred to as Hevamine A-like proteins. The protein MoMo30-plant exhibits unique characteristics that differentiate it from other proteins identified in the *Momordica* species, including ribosome-inactivating proteins like MAP30 and Balsamin. The MoMo30-plant protein exhibits binding affinity towards gp120 by means of its glycan moieties, hence serving as a lectin or carbohydrate-binding agent (CBA). Competitive binding agents (CBAs), such as MoMo30, have the ability to interact with glycans located on the surface of the enveloped glycoprotein of the human immunodeficiency virus (HIV), known as gp120, thereby obstructing viral entrance. Exposure to CBAs elicits two distinct responses from the virus. Initially, it impedes the infection of cells that are sensitive. Furthermore, MoMo30 plays a role in the determination of viruses that have modified glycosylation patterns, which may result in changes to their immunogenic properties. This drug has the potential to serve as a transformative element in the therapeutic approach to HIV/AIDS. It enables a swift decrease in viral loads while favouring the emergence of a less glycosylated virus, which could potentially enhance the immunological response of the host.³⁵

Coccinia rehmannii

C. rehmannii has been studied for its ability to block reverse transcriptase, an enzyme involved in retrovirus replication, for instance, HIV. It is one of the common restorative plants used by traditional healers for HIV/AIDS treatment in Botswana³⁶. Certain chemicals in the herb, including iridoid glycosides and phenolic compounds, block RT activity by 40%. However, no scientific investigations on the exact effects of *C. rehmannii* on HIV-infected people have been documented. More study is required to determine its antiviral capability.³⁷

Phyllanthus sp.

Phyllanthus is a plant genus in the Phyllanthaceae family. Its antiviral capabilities include virus replication suppression and immune response regulation. Alkaloids, tannins, flavonoids, lignans, phenols, terpenes, and gallic acid (GA) have been isolated and identified from several *Phyllanthus* species.³⁸ A research investigation was undertaken to address the inhibitory effects of *Phyllanthus sp.* on reverse transcriptase (RT) activity. The isolates of *Phyllanthus sp.* had inhibitory effects on the HIV-1 reverse transcriptase enzyme, as indicated by their IC₅₀ values. The replication of HIV-1 was suppressed by *P. urinaria* GA by the prevention of its entry into target cells via the inhibition of HIV-1 reverse transcriptase (RT), glycoprotein 120 (gp120), and P24.³⁹

Acacia sp.

A. auriculiformis, commonly known as Earleaf Acacia or Northern Black Wattle, some studies have investigated the bioactive compounds found in other *Acacia* species for their potential antiviral properties. *A. catechu*, for example, has been studied for its antiviral effects against RT-HIV-1. The bark extract of *A. catechu* demonstrated RT inhibitory activity, suggesting a potential role in HIV treatment.⁴⁰

A. auriculiformis, a member of the Fabaceae family, has saponins, alkaloids, and gallotannin. They exhibit anti-HIV action by inhibiting the RNA-dependent polymerase activity of RT-HIV. The ribonuclease H inhibitory activity of RT has also been examined.⁴⁰ Further scientific studies are necessary to ascertain the anti-RT activity of *A. auriculiformis* or its potential use as an antiviral agent.

Azadirachta Indica

A. indica, or Neem, is a versatile tree native to India that is utilized in Ayurvedic treatment. The Neem phytochemical test

reveals the presence of active chemical constituents such as triterpenoids, diterpenoids, steroids such as α -sitosterol and stigmasterol terpenoids, and non-isoprenoids, which include flavonoids (quercetin, catechin, and nimbaflavanone), tannins, coumarins (scopoletin), and isocoumarins (margocetin).⁴¹ The crude extract of *Azadirachta indica* demonstrated potent HIV-1 RT- inhibiting action. The extract reduced the polymerase activity of HIV-1 RT, with a peak inhibition of 92.4%. The potency was not significantly different ($p > 0.05$) from that of the conventional medication AZT.⁴²

Glycine soja

G. soja is a closely related species to cultivated soybean (*G. max*). *G. soja*, or mini-black soybean, produces a defensive protease inhibitor (PI) and hemagglutinin. Sequential chromatography on SP-sepharose, Q-sepharose, and DEAE-cellulose was employed to isolate 17.5 kDa PI and 25 kDa hemagglutinin from *G. soja*. The PI inhibits trypsin and chymotrypsin ($IC_{50} = 7.2$ and 8.8 M, respectively). Its anti-HIV efficacy has been studied, but its specific features have not been thoroughly investigated. *G. soja*'s PI and hemagglutinin inhibit HIV-1 RT ($IC_{50} = 3.2$ and 5.5 M, respectively).⁴³ More investigation is needed to assess the safety, efficacy, and appropriate use of *G. soja* or its components in the treatment of HIV/AIDS.

