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Research Paper

Evaluation of Antioxidant and Antidiabetic Activities of *Gymnema Sylvestre* and *Morinda Citrifolia* Extracts

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ABSTRACT

Gymnema Sylvestre and *Morinda Citrifolia* are two plant herbs with anti-oxidant qualities of their own. To study the efficacy of the combination of these two, assays are run with the extract of the plants. In this study we analyzed and assessed the anti-oxidant activity of extracts of herbal plants through the use of pharmacological assay (DPPH assay, FRAP assay). In vitro tests were performed on *Morinda Citrifolia* and *Gymnema Sylvestre* extract and Anti oxidant activity was seen. Antioxidant activity and Antidiabetic activity was found in both the plants.

INTRODUCTION

The study on the additive effect of herbal plant extracts having intrinsic antioxidant activities has attracted wide interest over the last few decades, especially when it comes to preventing oxidative stress and metabolic syndrome management. Both *Gymnema sylvestre* and *Morinda citrifolia*, alone known for their medicinal value, offer a promising argument to check their synergy-based impact on antioxidant activity. Oxidative stress, a result of an Imbalance between the production of harmful molecules called reactive oxygen species (ROS)

and the body's ability to naturally clean them up ,leading to potential damage to cells and tissues or repair the resultant damage, is involved in the pathogenesis of many chronic diseases, such as diabetes, neurodegenerative diseases, and cardiovascular diseases .In this research, we seek to assess the antioxidant effect of *Gymnema sylvestre* and *Morinda citrifolia* extracts, both alone and in combination, using in vitro assays, to clarify their possible synergistic effects and to provide a scientific rationale for their application in complementary and alternative medicine

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.Diabetes mellitus is a common metabolic disorder that presents a state of hyperglycemia due to defects in insulin secretion, insulin action, or a combination of the two. Natural compounds exhibiting antioxidant and antidiabetic activities have emerged as the focus of recent research. The search for effective, safe, and inexpensive therapeutic agents has been the driving force.

MATERIALS AND METHODS

The choice of *Gymnema sylvestre* and *Morinda citrifolia* for this work is based on their well-proven ethnopharmacological potentials and reported antioxidant activities. *Gymnema sylvestre*, a perennial climbing shrub that is endemic to India, has been a part of ancient traditional medicine over time for its potential in diabetic management, a capability of suppressing the sense of sweetness. *Morinda citrifolia* or Noni is a tropical tree that bears fruits with many documented health benefits ranging from antioxidant, anti-inflammatory, and immunomodulatory activity. The DPPH (2,2-diphenyl-1-picrylhydrazyl) and FRAP (ferric reducing antioxidant power) assays in vitro will be used to measure the antioxidant potential of plant extracts. These assays yield quantitative estimates of the free radical scavenging and oxidative species reducing capacities of the extracts, respectively. The DPPH assay, which involves the reduction of the stable free radical 2,2-diphenyl-1-picrylhydrazyl by antioxidants, is a commonly used procedure for assessing the free radical scavenging capacity of plant extracts. FRAP assay, measuring the ferric reducing ability of plasma, is used to measure the capacity of antioxidants to reduce ferric ions (Fe^{3+}) to ferrous ions (Fe^{2+}), and is an indicator of their reducing power.

METHODOLOGY

The extracts of *Gymnema sylvestre* and *Morinda citrifolia* were tested in a series of in vitro assays, such as DPPH and FRAP assays, to determine their antioxidant capacity.

The DPPH assay determines the scavenging capacity of antioxidants towards free radicals, whereas the FRAP assay measures the reducing ability of the extracts.

Both the assays give complementary information regarding the antioxidant activity of the herbal extracts. Virtual screening techniques have been employed to analyze the probable anti-diabetic action of medicinal plants. Medicinal herbs and plants possess curative actions due to the occurrence of complex chemical compounds of varying composition, which occur as secondary plant metabolites. Various medicinal plants' parts are employed to treat number of diseases based on traditional knowledge. It is utilized to screen for drug candidates by assessing their binding affinity towards target proteins implicated in glucose metabolism. Molecular docking experiments are typically employed to investigate the interactions between plant-derived compounds and major enzymes implicated in diabetes.

