Estimation of steroids and phenol phytochemicals in the common plants.

A DISSERTATION

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Submitted by:

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CANDIDATE'S DECLARATION

I Km Sakshi, Roll Number: 2K20/MSCBIO/09, student of M.Sc. Biotechnology, herebydeclare that the work which is presented in the Major Project entitled 'Estimation of steroids and phenol phytochemicals in the common plants" in the fulfillment of the requirement for the award of the degree of Master of Science in Biotechnology and submitted to the Department of Biotechnology, Delhi Technological University, Delhi, is an authentic record of my own carried out during the period from February - May 2022, under the supervision of Dr. Navneeta Bharadvaja.

The matter presented in this report has not been submitted by me for the award for any other degree of this or any other Institute/University. The work has been accepted in SCI/SCI expanded /SSCI/Scopus Indexed Journal OR peer-reviewed Scopus Index Conference with the following details:

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CERTIFICATE

I hereby certify that the project dissertation titled "Estimation of steroids and phenol phytochemicals in the common plants" which is submitted by Km Sakshi, Roll number 2k20/MSCBIO/09, Department of Biotechnology, Delhi Technological University, Delhi in partial fulfillment of the requirement for the award of the degree of Master of Science, is a record of the project work carried out by the student under my supervision. To the best of my knowledge this work has not been submitted in part or full for any degree or diploma to this university or elsewhere.

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Km. Sakshi

Abstract

Phytochemicals (quantitatively) were screened in four medicinally important plant species using four different solvents (water [AQ], acetone [AE], petroleum ether [PE], and chloroform [CF]. The phytochemicals in food have considerable value because of their therapeutic properties on health, as they provide protection against severe illness and medical situations such as tumor, diabetes, inflammation, microbial infections, parasitic infections, psychotic conditions, spasms, ulcers, etc. In the present study, we performed the qualitative phytochemical screening on the leaf extract of four different plants *Mentha piperita*, *Mangifera indica*, *Solanum lycopersicum*, *Helianthus annuus*. Secondary metabolites such as flavonoids, alkaloids, phenol, and steroids present in the four selected medicinal plants were identified and compared. There are phytochemicals present in all the plants that were selected for the study, such as alkaloids, flavonoids, steroids, and phenols. Qualitative estimation of these four phytochemical compounds has revealed that phenol is present in the highest amount in *Mentha piperita* species and steroids is present in all the plants.

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1. Introduction

Medicinal plants exhibit gained vast attention due to commercial application in the medicine, treatment of disease, flowering, cosmetics, and colouring. All over the world, herbs are considered to be a reliable key resource of drugs that are safe, less toxic, and economical and provide health benefits over macronutrients and micronutrients [1]. Since antiquity, nature has bestowed upon us a variety of herbs and plants, many of which are used as traditional medicines to relieve illness and are widely used today around the world. Health problems can still be treated with herbal treatment. They can provide people with more health benefits than macronutrients and micronutrients [2].

Herbs are safe, less toxic, economical, and are a reliable source of medicine in all parts of the world. Color, aroma, and flavor are all due to these substances. Plants are protected from diseases and damage by them. Phytochemicals derived from plants which that showed the beneficial effect to the anxiety, enhance eye health, protect from the pollution, and from the various electromagnetic waves. [3] They have been proven to protect human health in recent years when their nutritional intake is significant.

Plant tissues often contain concentrated amounts of phytochemicals, as well as pigment molecules. Different levels of these compounds are found in different plants depending on the variety, processing, cooking, and growing conditions. There is evidence that phytochemical supplements provide similar health benefits to dietary phytochemicals, but there is no convincing proof that they do so. [4] Phytochemicals are also likely to have health benefits, including protection against degenerative disorders, cancers, cardiovascular disease, and neurological diseases. Phytochemicals are found most abundantly in culmination and vegetables. In combination or on

their own, those phytochemicals have excellent healing capacities in treating a wide range of ailments [5].

The phytochemicals in food have considerable value because of their therapeutic properties on health, as they provide protection against severe illness and medical situation such as tumor, diabetes, inflammation, microbial infections, parasitic infections, psychotic conditions, spasms, ulcers, etc. [6] National Cancer Institute has prioritized the opportunities for most cancers prevention as a priority to the public through a superb focus on lifestyle, eating habits, prevention, and managing care. Several nutrients, such as A, B6, B12, D, E, and folate, can assist in the fight against cancer, suppress the immune system, and prevent most cancers in susceptible populations.[7] Research suggests that eating plenty of fruits, vegetables, and whole grains may help prevent oxidative damage and chronic illness.

Objectives-

1- Qualitative estimation of steroids and phenol in shade dried, sundried, and fresh leaf extract of *Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus* plants using water as solvent.

2- Qualitative estimation of steroids and phenol in *Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus* using organic solvents (methanol, chloroform, petroleum ether, hexane).

2. Literature review

2.1. Phytochemicals: Their biological effects

Furthermore, phytochemicals may moreover have beneficial effects on health, protecting from persistent degenerative conditions including cancer, cardiovascular and neurological issues. Phytochemicals are found in great abundance in fruits and vegetables. When taken individually or in combination, each of these phytochemicals has excellent healing properties for severe ailments.

Aspects of phytochemicals identified in food that have nutraceuticals homes are of huge significance because of their positive impact in the treatment of various cancer as they offer strength in variety of problem or ailment, together with various types of cancer, oral health, wound healing and also act as anti – microbial compounds. By focusing in particular on lifestyles, eating habits, prevention and comfort care, the National Cancer Institute has explained the possibility in maximum tumor growth inhibition as an essential element of public health. Vitamins, minerals, and phytochemicals were ranked as the top nutraceuticals [8].

Several vitamins were recommended as anticancer, immune-protective, and reducing the maximum cancers risk in the population susceptible to maximum cancers and individuals who self-medicate. [9] Tocopherols, carotenes, phenols, steroids and polyphenols are all powerful antioxidants, capable of scavenging free radicals.

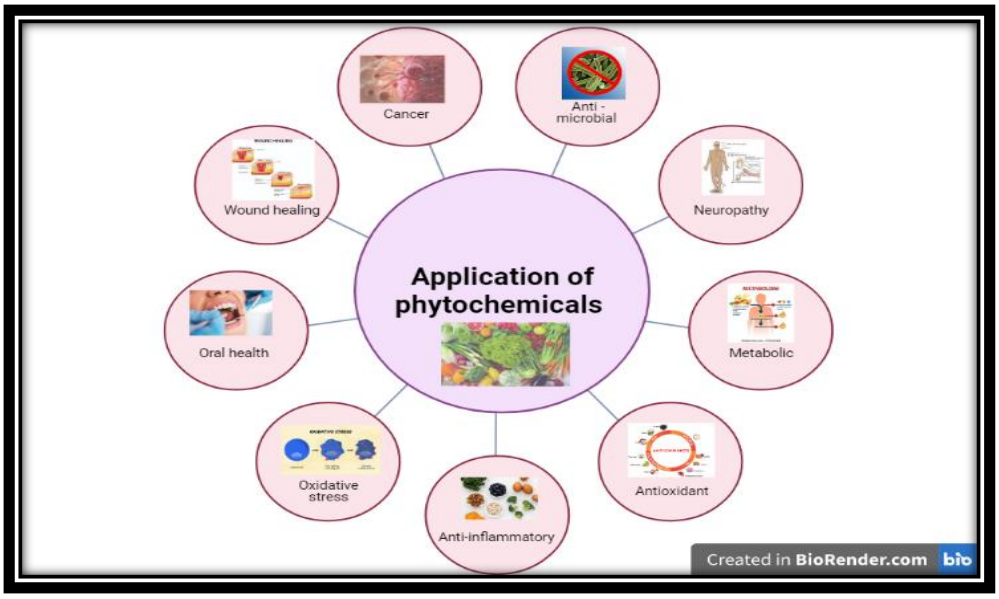

FIG 1 - Application of phytochemicals in various fields

2.2. Medicinal plants

The health of individuals and communities is greatly affected by medicinal plants. There are chemical substances in these plants that can have a physiological effect on the human body, which gives them their medicinal value. Pharmaceuticals, cosmetics, and neutraceuticals are incorporating medicinal plants. We know of about 7000 different pharmacologically important compounds that plant life has contributed to Western Pharmacopoeia. Quinine, taxol, campothecine, etc...Alkaloids, tannins, flavonoids, and phenolic compounds account for the majority of these bioactive plants' constituents [10]. Spices and food ı

from these indigenous medicinal plants. These substances have also been added to pregnant and nursing mothers' foods for medicinal purposes. The screening of higher plants for antimutagenic compounds has received a great deal of attention today. Several secondary metabolites found in higher plants are biologically active and show antimutagenic and anticarcinogenic properties, in addition to exhibiting structurally varied biologically active properties. Humankind does not

understand where they fit into the plant itself, but for the plant they are of prime importance. In India, some laboratories have tried finding possible chemopreventive agents from natural products. Many valuable drugs have been discovered with the help of traditional knowledge systems. Humankind does not understand where they fit into the plant itself, but for the plant they are of prime importance [11]. In India, some laboratories have tried finding possible chemopreventive agents from natural products. Although modern drug discovery and screening techniques have brought high throughput to drug discovery. Many valuable drugs have been discovered with the help of traditional knowledge systems. For humankind, they are of prime importance to health. Although their role in plants themselves is not well understood, they are important to human health. Spices and food plants are made from some of these indigenous medicinal plants. Understanding what plants contain chemically is advantageous not only for the discovery phytochemical compounds such as tannins, oils, and gums, which may serve as precursors for the synthesis of more complex chemicals. It would also be beneficial to discover the chemical composition of plants in order to determine their actual value as folkloric remedies. Chemical composition may be used therapeutically or inactively [12]. The active compounds are called active chemical components, while the inactive ones are called inert chemical components. Sometimes these substances are added to foods for pregnant or nursing mothers to provide them with medicine. The use of medicinal plants have increased day by day. There is a wide range of antifungal, anti-microbial, and antiviral activity in secondary metabolites and plant extracts. Furthermore, aromatic plants are also characterized by various aromatic and antiseptic properties. The natural products can be used to make 50 percent of the drugs because the cost is lower and the effect is less severe [13].

2.2.1 Medicinal properties of Mint: The Genus Mentha

Mint is the found in the family *Labiatae (Lamiaceae*). Mints are grown as an herb, shrub or small tree. The leaves are most commonly used in cooking, often in beverages or dishes such as mint tea [14]. The oils from the leaves, either alone or mixed with other oils, are used for cooking, as well as for their flavour. Mentha is a genus of flowering plants that contain a variety of mint species. Most common of them are peppermint, spearmint, and wild mint.

Mentha species are known for their aromatic leaves and small, tubular flowers. They are commonly used in teas, salads, and other foods. The leaves are also used for their strong flavour in various medicines, such as tea for indigestion. Mint is the most commonly used medicinal plants because it is the rich source of anti-oxidant and exhibit the polyphenol in high amount. The results showed that some plants regulators enhanced the growth of mint while the uptake of heavy metals by mint was suppressed.

Mint leaves and herbs contain that compounds which have vast biological activities [15]. mint (31%), menthol (11%), menthone (5%), menthofuran (3%), menthoxypropan-1,2-diol (2%), methyl and ethyl esters of menthone, menthofuran, menthol, and limonene, menthone is the first to be isolated from peppermint and is a major contributor to the aroma of peppermint oils. Menthol is used as a flavoring and cooling agent in foods, pharmaceuticals, and cosmetics. It has also been used as an analgesic and as anesthetic. In the human body, menthol is mainly excreted through the lungs. Mint leaves, which have a cooling effect on the body, and are used in many foods and beverages as a condiment, flavouring agent, or preservative [16].

2.2.2 Herbal Uses in Traditional Cuisine and Popular Medicine

Mint grown for its aromatic leaves, which have been used for making teas and other infusions. The herb has also traditionally been used as a mouthwash to treat bad breath and as a general detoxifier. Today, mint is used to flavour a variety of foods and beverages, such as ice cream and chewing gum.

Gastric distension: The decoction of mint is an effective remedy for gastric distension. The decoction of mint is also useful in treating flatulence and dizziness. The decoction of mint is also a valuable remedy for nausea and vomiting during and in the aftermath of pregnancy. It is also used as a cure for various bodily inflammations.