Phaseolus vulgaris

Phaseolus vulgaris L, or Extralong Autumn Purple Bean, is one of the popular cultivars. It has been reported that a 60-kDa dimeric lectin (EAPL) was isolated from this cultivar by liquid chromatography. The study showed that EAPL manifested significant HIV-1-RT inhibitory activity with an IC_{50} value of $1.8 \mu\text{M}$. The IC_{50} value of the positive control (pinto bean lectin) was $3.9 \mu\text{M}$.⁴⁴

Moringa oleifera

A phytochemical test of *M. oleifera* showed, for the most part, saponins, glycosides, alkaloids, flavonoids, tannins, sugars, gums, rhamnose, glucosinolates, isothiocyanates, vanillin, β -sitosterol, β -sitostenone, 4-hydroxymellin, two alkaloids, moringine and moringinine, and octacosanoic acid, plentiful in protein, calcium, iron, and vitamin C.⁴⁵ It has potent HIV-1 RT inhibitors. The results suggested that the concentrates could be effective as HIV-1 RT inhibitors, with IC_{50} values ranging from $9 \mu\text{M}$ to $79 \mu\text{M}$ for water and half-methanol extracts.⁴⁶

Securigera securidaca

Kaempferol and kaempferol-7-O-glucoside isolated from *S. securidaca* have been reported to have potent anti-HSV-1 activity. These compounds inhibited HIV-1 replication when added concurrently and before infection.⁴⁷

Furthermore, kaempferol and kaempferol-7-O-glucoside from *S. securidaca* were confirmed to be HIV RT inhibitors using the HIV-1 p24 antigen kit. The real-time polymerase chain reaction (RT-PCR) assay compares treated and untreated cells. The results showed that kaempferol and kaempferol-7-O-glucoside reduced HIV-1 growth by 82.3% and 95.2%, respectively.⁴⁸

CONCLUSION

Several studies have been published that describe the use of herbal concoctions to treat HIV and its consequences. The commercialization of herbal medications has increased substantially in the last twelve years, in tandem with the rising frequency of HIV infection. The utilization of traditional medicines may give chances to develop feasible and socially acceptable HIV treatments for use as adjuvants to antiretroviral regimens. Traditional remedies that are claimed to be useful against serious ailments, on the other hand,

should be subjected to some type of empirical investigation to assuage concerns about safety, efficacy, and additive benefits. The studies of the potential of several plants as anti-HIV agents yielded a total of eighteen potent candidates. The aforementioned items encompass: *Allium Sativum*, *Aloe Chabaudii*, *Amphipterygium Glaucum*, *Andrographis Paniculata*, *Hemidesmus*

Indicus, *Justicia Gendarussa*, *Calophyllum Brasiliense*, *Curcuma Longa*, *Terminalia Catappa L.*, *Momordica Charantia Descourt*, *Phyllanthus sp.*, *Coccinia Rehmannii Cogn*, *Acacia Auriculiformis*, *Azadirachta Indica A.Juss.*, *Glycine Soja*, *Phaseolus Vulgaris*, *Moringa Oleifera Lam*, and *Securigera Securidaca*. The information shown in Table 1 is indicative of the conclusion.