(i) DPPH ASSAY

PRINCIPLE:

The DPPH (2,2-diphenyl-1-picrylhydrazyl) assay is a spectrophotometric assay employed to assess the antioxidant activity of a compound, specifically its free radical scavenging ability.

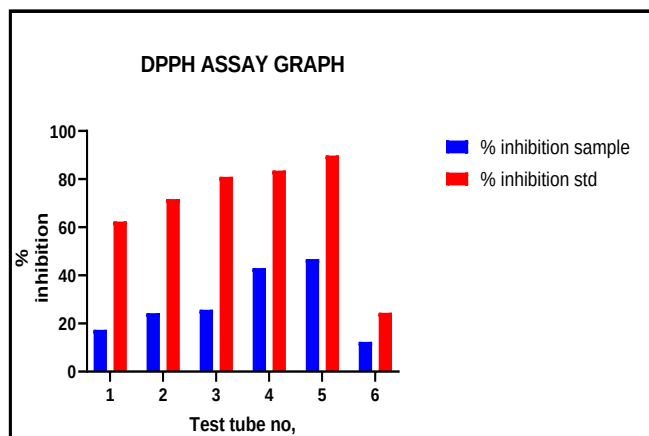
It entails the measurement of decolorization of the DPPH radical, a free radical with a typical purple color, when it reacts with an antioxidant.

The degree of decolorization, which is spectrophotometrically monitored, reflects the antioxidant's ability to scavenge free radicals. This concept can also be used to assess antidiabetic activity, as some antioxidants have been demonstrated to possess antidiabetic activity.



GRAPHICAL REPRESENTATION OF DATA

- DPPH graph



(ii) FRAP ASSAY

PRINCIPLE:

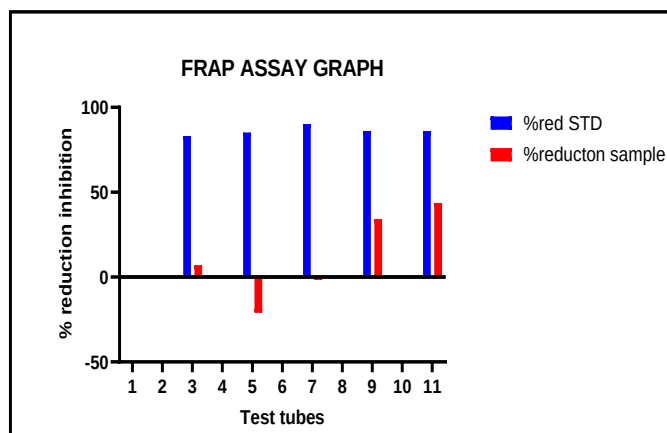
(a) Reduction Reaction: Antioxidants, including gallic acid, are able to donate an electron to ferric ions when a specific reagent is present, usually 2,4,6-tris(2-pyridyl)-s-triazine (TPTZ). The reaction reduces Fe^{3+} to Fe^{2+} .

(b) Formation of a Colored Complex: The ferrous ions (Fe^{2+}) formed after reduction then react with TPTZ to form a colored complex. This complex has a characteristic absorbance at approximately 593 nm, which can be detected by a spectrophotometer.

(c) Absorbance Measurement: Color intensity (absorbance) is directly related to the concentration of antioxidants in the sample. Absorbance shows higher reducing power and hence more antioxidant capacity.

GRAPHICAL REPRESENTATION OF DATA

- FRAP ASSAY Graph



(iii) ALPHA AMYLASE INHIBITORY ASSAY (BY CHROMOGENIC SUBSTRATE METHOD USING *Gymnema sylvestre* & *Morinda citrifolia*.)

PRINCIPLE:

α -amylase enzyme breaks p-nitrophenyl maltoside into p-nitrophenol, a yellow compound.