Sugarcane leaves are used to prepare a refreshing drink obtained by crushing sugarcane with mint leaves or by eating fat-rich yogurt with the addition of powdered sugarcane leaves. The drink is taken to prevent heat strokes and dehydration [17]. The crushed sugarcane leaves are used to prepare a refreshing drink obtained by crushing sugarcane with mint leaves or by eating fat-rich yogurt with the addition of powdered sugarcane leaves.

Mentha spicata is also used as a tea flavouring agent in various countries such as India, China, Korea, Japan and Malaysia. In India, spearmint leaves are used to flavour black tea [16]. The compound peppermint also contains many potent and beneficial compounds including menthyl esters, dimethysulfide, cadinene, acetaldehyde, amyl alcohol, pinene, phellandrene, and limone.

In folk medicine, mint has the credibility of successful alleviation of ailments such as parasites, headache, stomach cramps, flatulence and indigestion, nausea and vomiting, menstrual cramps and diarrhea. It is also used to relieve arthritic symptoms and to promote sweating in cases of high fever. It is also used to treat bronchitis and asthma [18]. In traditional Chinese medicine, mint is used to soothe coughs, expunge phlegm and promote sweating.

2.2.2.1 Antimicrobial activity of mint

Menthol is a colorless liquid with a menthol-like aroma. It occurs naturally in the oil of Mentha species, which are commonly known as peppermint plants. It is also synthesized industrially by the condensation of menthone with isobutene. Menthone is used in the production of menthol-based flavors and fragrances [19]. Some reseachers have demontrated the anti-pathogenic effect of petroleum ether, ethyl acetate, chloroform and water extract, which prevents further growth of the pathogens on the treated agar plates. The highest zone of inhibition was noted against B. subtilis with an ethyl acetate extract (13.1 mm diameter) against which the zones of inhibition of the water, chloroform, and petroleum ether extracts were 11.1mm, 9.9mm and 8.9mm, respectively. The water and chloroform extracts showed the least anti-pathogenic activity and only a 9mm diameter was observed against P. aerogenosa. The in vitro studies on the anti-bacterial activity of the water, chloroform, and petroleum ether extracts of peppermint against six clinical bacterial strains [20].

The high degree of variation in the chemical composition of different plant parts, their potential to adsorb and concentrate heavy metals, and their ability to store water and nutrients, opens up the possibility that they may contain novel compounds with antimicrobial properties that may have low toxicity and side effects [21]. This, in turn, may open the possibility of new and innovative modes of action for antifungal drugs and improve the treatment of fungal infections. We are hopeful that the discoveries from plant-science will improve the lives of many who are burdened by fungal infections

2.2.2.2. Anti – cancer effect of mint

Perillaldehyde (PAL) are two common monoterpene alcohols that are naturally occurring in essential oils of mint, as well as of gingergrass, lavender, cranberries, cherries, perilla, savin and

sage. POH and PAL can be extracted from the above-mentioned essential oils, and then purified to produce a number of different products [22]. POH is also the major component in certain natural supplements, such as lip balm, candle wax and salve, while PAL is primarily used as a flavouring agent in food, such as cheeses and desserts.

The exact course of action has not yet been determined, but in vitro studies showed that the extract of POH led to a reasonable inhibition of the growth of lung, breast and pancreatic cancer cells. It is possible that POH may be used to supplement the current standard of care for these types of cancer.

2.2.2.3. Anti – oxidant activity of mint

Free radicals are known for their ability to cause oxidative damage in biological tissues and molecules [23]. They are able to cause oxidative harm to organic molecules such as proteins, fats and DNA. It also contributes to the aging process.

S.No	Species of mint	Phytochemicals compounds	Medicinal benefits	Reference
01	*Mentha piperita*	Polyphenols, phenolic, piperitone, flavonoids, limonene, beta-caryopyllene, neomenthol and tannins.	Ayurvedic healing of digestive disorders, menstrual discomfort, skin problems like acne, rashes and itching.	22
02	*Mentha spicata*	Limonene, β-pinene, monoterpene hydrocarbons and piperitone oxide.	Respiratory disorders, antioxidant, antibacterial and hemorrhoids, and stomachache	23
03	*Mentha pulegium*	Pulegone, monoterpene. Beta - caryopyllene, neomenthol and tannins.	Antioxidant, antibacterial antimicrobial, and anti-tumor	19
04	*Mentha villosa*	Limonene, β-pinene, monoterpene hydrocarbons and piperitone oxide	Fever, digestive disorder and anti-septic properties	21
05	*Mentha arvensis*	Methanol, neo-methanol, methyl acetate and carvone	Antispasmodic, sedative, carminative, and antioxidant properties	24

Table 1 – Biological and structural properties of the above mentioned mint species.

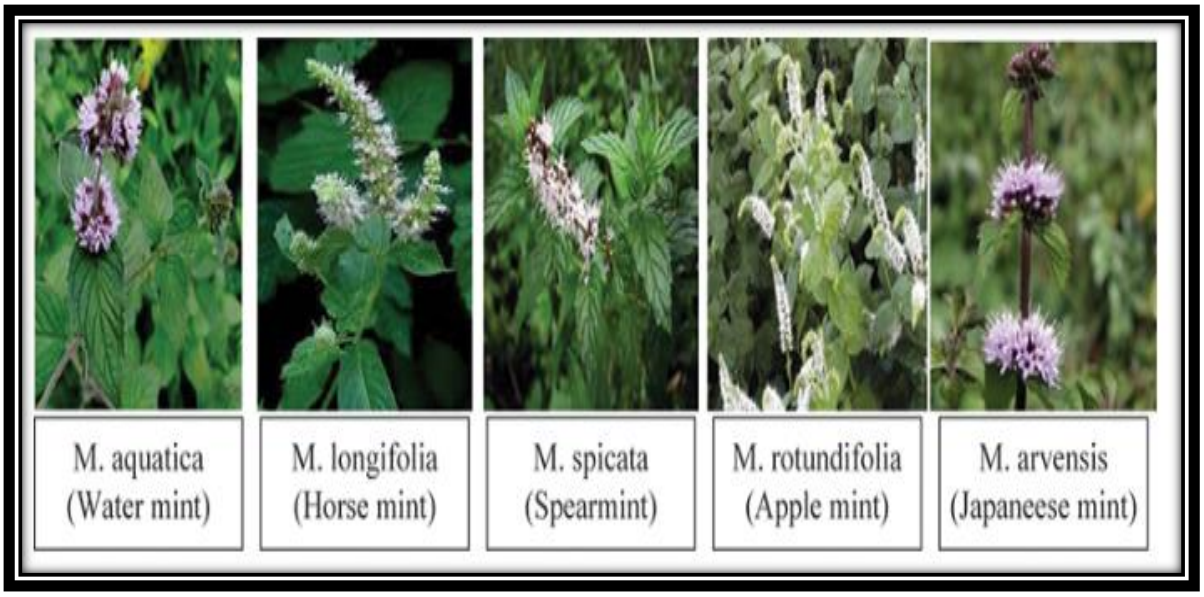

FIG 2: – Various species of Mentha and their common name

2.3 Mangifera and its pharmacological activities -

Mango is a great source of dietary fiber – an important nutrient that helps to keep you regular and healthy. Mango is also a good source of vitamin C and potassium, which support healthy blood pressure and heart health, respectively [25]. In addition, mango is a good source of folate, which is important for a healthy nervous system and may help to protect against some forms of cancer. It is also known as Indian mangosteen. In addition to its fruit, mangoes are also cultivated for their leaves, which can be used to make a variety of herbal remedies and teas. The fruit is commonly eaten raw, used in various dishes and beverages, and juiced [26]. The bark is smooth, dark brown, and thick, with vertical furrows that are lighter on the bottom side. The inner bark is white and fibrous. The leaves are alternate, simple and asymmetrical, with small, serrated, dark green leaves that are often twisted at the tip. The leaves are often found on the upper parts of the tree.

The tree is propagated by seeds, with the exception of the durian, which is propagated by cuttings, and the cashew, which is propagated by grafting. In India, the mango is the 2nd most important fruit crop, with a production of over 12 million tonnes, representing nearly 50% of the country.

The largest, healthiest and deepest roots are found in the crown of the tree. The crown of a young tree is compact and closely knit, with a diameter of 5-10 cm. As the tree grows, the crown gradually opens, with the diameter gradually increasing to 50-70 cm. The leaf is usually tapering at the base, though sometimes it is rounded [28]. The margin is dentate (notched) at the apex, and may be entire, or occasionally, crenate (scraggly).

The male flowers are in groups of up to three, with a large, green calyx and a small, white, egg-shaped corolla. The female flowers are solitary or in pairs, with a brown calyx and large, white to pinkish, bell-shaped corolla [29].

FIG 2 – Picture showing the leaves of *Mangifera indica*

The flowers are zygomorphic, and the calyx is long and thin, almost as long as the corolla. The corolla is long, about the same length as the calyces, and is tubular with the throat dilated into a small throat. They are light brown in color, with a waxy coating, and they are easily transferred to

another flower. The anthers of the flower are yellow, with the lobes of the anthers appearing as a fringe when viewed from the top. When the flower is opened, the anthers are seen to have a greenish color [30].

The flesh is soft and pulpy, with a sweet, subacid, aromatic flavour and a juicy, watery pulp. The pulp is white, yellow or greenish, and has a high water content. The fruit taken as raw or dried and ground a powder or paste, which is known by many different names, such as rahayu, gula Jawa, gula kering, etc. The powder or paste is used to flavour a variety of dishes, such as curries, stews, pickles, etc.

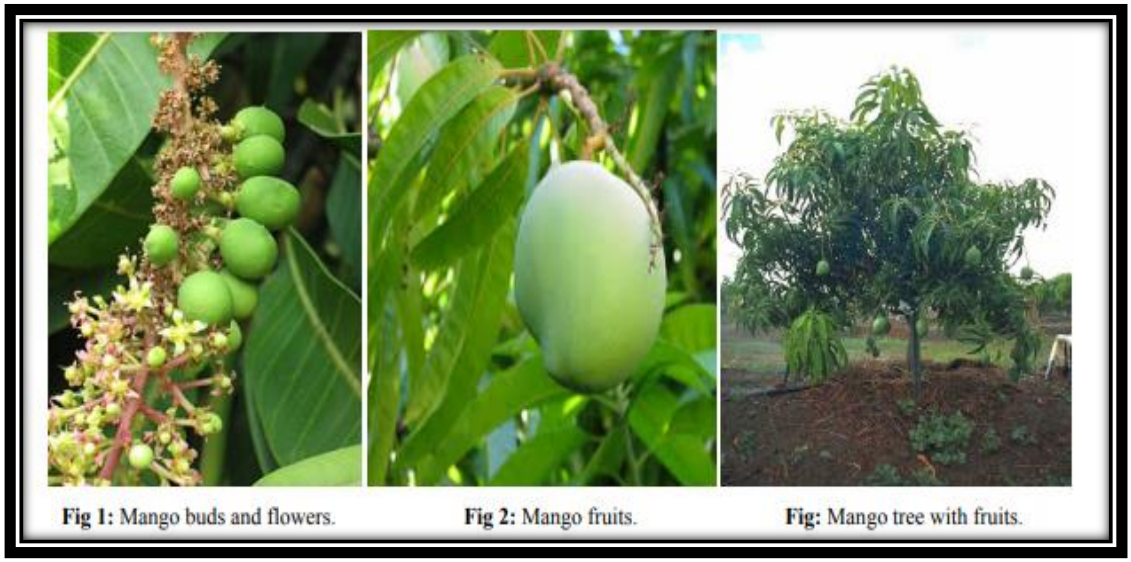

FIG 3 – Picture showing the Mangifera indica buds, fruits and its leaves.

2.3.1. Medicinal uses of *Mangifera genus*

2.3.1.1. Anti – cancer properties mango leaves –

The mango fruit pulp, expressed juice, expressed seed and expressed leaf extracts have shown significant anti-tumor activity. The mango leaf extract also showed significant antiproliferative activity on the hepatoma cell line (HepG2) and myeloma cell line (K562) [31]. The seed extract

showed significant antiproliferative activity on the lung cancer cells (A549) and skin cancer cells (MesoS). Methanolic mango leaves extract has been shown to have anticancer activity in a number of studies.

The mechanism through which whole mango fruit and leaves extract inhibit the cell cycle is likely the result of the high levels of quercetin and kaempferol, both of which have been shown to impair the functions of the cyclin-dependent kinases CDK2 and CDK4. Outcomes suggest that whole mango juice and mango juice extracts have the potential to be used as a dietary supplement or as a component of traditional healing practices for the prevention and treatment.