Table. 1

<i>Plant</i>	<i>Contents of RTi</i>	<i>Method</i>
<i>Allium Sativum</i>	Organosulfur compounds (S-allyl-L-cysteine sulfoxide)	Fifty percent inhibitory concentrations (IC ₅₀) of garlic's hexane extracts against HIV-1 RT using a fluoroscopic assay showed 64.08 ± 1.09 µl/ml.
<i>Aloe Chabaudii</i>	Allicin	HIV-1 RT inhibitory activity (IC ₅₀) of <i>Aloe Chabaudii</i> 's water extracts showed 0.6 ± 0.06 mg/ml.
<i>Amphipterygium Glaucum</i>	The information remains undisclosed at present.	<i>Amphiterygium Glaucum</i> exhibited inhibitory activity against HIV reverse transcriptase with IC ₅₀ values of 97.83 ± 2.03 µg/mL.
<i>Andrographis Paniculata</i>	Andrographolide	<i>A. paniculata</i> showed 92% of HIV-1 RT inhibition at 125 µg/mL with an IC ₅₀ of 772 µg/mL, while the standard drug showed 93% of HIV-1 RT inhibition at 250 µg/mL with an IC ₅₀ of <31.2 µg/mL.
<i>Hemidesmus Indicus</i>	Lupeol acetate and Lupeol	Lupeol acetic acid derivation and Lupeol hindered the HIV-1 RT-related RNase H work with IC ₅₀ estimations of 63 and 11.6 µM.
<i>Justicia Gendarussa</i>	Flavonoid glycosides: gendarusin A and B	Water extracts of <i>Justicia Gendarussa</i> after 60 minutes of incubation at 200µl/mL concentrations had an HIV-1 RT inhibition ratio (% IR) higher than 90%. Moreover, 70% EtOH extricates <i>Justicia gendarussa</i> at 100 ppm, which was able to diminish HIV development hindrance (viral burden) to 1.47 105 duplicates/ml after 60 minutes of hatching.

<i>Plant</i>	<i>Contents of RTi</i>	<i>Method</i>
<i>Calophyllum Brasiliense</i>	Tetracyclic dipyrano coumarins	Calophyllum brasiliense hexane separate displayed huge hindrance (> or =70%) of HIV-1 RT action and indicated diminished poisonousness to human lymphocytic MT2 cells and were additionally tried as inhibitors of HIV-1 IIIb/LAV imitation in a cell framework.
<i>Curcuma Longa</i>	<i>Curcumin</i>	Seal et al.'s docking study on HIV-1 reverse transcriptase with phytochemicals derived from curcumin at cavity 1 of RT found a binding affinity of -11.22, with ligand efficiency values of -5.36, -0.41, and -4.10.
Terminalia Catappa L.	Punicalin and punicacortein C	purified HIV RT with ID50 of 8 µM and 5 µM
Momordica Charantia Descourt	<i>MRK29 protein</i> 28.6 kD (1Asp Val Asn Phe Arg Leu Ser Gly Ala 10Asp Pro Arg X Tyr Gly Met Phe Ile Glu 20Asp)	At the concentration of 18 micrograms/ml, MRK29 inhibited the HIV-1 RT with 50% IR.
Coccinia Rehmamii Cogn	Iridoid Glycosides And Phenolic Compounds	Inhibited RT activity (p < 0.0001) was slightly above 40 %
Phyllanthus sp	<i>Gallic Acid</i>	The PE and GA disconnected from P. urinaria had hostile HIV-1 exercises with IC50s of 0.61 mg/mL and 0.76 mg/mL, respectively.
Acacia Auriculiformis	Saponins, alkaloids and gallotannin	Restraint of RNA-dependent-DNA polymerase movement of HIV-1 converse transcriptase. Additionally, restraint of ribonuclease H movement of reverse transcriptase has been contemplated.
Azadirachta Indica A.Juss.	<i>The information currently remains undisclosed.</i>	Reduced (p < 0.05) the polymerase activity of the recombinant HIV-1 RT with a peak inhibition of 92.4% at 100 µg/ml
Glycine Soja	17.5 kDa Protease Inhibitor, hemagglutinin	IC50 = 7.2 and 8.8 µM
Phaseolus Vulgaris	<i>Lectins</i>	Inhibited the activity of HIV-1 reverse transcriptase with an IC50 of 7.6 µM.
Moringa Oleifera Lam.	<i>The information presently remains undisclosed.</i>	With IC50 values ranging from 9 µg/ml to 79 µg/ml for water and 50% methanol extracts.
Securigera Securidaca	Kaempferol and kaempferol-7-O-glucoside	Inhibited HIV-1 multiplication with an inhibition rate of 82 ± 3.1% and 95 ± 1.2%

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DECLARATION OF INTERESTS

The authors of this paper disclose that they have no competing interests.

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