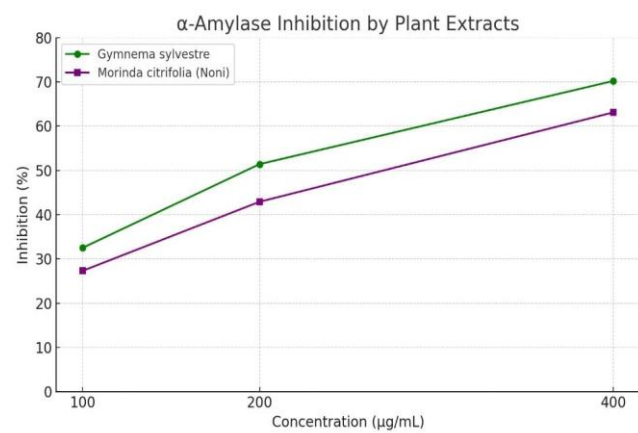
Presence of an α -amylase inhibitor (such as constituents in *G. sylvestre* or *M. citrifolia*) decreases p-nitrophenol formation.

Intensity of yellow color is determined spectrophotometrically at 405 nm.

Decreasing absorbance = Increasing enzyme inhibition by plant extract.

GRAPHICAL REPRESENTATION OF DATA

- Graph of Alpha amylase assay



RESULT AND DISCUSSION

Antioxidants are like your body's own protective squad, protecting you from poisonous molecules called free radicals. Free radicals can damage your cells and DNA, causing you to age and get sick. How antioxidants protect you:

- **Cell Protection:** They are like cell shields, stopping damage and slowing down aging.
- **Decrease Inflammation:** Antioxidants can decrease chronic inflammation, which is connected with conditions such as Cardiovascular diseases and arthritis.
- **Healthy Heart:** They keep your heart and blood vessels healthy by improving circulation and reducing the risk of CVS
- **Cancer Protection:** By protecting your DNA, antioxidants decrease the risk of cancer-causing mutations.
- **Immune Function:** They improve your ability to deal with infection and illness by strengthening your immune system.
- **Skin Protection:** Antioxidants safeguard your skin against UV damage, reducing signs of aging and skin cancer risk.
- **Brain Health:** Antioxidants guard your brain against injury, encouraging healthier memory and brain function with age.

- **Detox Support:** Antioxidants help your body purge toxins, supporting the liver and kidneys in their work detoxifying.

Essentially, antioxidants are your body's in-built shield, keeping you healthy, young, and reducing the risk of chronic disease.

Antidiabetic activity is the ability of certain food, chemicals, or drugs to avoid or manage diabetes by keeping blood sugar under control. Here's how it benefits the body:

- **Regulation of Blood Sugar:** It keeps blood sugar levels in check by either boosting the body's sensitivity to insulin or stimulating the secretion of insulin.
- **Improved Insulin Sensitivity:** Certain compounds enhance the body's insulin sensitivity, which is essential for controlling type 2 diabetes.
- **Avoiding Blood Sugar Peaks:** Some foods retard the release of sugar, avoiding those quick spikes in blood sugar that can be detrimental in the long run.
- **Weight Control:** Certain antidiabetic foods regulate appetite and metabolism, making it simpler to keep weight under control, which is important for controlling diabetes.
- **Reducing Inflammation:** Repeated inflammation enhances insulin resistance, and that's why antidiabetic foods are mostly anti-inflammatory to help avert this threat.
- **Preventing Complications:** Chronic diabetes may damage nerves, kidneys, and the eyes. Antidiabetic foods act as antioxidants and prevent these complications.
- **Protecting Cardiovascular Health:** Diabetes increases the susceptibility to cardiovascular diseases, so antidiabetic foods help dilate blood vessels, lower cholesterol, and regulate blood pressure.

RESULT



Gymnema sylvestre and *Morinda citrifolia* both medicines were tested and researched with the use of assays. Both of them have antidiabetic activity and antioxidant activity as indicated by the observation data.

CONCLUSION

Noni (*Morinda citrifolia*) and *Gymnema sylvestre* both possess high levels of potent antidiabetic and antioxidant activities. Both plants have shown potential to modulate glucose levels in blood and combat oxidative stress, and therefore they are effective for diabetes and overall wellness. In conclusion, both Noni and *Gymnema sylvestre* contain potential answers to the management of diabetes, due to their antidiabetic and antioxidant properties. Their potential in inhibiting blood glucose and reducing oxidative damage is an indication of how they can potentially be used in complementary or alternative therapy for the management of diabetes.

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