Mangiferin can trigger the activity of telomerase, which is an enzyme that lengthens telomeres. Telomeres are DNA structures that cap and protect the ends of chromosomes. In humans, telomeres shorten as cells age, which may affect the cells' ability to divide [32].

2.3.1.2. Anti-diabetic activity of mango leaves –

It is recommended to take these leaves on an empty stomach so that they control blood sugar levels. Other benefits include the reduction of blood sugar levels, the treatment of diabetic angiopathy, and the reduction of diabetic retinopathy [33]. A compound in leaves, ethyl acetate, reacts with insulin in the blood and stimulates glycogen synthesis.

2.3.1.3. Anti-hemorrhagic property of mango leaves -

The anti-hemorrhagic activity of mango methanolic extract was evaluated against the venom of Russell’s viper, outcomes that the mango extract demonstrated attenuated the hemorrhagic activities of snake venom in mice.

2.3.1.4. Prevent from kidney failure

This was accompanied by increased GFR, TGF-β1 and HGF levels, and decreased TNF-α levels in the kidney tissues. These findings suggest that creatine supplementation may favorably impact the renal health of athletes. Creatine is an amino acid that is commonly fed to the dog to enhance the renal function. It has been suggested that; creatinine is the most common excreted nitrogenous waste product in the body [34]. The kidney excretes it to the urine and the urinary creatinine concentration may be used as a measure of the effectiveness of renal function. Creatinine has also been suggested to be an indicator of the efficacy of renal function in general.

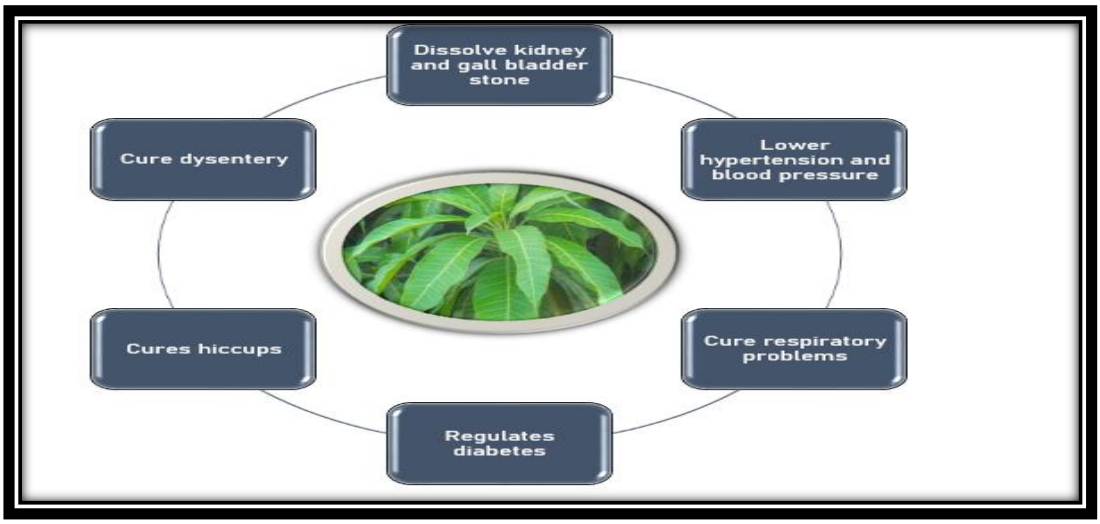

FIG 4: – Showing the various biological and medicinal properties of mango leaves.

2.3.2. *Mangifera* leaves property in other various disease

A recent study of the anti-diabetic properties of *mangifera* seeds and leaves is providing new information on the role in various disease. Study participants were primarily concerned about finding out how the leaves produce their anti-diabetic properties. This was accomplished by examining the effect of the leaves on isolated rat and mouse adipocytes. The anti-diabetic activity of the leaves was independent of any effect on glucose and lipid metabolism [35]. Antioxidant activity is when a substance has antioxidant activity, this is an antioxidant and the presence of an

antioxidant in the substance allows it to become more oxidized and reduce the ability of the substance to reduce free radicals.

Mango leaves are so popular for promoting diabetes. As a result, mango leaves are a source of tannin, the most potent tannin in nature. As discussed in the previous example, tannins are found abundantly within the mango, and since tannins are found in the leaves, it is possible that tannins in mango leaves may have the same properties as tannins found in the mango itself.

The result of this investigation was found to be significant. According to the study, the blood glucose levels of the subjects was found to be significantly lowered after the mango leaves powder treatment [36]. The blood glucose levels of the subjects was found to be lowered after the mango leaves powder treatment.

The leaves of mango are rich sources of flavonoids and flavones, with a high content of phenolic compounds that can inhibit the inflammatory response.

2.4 Solanum lycopersicum properties and biological activities

2.4.1. Botanical description

Tomatoes (*Solanum lycopersicum*) are a member of the *Solanaceae* plant family and are one of the most commonly produced vegetables on the planet. It has typically red fruit having a high content of lycopene. It is a nightshade plant that grows to a height of 1–3 meters and has a weak stem that often stretches over the ground and vines over neighboring plants. It's a perennial plant that flourishes in temperate climates. Tomatoes are consumed in a variety of ways, including raw, as an ingredient in a variety of cuisines and sauces, and in beverages. Moisture, protein, total lipids,

and carbs are all high, at 94.78 percent, 1.167 percent, 0.97 percent, and 3.18 percent, respectively [37]. It is a warm-season crop that, after potatoes, is the second most cultivated crop in the United States. Tomato plants are dicots, with branching stems and an apical bud at the tip that accomplishes the real growth. The tomato's main constituent is water, which makes up 93-95 percent of the whole fruit, with the remaining 5-7 percent made up of dry matter like carbohydrates, proteins, vitamins, and insoluble fiber hemicellulose, cellulose. The major flavonoid present in the skin of the tomato is Naringenin. Tomatoes are eaten in a variety of ways all around the world. They're made into ketchup, powder, sauce, juice, salsa, paste, and other products. Tomatoes are high in lycopene (87%) as well as other carotenoids like carotene, lutein, and L-ascorbic acid. They are high in antioxidants, which assist to scavenge free radicals and reactive oxygen species (ROS) from our bodies, reducing the risk of oxidative stress [38]. It also aids in the prevention of chronic diseases such as cancer, cardiovascular disease, and cholesterol reduction. Tomatoes are less sweet in taste due to their low sugar content and calories. The green color of the tomato is due to the presence of chlorophyll in them.

The tomato consists of the toxic glycoalkaloid called tomatine. Tomatine is present in various parts of the tomato plant such as leaves, stems, and green unripe tomato. The fully ripened tomato has reduced the content of tomatine but has a good beneficial physiological effect on the human body. However, tomato leaf use as tea has been linked to tomatine toxicity, which has been linked to at least one of the following: Raw tomato eating can cause allergies and potentially life-threatening anaphylaxis, especially in youngsters and allergy-prone persons [39]. Symptoms related to the toxicity of the tomatine in animals include vomiting, confusion, weakness, diarrhea, etc. tomato consists of good monounsaturated fatty acids which include Aspartic acid, oleic acid,

and glutamic acid. The content of glutamic and aspartic acid is a maximum which is 0.16mg and 0.42 mg.

Tomatine has a good efficiency in reducing cholesterol. When rats consume it orally, it is extremely strong and poisonous. In a study, it was observed that a diet having good quantities of tomatine reduced the LDL cholesterol level to 41% and there was no change in HDL level was observed [40]. The conventional methods for the extraction of lycopene involve sonication, blending, organic solvent extraction, blending, etc. but there are many drawbacks associated with these types of techniques such as the high cost of extraction, and the requirement of more quantities of solvents and samples, long extraction time. The final sample obtained after the extraction through these conventional techniques requires the final clean-up and the subsequent concentration before the analysis. The new methods of extraction include pressurized liquid extraction, supercritical fluid extraction, and microwave-assisted extraction.

2.4.1. Medicinal uses of tomato

2.4.1.1 Diabetes

Diabetes is a multifactorial disease caused by oxidative stress, excessive cholesterol levels, insulin resistance (low insulin levels in the blood), diminished Glucose Transporter Type (GLUT)-4, and reduced insulin binding to its receptor. Diabetes leads to an increased incidence of heart disease, thicker blood, increased hypertension, and more risks of heart disease. The killing of beta-pancreatic cells by the host's reaction to T cells and macrophages is the major feature of diabetes.

In the case of hyperglycemia, there are increased sugar levels in the blood which in turn affect the kidney, heart, and liver tissues [41]. Other effects of diabetes are eyes, immunity, feet, etc. the excessive glucose concentration in the blood leads to the division of vascular smooth muscle cells which increases the incidence to increased incidence to many cardiovascular diseases. Enhancing glucose secretion, reducing immune cell formation, and stimulating cell survival proteins are all approaches to preventing diabetes and avoiding its complications. A randomized trial was done on 12 women and 13 men 27-28 years of age comparing the effect of high-fat meals without tomatoes and a high tomato-rich diet. The blood glucose levels were measured after the 6 days and good results ie. Sufficiently low glucose levels were found in the blood of those people who were on a tomato-rich diet. Thus, it was found that beta-carotene supplementation avoids the chances of developing diabetes. Tomatoes are a good source of antioxidants which decreases the chance of developing diabetes [42].

2.4.1.2. Cardiovascular diseases

Cardiovascular diseases are caused by the accumulation of fat inside the arteries which blocks them leading to the state called atherosclerosis. Conditions like obesity, diabetes, and hypertension lead to other serious complications like coronary heart disease, cardiomyopathy, etc. cardiovascular diseases are also caused by increased production of thromboxane and adenosine diphosphate [43]. The tomatoes contain a good amount of carotene, lycopene, and tomatine which decreases the LDL cholesterol levels in the blood. A high intake of tomatoes leads to LDL oxidation and production of lipid peroxidases which help in controlling the cholesterol levels in the blood. A study was conducted in which volunteers were taken and were fed on a tomato-free diet for 3 weeks and a tomato-rich diet. It was observed that at the end of 3 weeks patients fed on

a high tomato-rich diet showed low LDL levels in blood up to 5.9% and cholesterol levels up to 12.9%. The blood levels showed a good concentration of lycopene, beta and gamma carotene [45].

2.5. Helianthus annus's medicinal properties in several disease

2.5.1. Botanical description

Helianthus annus (sunflower) is a plant of good medicinal value and therapeutic importance. It is commonly cultivated in different parts of the world such as America, Africa, Australia, and Asia. The seed of the sunflower is eaten and used for the extraction of the oil and that edible oil is used throughout the world. The sunflower is rich in a large number of phytochemicals such as flavonoids, alkaloids, tannins, phenol, steroids, carbohydrates, etc [46]. The seeds of the *Helianthus annus* can be used for a variety of purposes such as garnishing, eating, salad, and bakery.

The *Helianthus annus* plant is approximately 3 meters tall and it has a hairy stem. The leaves of the plant are toothed edge, rough, and have alternate symmetry. The color of the flowers is yellow and the plant has taproots. The sunflower genome is diploid and it has 17 chromosomes. The main characteristic of the sunflower is its head always follows the sun throughout the sky. Almost all the parts of the plant- seeds, leaves, bark, the stem has medicinal importance.

The main property of the sunflower is the antioxidant, antifungal and anticancer activity. The phytochemical analysis of the sunflower showed that it has a large number of phenols and has good free radical scavenging properties.

The different parts of the sunflower have a good medicinal value. The crushed leaves of the sunflower are used as medical coverage for the snakebites, sores, and spider bites. The flower of *H. annuus* is used for cancer treatment [47].

3. Secondary metabolites of plants

3.1. Flavonoids

Natural chemicals originating from plants are of particular interest because of their high bioavailability, safety, few side effects, and, most importantly, low cost. Flavonoids are polyphenolic chemicals found in nature that make up a wide collection of secondary plant metabolites with intriguing biological properties. Flavonoids have been extensively investigated for their health advantages, in addition to their plentiful availability in our everyday diets, such as green leaves, fruits, red wine, and tea vegetables, due to their nontoxicity in nature and wide and broad aspect of their benefits in biological activities. Chemoprevention and their therapeutic role in the prevention of various types of cancer [48].

Plants produce phytochemicals, a group of compounds that aid in plant growth and protect them from predators. Currently, the use of phytochemicals, particularly polyphenols, as alternative anticancer medications is a promising option, as they reduce or eliminate the side effects of more severe conventional therapy. Furthermore, our bodies develop resistance to several traditional cancer medicines. Flavonoids are secondary phenolic compounds present in medicinal plants' fruits, vegetables, grains, barks, roots, stems, and flowers. The fact that polyphenols can be extracted using easy and eco-friendly methods like ultrasound-assisted extraction, and that

following sterilization, polyphenols retain the majority of their capabilities, will aid research into polyphenols as possible anticancer treatments. Flavonoids aid cancer chemoprevention by regulating a number of important pathways involved in cancer growth and metastasis. Flavonoids have the ability to control tumor formation via regulating signaling molecules such as VEGF, MMPs, ILs, HIF, and others [49].

3.2. Flavonoids as therapeutic agents targeting different types of cancer

Breast, prostate, and colon cancer rates are lower in communities with high isoflavone intake from soy diet, according to epidemiological studies. Genistein is an isoflavone polyphenol which is found in soy protein act as a strong chemopreventive against cancer. In some studies has been shown that luteolin exhibit antiproliferative property which can inhibit the proliferation of cancer cells by cell cycle arrest and apoptosis. Proteasome - mediated pathway could also be inhibited by luteolin. Quercetin is a preventive agent against cancer that can inhibit the protein kinases. Cell proliferation, cell growth and Bcl-2 expression were all decreased when combining pterostilbene and quercetin. Researchers have found that combining EGCG with other cancer – fighting drugs such as doxorubicin, cisplatin and tasocitinib reduced tumor growth, increased cell death and improved survival rate in various mode of cancer [50]. Different classes of natural compounds, namely Flavonoids, Flavones, Anthocyanins and isoflavonoids. It is one of the potent secondary metabolites which play important role in the inhibition of cancer cells. It exhibit wide range of anti-cancer.

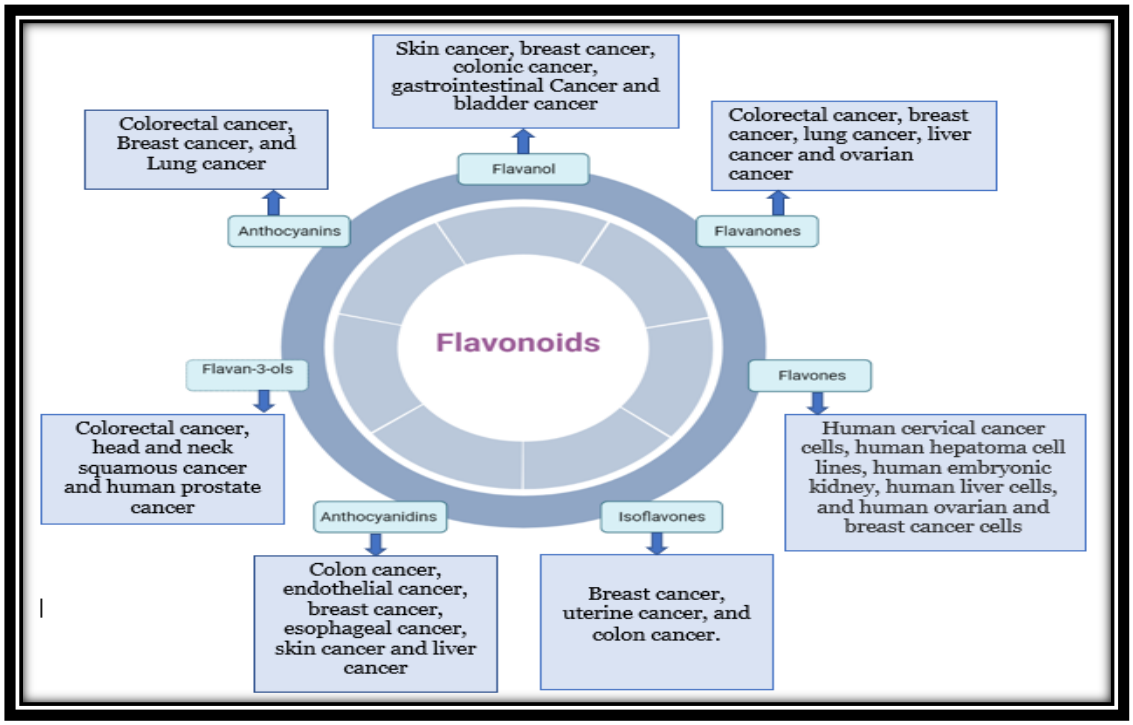

FIG - Classification of flavonoids in various subgroups and their cancer types.

3.3. Pharmaceuticals, Anticancer, and Physiological properties of plant flavonoids

Several studies have demonstrated flavonoids' potential to inhibition of cancer cells. Because flavonoids have a range of anti-cancer pathways, they have a significant anti-cancer effect.

Anti-cancer activity of flavonoids –

Flavonoids may stimulate the cell death pathways by targeting the apoptotic signaling cascade. Flavonoids and their subgroups could trigger and proliferate the various signaling pathways such as protein kinase C (PKC), tyrosine kinase, EGRF signaling pathway, Topoisomerase inhibition, and Population of T- and B cells enhancement [51]. Flavonoids act as potent aromatase inhibitors in breast cancer.

3.3.1. Anti-inflammatory activity of flavonoids –

The protective mechanism of the body is the result of the inflammation and results in tumor formation, angiogenesis pathways, proliferation, and metastasis [52]. Quercetin, hesperidin, apigenin, and luteolin are the subclasses of flavonoids that have an anti-inflammatory effect. Flavonoids can modulate the count and differentiation of the immune cells. It can trigger the activity of the mammalian target of rapamycin (mTOR) and inhibit the T effector differentiation.

3.3.2. Anti-oxidant activity of flavonoids –

The inflammation process is directly linked to the amount of ROS produced, which causes oxidative stress resulting in cancer and degenerative disease. Flavonoids exhibit dual functions in ROS homeostasis. In the normal condition, it will act as an anti-oxidant and potent anti-oxidant in the cancer cells and trigger the apoptotic pathways [51]. Flavonoids have phenolic hydroxyl which can scavenge reactive oxygen species (ROS) and bind metal ions.

3.3.3. Anti-angiogenesis activity of flavonoids –

It is the process of formation of new blood cells and it is regulated by angiostatic and endogenous factors. Any disruption in this process can lead to uncontrolled growth and metastasis of the tumor. Flavonoids can act as angiogenesis inhibitors which can Because of their anti-angiogenic qualities, these inhibitors can prevent nutrition and oxygen from reaching rapidly developing malignant cells, resulting in cell death [53]. These inhibitors can trigger the proliferation, lumen formation, and migration of endothelial cells.

3.3.4. Flavonoids could induce anti-tumor and cell cycle arrest –

p53 exhibit a significant role in apoptosis, and DNA repairs by acting transactivator or transrepressor. Flavonoids can inhibit any steps in the NF-kB signaling pathway and DNA binding of the dimers. Flavonoids have been discovered to inhibit the activation of activator protein-1 (AP-1) and affect the expression of AP-1 target genes.

S.No.	Members of the flavonoids family	Sources	Properties	Mechanism of action	Reference
01	Anthocyanins	Tomato (*Solanum lycopersicum*), pepper (*Capsicum* sp p.), eggplant (*Solanum melongena*) and potato (*Solanum tuberosum*).	Water-soluble, presence of chelating metal ions, the positive charge in acidic solution, antioxidant activity,	Activate multiple genes that are involved in the cellular processes including PI3K/Akt, ERK, JNK, and MAPK pathways	50
02	Flavones	*S. baicalensis Menthapiperita, Origanumvulgare, Camellia sinensis , Camellia sinensis*	Increased lipophilicity, high potential cellular activities, Anti-oxidant.	Modulate the reactive oxygen species expression	51
03	Isoflavonoids	Papilionoideae subfamily of the Fabaceae family (legumes).	Antioxidant, antihelminthic and cholesterol-reducing, chemotherapeutic	induced cell cycle arrest	49

04	Anthocyanidins	*Meconopsis* species, *Tulipa gesneriana*, *Tulipa fosteriana* and *Tulipa eichleri*.	1.1.1 Antioxidants, Anti-inflammation antimicrobial, Anti-mutagenesis,	Block tumourigenesis, can act on Ras-ERK and PI3K/Akt pathways, inhibit the auto phosphorylation of receptor TKs (RTKs)	54
05	Flavonols	Spinacia oleracea, Brassica oleracea, Phaseolus vulgaris L, Aggregate fruits	Antioxidants; Antimicrobial, anti-inflammatory	Inhibit various cancer enzyme activity. Induce apoptosis.	53

Table 2- Implementations of different class of flavonoids in various cancer describing their properties and role of mechanism.

4. Biological and medicinal properties of Sterol –

Sterol are the naturally occurring compounds in the plant cell well. Plant steroids are unique class of chemical compounds that are found throughout the animal and plant kingdom. Glucocorticoids can induce tumors, or even cause cancer [55]. Plant sterols are responsible for the yellow colour of egg yolks and the shocking pink color of meats and dairy products [56]. They are also used as dietary supplements. Phytosterols are the primary plant constituents that confer cholesterol-lowering effects in the human diet. They are found in all plant foods, but their quantity and concentration varies significantly between plant foods. In general, plant foods are rich in fiber and nutrients such as fruits, vegetables and whole grains, contain the most phytosterols. Plant foods

that are high in fat and fat ingredient as meat, dairy and oils, contain relatively low amounts of phytosterols.

Research has shown that phytosterols may reduce the risk of cardiovascular disease by minimize the level of cholesterol, both of which can lead to heart attack and stroke. They are commonly used as food additives, for nutritional supplements, for medical uses, and for industrial purposes. Phytosterols are also used as pharmaceuticals [57].

Phytosterols are unsaturated or saturated compounds that are found in plants, which are biologically inactive forms of cholesterol. As such, they do not contribute to the cholesterol content of the body.

PS is a major component of the thylakoid membrane of photosynthetic cells, which maintain the transportation between two cells and maintain communication between them, and may also act as a structural component. PS consists of two long, hydrophilic polypeptide chains, the hydrophilic domain of which is exposed to the aqueous environment of the cell, and the hydrophobic domain of which is buried within the lipid bilayer [58].

5. Alkaloids

The alkaloids are an extremely diverse group of chemical compounds, the majority of which are plant-derived or animal-derived, that are not easily synthesized in the lab. Alkaloids are closely associated with the name of the alkali from which they were isolated, e.g. caffeine is a caffeine alkaloid, quinine is a quinine alkaloid, sanguinarine is a sanguinarine alkaloid, and the indole-based compounds [59]. Alkaloids are basically produced by various terrestrial plants, bacteria, fungi and viruses. Alkaloids can be extracted from plants, fungi, and marine organisms and may be used as medicines, food additives, and cosmetics, or for other purposes.

Communesin, one of the major alkaloid from a marine red alga, was isolated from a marine red alga, Gracilaria vermiculophylla. Communesin is an important feature of an algal alkaloid because it was either a natural component or a host product. Some alkaloids were produced by host organisms on algae [60]. For example, communesin was isolated from Gracilaria vermiculophylla.

6. Phenols

Phenolic chemicals give plants and fruits their distinct taste, flavor, and health-promoting characteristics [61]. Phytochemicals called phenolics are abundant in the plant world and maybe easily be isolated from fruits and vegetables. They perform multiple functions in the plant which include plant growth, development, and providing defense. Phenolic chemicals give the plant its color and flavor. These compounds are also produced in the plant due to the response to some abiotic or environmental stresses such as pollution, light, chilling, etc. These chemicals are also created in plants as a result of regular metabolic processes, and they operate as signaling molecules in plants that regulate physical function. In plants, these phenolic chemicals also have a protective role. They defend plants from bacteria, fungus, viruses, and insects.

Consumption of phenolic phytochemical-rich foods has been linked to a variety of health advantages for the human body in both epidemiologic and experimental investigations. People that consume phenolic compounds reap numerous health benefits [62]. Food, nutritional, and medicinal sciences have all been drawn to phenolic phytochemicals. The absorption rate of phenolic compounds is too low in the human body. More than 8000 phenolic phytochemicals have been confirmed to exist in various fruits and vegetables, making them the biggest category of phytochemicals. The molecular structure of plant phenolic compounds varies, but they all have

hydroxylated aromatic rings Secondary metabolites, such as phenolic chemicals, are poorly known in plants.

Phenolic acids have been shown to have a variety of biological functions. Increases bile output and lowers blood pressure. Phenolic acids also have properties like anti-inflammatory, antispasmodic, antidepressant activities, and anti-tumor activity [63].

They play an excellent role as antioxidants. They can contribute an electron, allowing the oxidizable substrate to be converted into less detrimental compounds. One of the hottest subjects in science is the investigation of the antioxidant potential of phenolic extracts obtained from plant species; nonetheless, in vitro studies are the most popular. Studies have demonstrated the importance of eating fruits on a regular basis, particularly for improving the quality of life and preventing diseases linked to oxidative stress [64]. Antiviral, antibacterial, and antimicrobial actions are among the other biological effects of phenolic acids.

Materials and methods

Instrumentation and apparatus

Test tubes, conical flask, beakers, whatman filter paper No 42, pipette, measuring cylinder, hot plate, weighing balance, burette, funnel, biological oxygen demand (BOD), Heating mantle, mortar and pestle, cultural tubes, test tube stand, centrifuge, spectrophotometer, spatula, Tissue paper, glass rod, falcon tubes, china dish, aluminum foil, micropipette, tips, cuvette.

Chemicals –

Petroleum, ether, hexane, distilled water, 5% ferric acidified solution, chloroform, concentrated sulphuric acid, gallic acid,

Preparation of standard solutions

Preparation of 5% ferric chloride solutions - g of ferric chloride was mixed with 20ml of distilled water.

Collection of plant materials

1 - **For the sun-dried** –

Plants Leaves of *Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus* were identified at the department of Plant Biotechnology, Nursery of Delhi Technological University. The fresh and healthy leaves of *Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus* were collected and washed through tap water and rinse through double distilled water then leave for seven days for the dried under the sun for seven days. washed and shade dried for seven days. Then broke the leaves into small pieces and grounded into fine powder using mortar and pestle and stored at room temperature or further use.

2- **For the shade – dried** –

We collected leaves from the four selected plants (Mentha piperita, Mangifera indica, Solanum lycopersicum, and Helianthus annuus) and washed them with tap water and then double distilled water to remove dirt. We spread the leaves evenly on the newspaper and let them dry at room temperature for seven days in the plant biotech lab of Delhi Technological University.

After seven days, the leaves were crushed in a pestle and mortar and finely ground to make a powder. After that, the powder was placed in a china dish and covered in aluminum foil for further testing.

3 – **For the fresh leaves –**

For the production of fresh plant leaf samples (Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus). The leaves were freshly picked rinsed with tap water and then with double distilled water to eliminate debris and then thick paste was prepared separately in the grinder. For additional testing, the paste was stored in sealed glass bottles

Extract preparation

Shade dried-

1- 2g of the finely powdered shade dried leaves of (*Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus*) was put on the aluminum foil and was weighed separately on the weighing balance.

2- The 2g powder of *(Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus)* leaves was separately transferred into 4 different conical flasks.

3 - The 4 different conical flasks were labelled with the black permanent marker with the name of the respective plant species.

4 - 100ml of double distilled water was taken in the measuring cylinder and then it was put separately into the 4 different conical flasks having 2g of powdered sample.

5- To ensure that the material was thoroughly mixed, the flasks were shaken in a clockwise motion.

6- The flasks having the material were then boiled on the heating mantle at 60℃ for 5 mins with occasional shaking.

7- The heated sample was allowed to cool at room temperature and then it was transferred into the falcon tubes and centrifuged at 40000rpm for 10mins in the centrifuge.

8- The centrifuged sample was then filtered in the conical flask using Whatman filter paper.

9- The filtrate was then stored for further phytochemical analysis.

Sundried-

1- 2g of the finely powdered sun dried leaves of *(Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus)* was put on the aluminum foil and was weighed separately on the weighing balance.

2- The 2g powder of *(Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus)* leaves was separately transferred into 4 different conical flasks.

3- The 4 different conical flasks were labeled with the black permanent marker with the name of the respective plant species.

4 - 100ml of double distilled water was taken in the measuring cylinder and then it was put separately into the 4 different conical flasks having 2g of powdered sample.

5 - To ensure that the material was thoroughly mixed, the flasks were shaken in a clockwise motion.

6- The flasks having the material were then boiled on the heating mantle at 60℃ for 5 mins with occasional shaking.

7- The heated sample was allowed to cool at room temperature and then it was transferred into the falcon tubes and centrifuged at 40000rpm for 10mins in the centrifuge.

8- The centrifuged sample was then filtered in the conical flask using Whatman filter paper.

9- The filtrate was then stored for further phytochemical analysis.

Fresh sample-

1- The 10ml of freshly prepared paste of the leaves of *(Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus)* was put in the conical flask and then was separately transferred into 4 different conical flasks.

2- The 4 different conical flasks were labeled with the black permanent marker with the name of the respective plant species.

3- 100ml of double distilled water was taken in the measuring cylinder and then it was put separately into the 4 different conical flasks having 2g of powdered sample.

4 - To ensure that the material was thoroughly mixed, the flasks were shaken in a clockwise motion.

5 - The flasks having the material were then boiled on the heating mantle at 60℃ for 5 mins with occasional shaking.

6- The heated sample was allowed to cool at room temperature and then it was transferred into the falcon tubes and centrifuged at 40000rpm for 10mins in the centrifuge.

7- The centrifuged sample was then filtered in the conical flask using Whatman filter paper.

8- The filtrate was then stored for further phytochemical analysis.

Solvent extract preparation

For petroleum ether solvent

1- The 1g of *(Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus*) leaves were put in the conical flask and then was separately transferred into 4 different conical flasks.

2- The 4 different conical flasks were labeled with the black permanent marker with the name of the respective plant species.

3- 15ml petroleum ether was taken in the measuring cylinder and then it was put separately into the 4 different conical flasks having 1g of powdered sample.

4 - To ensure that the material was thoroughly mixed, the flasks were put in the BOD shaker for 48h at 35^{O}C.

5- Then sample was allowed to cool at room temperature and then it was transferred into the falcon tubes and centrifuged at 40000rpm for 10mins in the centrifuge.

6- The centrifuged sample was then filtered in the conical flask using Whatman filter paper.

7j- The filtrate was then stored for further phytochemical analysis.

For n – hexane solvent

1- The 1g of *(Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus)* leaves were put in the conical flask and then was separately transferred into 4 different conical flasks.

2- The 4 different conical flasks were labeled with the black permanent marker with the name of the respective plant species.

3- 15ml n- hexane was taken in the measuring cylinder and then it was put separately into the 4 different conical flasks having 1g of powdered sample.

4 - To ensure that the material was thoroughly mixed, the flasks were put in the BOD shaker for 48h at $35^{O}C$.

5- Then the sample was allowed to cool at room temperature and then it was transferred into the falcon tubes and centrifuged at 40000rpm for 10mins in the centrifuge.

6- The centrifuged sample was then filtered in the conical flask using Whatman filter paper.

7- The filtrate was then stored for further phytochemical analysis.

For Methanol solvent

1- The 1g of *(Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus)* leaves were put in the conical flask and then was separately transferred into 4 different conical flasks.

2- The 4 different conical flasks were labeled with the black permanent marker with the name of the respective plant species.

3- 15ml methanol was taken in the measuring cylinder and then it was put separately into the 4 different conical flasks having 1g of powdered sample.

4 - To ensure that the material was thoroughly mixed, the flasks were put in the BOD shaker for 48h at $35^{O}C$.

5- Then sample was allowed to cool at room temperature and then it was transferred into the falcon tubes and centrifuged at 40000rpm for 10mins in the centrifuge.

6- The centrifuged sample was then filtered in the conical flask using Whatman filter paper.

7- The filtrate was then stored for further phytochemical analysis.

For chloroform solvents

1- The 1g of *(Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus)* leaves was put in the conical flask and then was separately transferred into 4 different conical flasks.

2- The 4 different conical flasks were labeled with the black permanent marker with the name of the respective plant species.

3- 15ml chloroform was taken in the measuring cylinder and then it was put separately into the 4 different conical flasks having 1g of powdered sample.

4 - To ensure that the material was thoroughly mixed, the flasks were put in the BOD shaker for 48h at $35^{O}C$.

6- Then the sample was allowed to cool at room temperature and then it was transferred into the falcon tubes and centrifuged at 40000rpm for 10mins in the centrifuge.

7- The centrifuged sample was then filtered in the conical flask using Whatman filter paper.

8- The filtrate was then stored for further phytochemical analysis.

Qualitative estimation of the phytochemicals in the medicinal plants

Qualitative estimation of Steriods (Salkowski test) –

1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then 10 ml of chloroform was added after this few drops of concentrated sulphuric acid was added carefully and allow to stand for the formation of ring.

Qualitative estimation of phenol compounds –

1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then few drops of 5% acidified ferric chloride solution was added carefully and leave for sometimes without any disturbance.

Results and discussion

Determination of the presence of steroids and phenol in these medicinal plants

1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then 10 ml of chloroform was added after this few drops of concentrated sulphuric acid was added carefully and allow to stand and formation of the red color ring at bottom is the indication of presence of steroids. 1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then few drops of 5% acidified ferric chloride solution was added carefully and leave for sometimes without any disturbance then formation of the black blue color indicate the presence of phenol.

Table – Illustrate the phytochemical analysis of steroids and phenol in the shade-dried selected flora.

S. No.	Name of the plants	Steroids	Inference	Phenol	Inference
01	*Mentha piperita*	+	Presence of red color at the lower layer	+	Presence of Bluish black color
02	*Mangifera indica*	+	Presence of red color at the lower layer	+	Presence of Bluish black color
03	*Solanum lycopersicum*	+	Presence of red color at the lower layer	–	Absence of Bluish black color
04	*Helianthus annuus*	+	Presence of red color at the lower layer	+	Presence of Bluish black color

Table - Illustrate the phytochemical analysis of steroids and phenol in the sun -dried selected flora.

S. No.	Name of the plants	Steroids	Inference	Phenol	Inference
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03	*Solanum lycopersicum*	+	Presence of red color at the lower layer	–	Absence of Bluish black color
04	*Helianthus annuus*	+	Presence of red color at the lower layer	+	Presence of Bluish black color

FIG: Picture showing the steriods result of the shade dried leves of *Solanum lycopersium, Mangifera indica, Helianthus annus and Mentha piperita plants*.

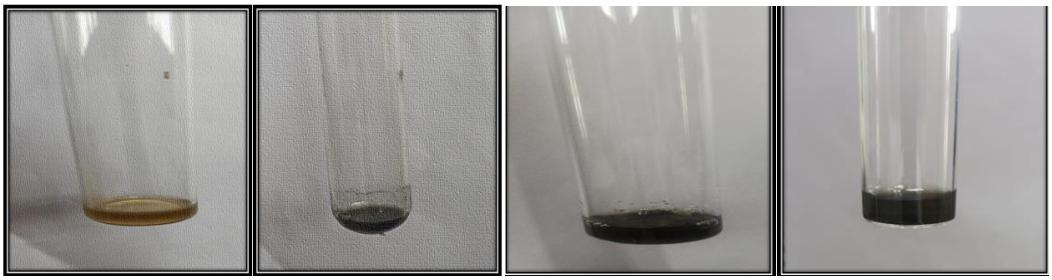


FIG: Picture showing the phenol result of the shade dried leves of *Solanum lycopersium, Mangifera indica, Helianthus annus and Mentha piperita plants*.

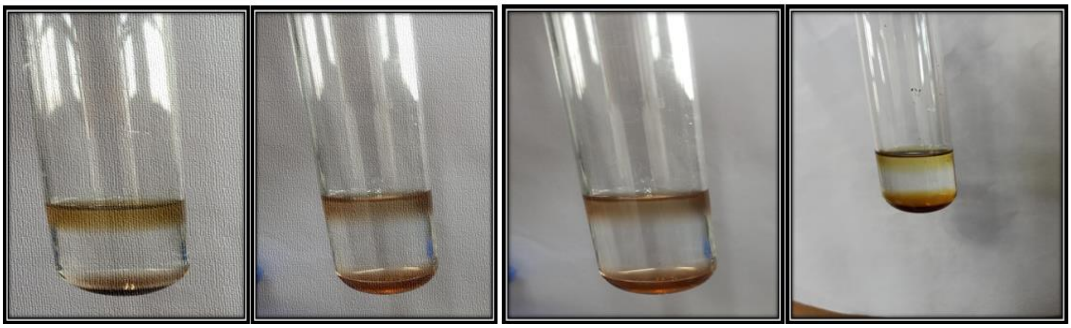


FIG: Picture showing the steriods result of the sun - dried leves of *Solanum lycopersium, Mangifera indica, Helianthus annus and Mentha piperita plants*

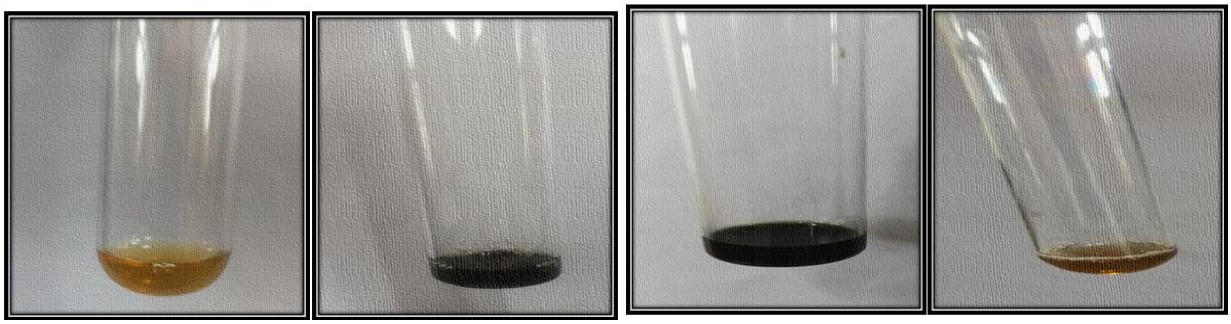


FIG: Picture showing the phenol result of the sun - dried leves of *Solanum lycopersium, Mangifera indica, Helianthus annus and Mentha piperita plants*

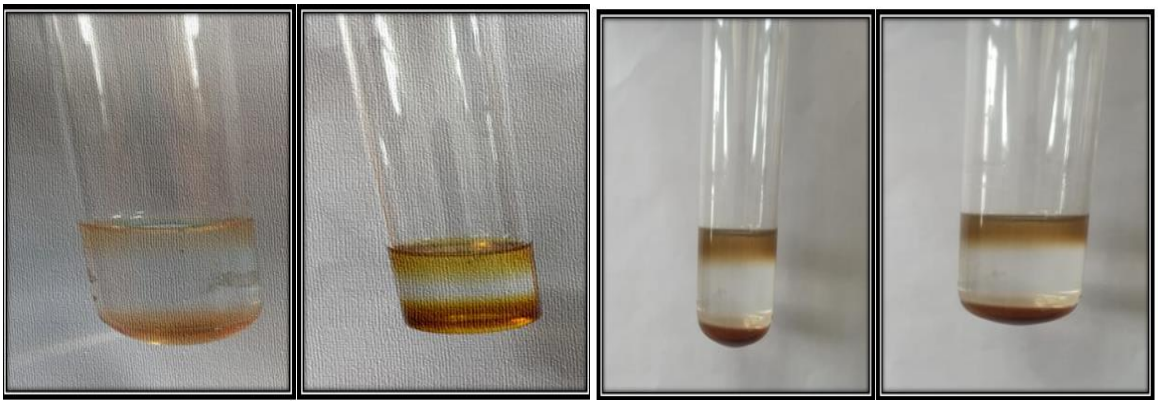


FIG: Picture showing the steriods result of the fresh leves of *Solanum lycopersium, Mentha piperita, Helianthus annus and Mangifera indica plants*

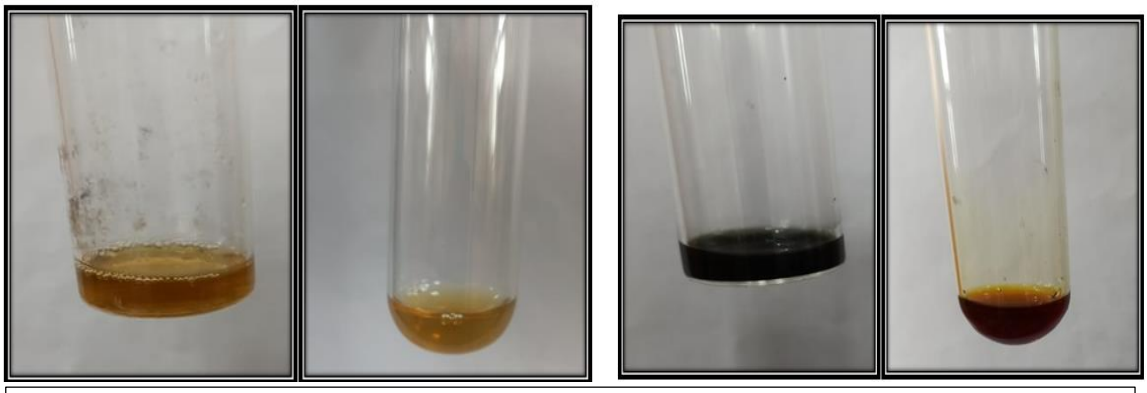


FIG: Picture showing the phenol result of the fresh leves of *Helianthus annus, Solanum lycopersium, ,Mangifera indica and Mentha piperita plants*

Solvent extraction of plant sample

Determination of the presence of steroids and phenol in these medicinal plants

1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then 10 ml of chloroform was added after this few drops of concentrated sulphuric acid was added carefully and allow to stand and formation of the red color ring at bottom is the indication of presence of steroids. 1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then few drops of 5% acidified ferric chloride solution was added carefully and leave for sometimes without any disturbance then formation of the black blue color indicate the presence of phenol.

Table – Illustrate the phytochemical analysis of steroids and phenol in the methanolic extraction selected flora.

S. No.	Name of the plants	Steroids	Inference	Phenol	Inference
01	*Mentha piperita*	+	Presence of red color at the lower layer	+	Presence of Bluish black color
02	*Mangifera indica*	+	Presence of red color at the lower layer	+	Presence of Bluish black color
03	*Solanum lycopersicum*	–	Absence of red color at the lower layer	+	Absence of Bluish black color
04	*Helianthus annuus*	+	Presence of red color at the lower layer	+	Presence of Bluish black color

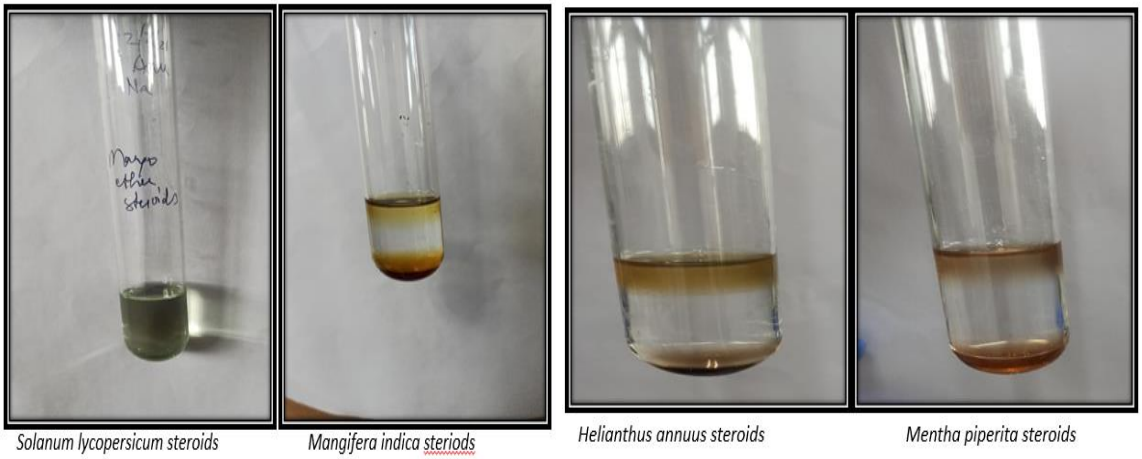


FIG: Picture showing the steriods result of the methanolic leves of *Solanum lycopersium, Mangifera indica, Helianthus annus and Mentha piperita plants*

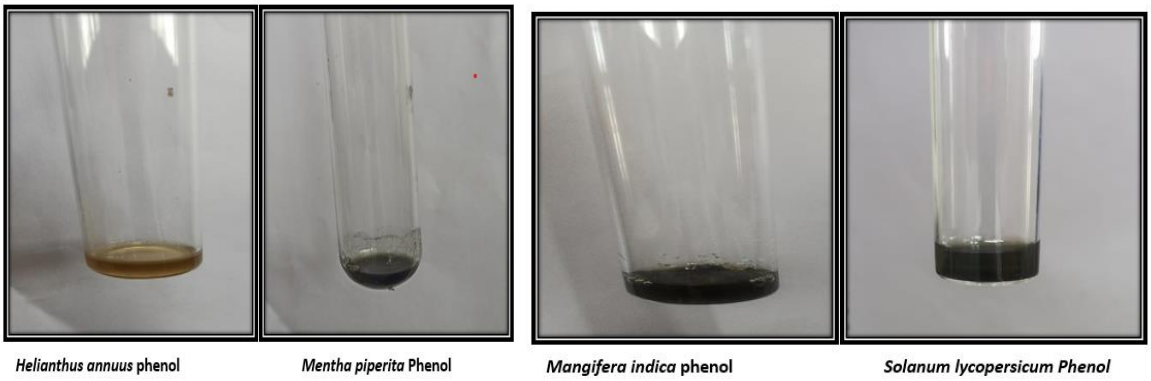


FIG: Picture showing the phenol result of the methanolic leves of, *Helianthus annus, Mentha piperita, Mangifera indica and, Solanum lycopersium plants*

Chloroform extraction of plant sample

Table – Illustrate the phytochemical analysis of steroids and phenol in the chloroform extraction selected flora.

Determination of the presence of steroids and phenol in these medicinal plants

1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then 10 ml of chloroform was added after this few drops of concentrated sulphuric acid was added carefully and allow to stand and formation of the red color ring at bottom is the indication of presence of steroids. 1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then few drops of 5% acidified ferric chloride solution was added carefully and leave for sometimes without any disturbance then formation of the black blue color indicate the presence of phenol.

S. No.	Name of the plants	Steroids	Inference	Phenol	Inference
01	*Mentha piperita*	+	Presence of red color at the lower layer	+	Presence of Bluish black color
02	*Mangifera indica*	+	Presence of red color at the lower layer	+	Presence of Bluish black color
03	*Solanum lycopersicum*	+	Absence of red color at the lower layer	+	Absence of Bluish black color
04	*Helianthus annuus*	+	Presence of red color at the lower layer	–	Absence of Bluish black color

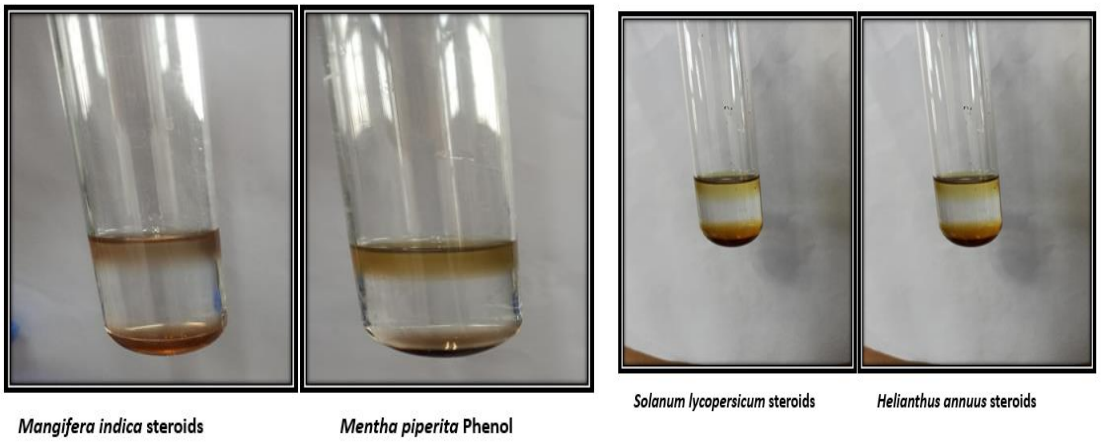


FIG: Picture showing the steriods result of the chloroform extraction leves of *Mangifera indica, Mentha piperita, and, Solanum lycopersium and Helianthus annus*

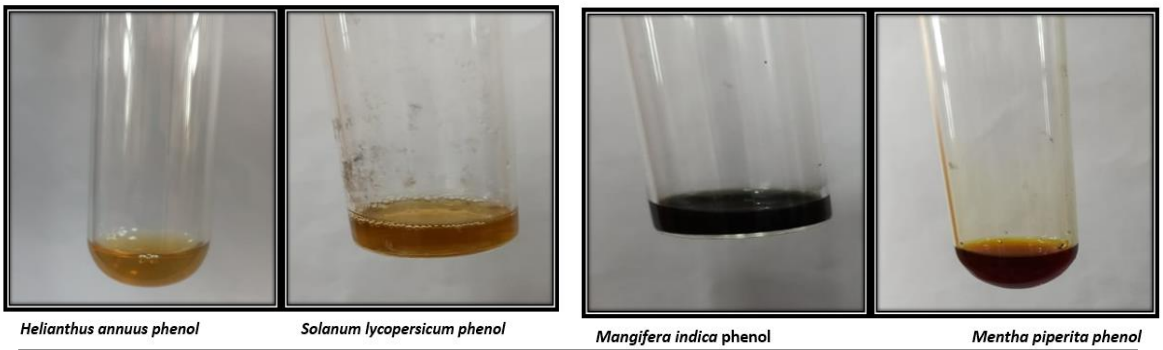


FIG: Picture showing the phenol result of the chloroform extraction leves of *Helianthus annus, Solanum lycopersium, Mangifera indica, Mentha piperita, and plants.*

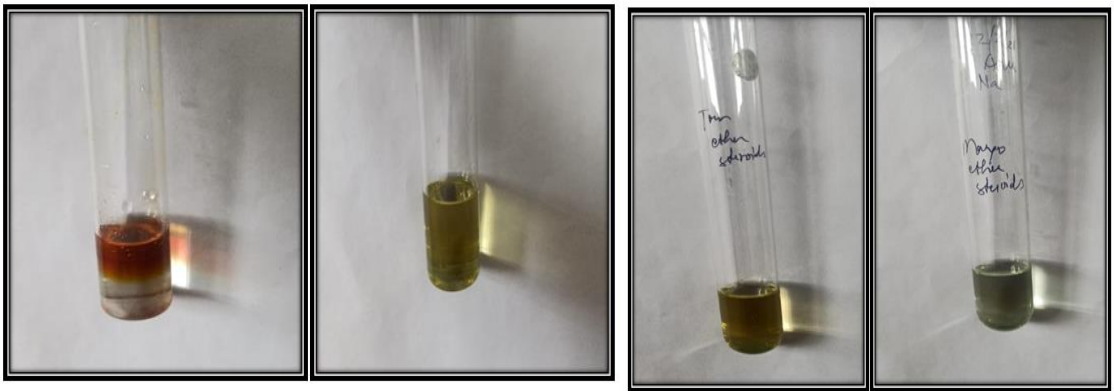
Petroleum ether extraction of plant sample

Determination of the presence of steroids and phenol in these medicinal plants

1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then 10 ml of chloroform was added after this few drops of concentrated sulphuric acid was added carefully and allow to stand and formation of the red color ring at bottom is the indication of presence of steroids. 1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then few drops of 5% acidified ferric chloride solution was added carefully and leave for sometimes without any disturbance then formation of the black blue color indicate the presence of phenol.

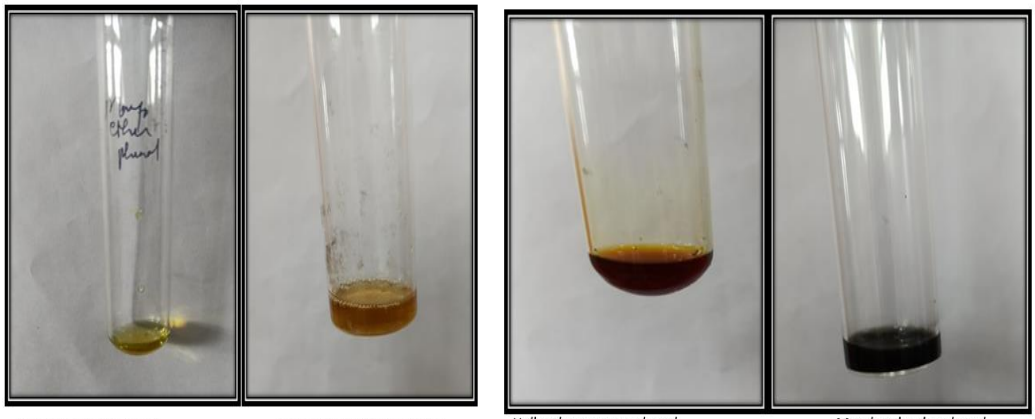
Table – Illustrate the phytochemical analysis of steroids and phenol in the petroleum ether extraction selected flora.

S. No.	Name of the plants	Steroids	Inference	Phenol	Inference
01	*Mentha piperita*	+	Presence of red color at the lower layer	-	Presence of Bluish black color
02	*Mangifera indica*	+	Presence of red color at the lower layer	-	Presence of Bluish black color
03	*Solanum lycopersicum*	–	Absence of red color at the lower layer	–	Absence of Bluish black color
04	*Helianthus annuus*	+	Presence of red color at the lower layer	+	Presence of Bluish black color



Mangifera indica steroids. *Mentha piperita steroids* *Helianthus annuus steroids.* *Solanum lycopersicum steroids.*

FIG: Picture showing the steriods result of the petrolium ether extraction leves of *Mangifera indica, Mentha piperita, Helianthus annus and Solanum lycopersium*



Mangifera indica phenol *Solanum lycopersicum phenol* *Helianthus annuus phenol* *Mentha piperita phenol*

FIG: Picture showing the phenol result of the petrolium ether extraction leves of *Mangifera indica, Solanum lycopersium, Helianthus annus and Mentha piperita*

Hexane extraction of plant samples

Table – Illustrate the phytochemical analysis of steroids and phenol in the hexane extraction selected flora.

Determination of the presence of steroids and phenol in these medicinal plants

1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then 10 ml of chloroform was added after this few drops of concentrated sulphuric acid was added carefully and allow to stand and formation of the red color ring at bottom is the indication of presence of steroids. 1ml of each plant extract was taken a test tube which is properly rinsed from distilled water then few drops of 5% acidified ferric chloride solution was added carefully and leave for sometimes without any disturbance then formation of the black blue color indicate the presence of phenol

S. No.	Name of the plants	Steroids	Inference	Phenol	Inference
01	*Mentha piperita*	+	Presence of red color at the lower layer	-	Presence of Bluish black color
02	*Mangifera indica*	+	Presence of red color at the lower layer	-	Presence of Bluish black color
03	*Solanum lycopersicum*	–	Absence of red color at the lower layer	–	Absence of Bluish black color
04	*Helianthus annuus*	–	Absence of red color at the lower layer	–	Presence of Bluish black color

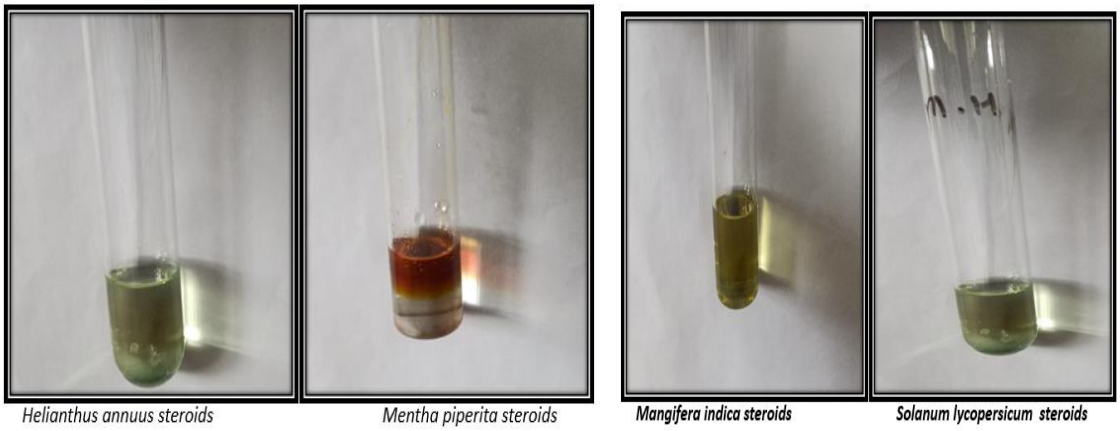


FIG: Picture showing the steriods result of the hexance extraction leves of *Helianthus annus, Mentha piperita, Mangifera indica, and Solanum lycopersium,*

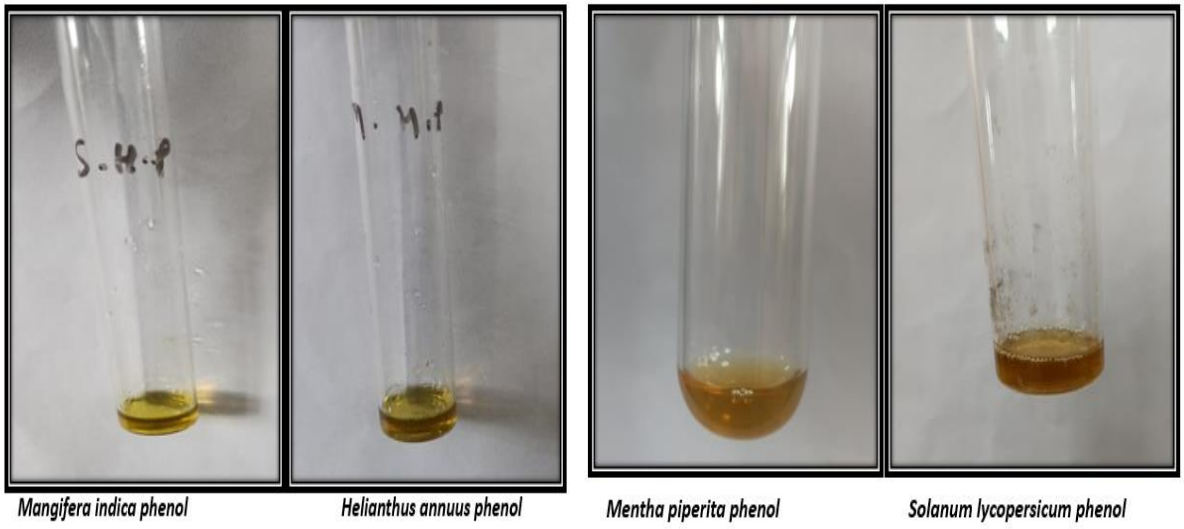


FIG - FIG: Picture showing the phenol result of the hexance extraction leves of *Mangifera indica, Helianthus annus, Mentha piperita, and Solanum lycopersium.*

Discussion

There is significant interest in plants as a source of new therapeutic agents and their bio-active components such as antioxidants, hypoglycemic and hypolipidemic properties. Traditionally, different potent natural herbs and plant-based components have been used to manage different diseases in India. Many of the currently available medicines are derived directly or indirectly from plants, which have invariably been exemplary sources of drugs. Antioxidants are probably the most well-known flavonoids. These enzymes alter the body's biochemical response to carcinogenic chemicals, viruses, and allergens. The characteristics of many plants are anti-cancer, anti-inflammatory, antibacterial, and anti-allergic, and could be useful therapeutically. A natural alkaloid is an organic compound that contains nitrogen. They are also physiologically active, as well as sedative and analgesic. A natural alkaloid is an organic compound that contains nitrogen. They are also physiologically active, as well as sedative and analgesic. Phenolic compounds, among the best-known secondary metabolites of plants, act as natural antioxidants In the present study, we performed the qualitative and quantitative phytochemical screening on the leaf extract of four different plants *Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus.*

The qualitative test for the phytochemical screening of steroids in Mentha piperita, Mangifera indica, Solanum lycopersicum, Helianthus annuus showed a positive result. The phenol was present in Mentha piperita and Solanum lycopersicum respectively.

The phytochemical screening revealed the presence of flavonoids in all four solvents hexane, chloroform and methanol, and petroleum ether insoluble fractions. Sterids wer e present in all of

the plant species except Solanum *lycopersicum* Helianthus annuus (in all four solvents hexane, chloroform, petroleum ether, and methanol) and Mentha piperita in hexane as the solvent.

The quantitative test for flavonoids in *Mangifera indica* is 16.8% and Mentha piperita is 8% respectively.

Conclusion

Bio-active compounds derived from the plants are effective and exhibit the minium side effects. The studies have beem done on the four medicinal plants *Mentha piperita, Mangifera indica, Solanum lycopersicum, and Helianthus annuus.* These plants's leaves have shown the presence of various phytochemical compounds. These phytochemicals exhibit their therapeutic effects on the several disease.

Reference

1. Petrovska, B. B. (2012). Historical review of medicinal plants' usage. Pharmacognosy reviews, 6(11), 1.
2. Gurib-Fakim, A. (2006). Medicinal plants: traditions of yesterday and drugs of tomorrow. *Molecular aspects of Medicine*, *27*(1), 1-93.
3. Farnsworth, N. R., Akerele, O., Bingel, A. S., Soejarto, D. D., & Guo, Z. (1985). Medicinal plants in therapy. *Bulletin of the world health organization*, *63*(6), 965.
4. Craig, W. J. (1997). Phytochemicals: guardians of our health. *Journal of the American Dietetic Association*, *97*(10), S199-S204.
5. Boyer, J., & Liu, R. H. (2004). Apple phytochemicals and their health benefits. *Nutrition journal*, *3*(1), 1-15.
6. King, A. M. Y., & Young, G. (1999). Characteristics and occurrence of phenolic phytochemicals. *Journal of the American Dietetic Association*, *99*(2), 213-218.
7. Winston, C., & Beck, L. (1999). Phytochemicals: health protective effects. *Canadian Journal of Dietetic Practice and Research*, *60*(2), 78.
8. Zhang, Y. J., Gan, R. Y., Li, S., Zhou, Y., Li, A. N., Xu, D. P., & Li, H. B. (2015). Antioxidant phytochemicals for the prevention and treatment of chronic diseases. *Molecules*, *20*(12), 21138-21156.
9. Chaudhary, P., Sharma, A., Singh, B., & Nagpal, A. K. (2018). Bioactivities of phytochemicals present in tomato. *Journal of food science and technology*, *55*(8), 2833-2849.
10. Rios, J. L., & Recio, M. C. (2005). Medicinal plants and antimicrobial activity. *Journal of ethnopharmacology*, *100*(1-2), 80-84.

11. Duke, J. A. (1985). Medicinal plants. *Science*, *229*(4718), 1036-1036.
12. Balunas, M. J., & Kinghorn, A. D. (2005). Drug discovery from medicinal plants. *Life sciences*, *78*(5), 431-441.
13. Kala, C. P., Dhyani, P. P., & Sajwan, B. S. (2006). Developing the medicinal plants sector in northern India: challenges and opportunities. *Journal of Ethnobiology and Ethnomedicine*, *2*(1), 1-15.
14. R Pereira, O., & M Cardoso, S. (2013). Overview on Mentha and Thymus polyphenols. *Current Analytical Chemistry*, *9*(3), 382-396.
15. Kunnumakkara, A. B., Chung, J. G., Koca, C., & Dey, S. (2009). Mint and its constituents. In *Molecular targets and therapeutic uses of spices: Modern uses for ancient medicine* (pp. 373-401).
16. Tzanetakis, I. E., Postman, J. D., & Martin, R. R. (2006). Mint virus X: a novel potexvirus associated with symptoms in 'Variegata'mint. *Archives of virology*, *151*(1), 143-153.
17. Lemjallad, L., Chabir, R., Kandri Rodi, Y., El Ghadraoui, L., Ouazzani Chahdi, F., & Errachidi, F. (2019). Improvement of heliciculture by three medicinal plants belonging to the Lamiaceae family. *The Scientific World Journal*, *2019*.
18. Mejdoub, K., Benomari, F. Z., Djabou, N., Dib, M. E. A., Benyelles, N. G., Costa, J., & Muselli, A. (2019). Antifungal and insecticidal activities of essential oils of four Mentha species. *Jundishapur J. Nat. Pharm. Prod*, *14*, e64165.
19. El Hassani, F. Z. (2020). Characterization, activities, and ethnobotanical uses of Mentha species in Morocco. *Heliyon*, *6*(11), e05480.

20. Kohari, Y., Yamashita, S., Chiou, T. Y., Shimotori, Y., Ohtsu, N., Nagata, Y., & Murata, M. (2020). Hydrodistillation by solvent-free microwave extraction of fresh Japanese peppermint (Mentha arvensis L.). *Journal of Essential Oil Bearing Plants*, *23*(1), 77-84.
21. Murray, M. J., & Reitsema, R. H. (1954). The genetic basis of the ketones, carvone, and menthone in Mentha crispa L. *Journal of the American Pharmaceutical Association (Scientific ed.)*, *43*(10), 612-613.
22. Hernandez, J. A., & Thimmaiah, A. (2018). Meta-analysis of 10 herbs of Iowa for traditional, homeopathic and modern medicinal uses. *Int J Complement Alt Med*, *11*(6), 326-32.
23. Rodriguez-Fragoso, L., Reyes-Esparza, J., Burchiel, S. W., Herrera-Ruiz, D., & Torres, E. (2008). Risks and benefits of commonly used herbal medicines in Mexico. *Toxicology and applied pharmacology*, *227*(1), 125-135.
24. Dog, T. L. (2006). A reason to season: the therapeutic benefits of spices and culinary herbs. *Explore: the journal of science and healing*, *2*(5), 446-449.
25. Mia, M., Roy, S., Das, S. K., & Rahman, M. (2020). Mango leaf disease recognition using neural network and support vector machine. *Iran Journal of Computer Science*, *3*(3), 185-193.
26. Galal, A. A., El-Bana, A. A., & Janse, J. (2006). Bacillus pumilus, a new pathogen on mango plants. *Egypt J Phytopathol*, *34*(1), 17-29.
27. Omar, N. H., Mohd, M., Nor, N. M. I. M., & Zakaria, L. (2018). Characterization and pathogenicity of Fusarium species associated with leaf spot of mango (Mangifera indica L.). *Microbial pathogenesis*, *114*, 362-368.

28. Omar, N. H., Mohd, M., Nor, N. M. I. M., & Zakaria, L. (2018). Characterization and pathogenicity of Fusarium species associated with leaf spot of mango (Mangifera indica L.). *Microbial pathogenesis*, *114*, 362-368.
29. Srunitha, K., & Bharathi, D. (2018). Mango leaf unhealthy region detection and classification. In *Computational Vision and Bio Inspired Computing* (pp. 422-436). Springer, Cham.
30. Omotioma, M., Ejikeme, P. C. N., & Mbah, G. O. (2014). Comparative analysis of the effects of cashew and mango extracts on the rheological properties of water based mud. *Journal of Engineering Research and Applications*, *4*, 56-6.
31. Nikam, R., & Sadavarte, M. (2015, March). Application of Image Processing Technique in Mango Leaves Disease Severity Measurement. In *National Conference on Emerging Trands in Computer, electrical and Electronics (ETCEE-2015), International Journal of Advance Engineering and Research Development (IJAERD)*.
32. Masibo, M., & He, Q. (2009). Mango bioactive compounds and related nutraceutical properties—a review. *Food Reviews International*, *25*(4), 346-370.
33. Ali, B. A., Alfa, A. A., Tijani, K. B., Idris, E. T., Unoyiza, U. S., & Junaidu, Y. (2020). Nutritional Health Benefits and Bioactive Compounds of Mangifera indica L (Mango) Leaves Methanolic Extracts. *Asian Plant Res. J*, *6*, 41-51.
34. Masibo, M., & He, Q. (2009). Mango bioactive compounds and related nutraceutical properties—a review. *Food Reviews International*, *25*(4), 346-370.
35. Gupta, S., Kumar, D., & Gaur, J. P. (2009). Kinetic and isotherm modeling of lead (II) sorption onto some waste plant materials. *Chemical Engineering Journal*, *148*(2-3), 226-233.

36. Saleem, M., Tanvir, M., Akhtar, M. F., Iqbal, M., & Saleem, A. (2019). Antidiabetic potential of Mangifera indica L. cv. Anwar Ratol leaves: medicinal application of food wastes. *Medicina*, *55*(7), 353.
37. Cassells, A. C., & Barlass, M. (1976). Environmentally induced changes in the cell walls of tomato leaves in relation to cell and protoplast release. *Physiologia Plantarum*, *37*(3), 239-246.
38. Islam, W. (2017). Management of plant virus diseases; farmer's knowledge and our suggestions. *Hosts and Viruses*, *4*(2), 28.
39. Prathusha, P., Murthy, K. E., & Srinivas, K. (2019, December). Plant Disease Detection Using Machine Learning Algorithms. In *International Conference On Computational And Bio Engineering* (pp. 213-220). Springer, Cham.
40. Kumar, C. P., & Sachin, J. (2013). Pharmacological action of plant alkaloids in female reproductive system of test animals and/or human beings: A review. *Int. J. Pharm. Sci. Rev. Res*, *23*(2), 98-107.
41. Li, H. L., Zhang, H., Yu, C., Ma, L., Wang, Y., Zhang, X. Z., & Han, Z. H. (2012). Possible roles of auxin and zeatin for initiating the dwarfing effect of M9 used as apple rootstock or interstock. *Acta physiologiae plantarum*, *34*(1), 235-244.
42. Thenmozhi, S., Lakshmi, R. J., Ibrahim, I., & Mohan, R. (2021). A Novel Plant Leaf Ailment Recognition Method using Image Processing Algorithms.
43. Chairman, K., Amuthan, M., Ramesh, S., Vasanthi, K., & Singh, A. R. (2013). Isolation and Identification of Bio-fertilizing Microorganisms from Soil Samples and Determination of Growth Condition in Chilly and Cluster Beans. *Medicinal Plant Research*, *3*.

44. Liu, J., Liu, X., Dai, L., & Wang, G. (2007). Recent progress in elucidating the structure, function and evolution of disease resistance genes in plants. *Journal of genetics and genomics*, *34*(9), 765-776.
45. Ishizawa, K., & Esashi, Y. (1988). Action mechanism of ethylene in the control of sugar translocation in relation to rice coleoptile growth I. sucrose metabolism. *Plant and cell physiology*, *29*(1), 131-141.
46. Bazzaz, F. A., Rolfe, G. L., & Carlson, R. W. (1974). Effect of Cd on photosynthesis and transpiration of excised leaves of corn and sunflower. *Physiologia Plantarum*, *32*(4), 373-376.
47. Boyer, J. (1970). Leaf enlargement and metabolic rates in corn, soybean, and sunflower at various leaf water potentials. *Plant physiology*, *46*(2), 233-235.
48. Panche, A. N., Diwan, A. D., & Chandra, S. R. (2016). Flavonoids: an overview. *Journal of nutritional science*, *5*.
49. Rengasamy, K. R., Khan, H., Gowrishankar, S., Lagoa, R. J., Mahomoodally, F. M., Khan, Z., ... & Pandian, S. K. (2019). The role of flavonoids in autoimmune diseases: Therapeutic updates. *Pharmacology & therapeutics*, *194*, 107-131.
50. Karak, P. (2019). Biological activities of flavonoids: an overview. *Int. J. Pharm. Sci. Res*, *10*(4), 1567-1574.
51. Suzuki, T., & Hara, H. (2011). Role of flavonoids in intestinal tight junction regulation. *The Journal of nutritional biochemistry*, *22*(5), 401-408.
52. Ciumărnean, L., Milaciu, M. V., Runcan, O., Vesa, Ș. C., Răchișan, A. L., Negrean, V., ... & Dogaru, G. (2020). The effects of flavonoids in cardiovascular diseases. *Molecules*, *25*(18), 4320.

53. Uddin, M., Kabir, M., Niaz, K., Jeandet, P., Clément, C., Mathew, B., ... & Aleya, L. (2020). Molecular insight into the therapeutic promise of flavonoids against Alzheimer's disease. *Molecules*, *25*(6), 1267.

54. Gross, M. (2004). Flavonoids and cardiovascular disease. *Pharmaceutical biology*, *42*(sup1), 21-35.

55. Patel, S. S., & Savjani, J. K. (2015). Systematic review of plant steroids as potential antiinflammatory agents: Current status and future perspectives. *The journal of phytopharmacology*, *4*(2), 121-125.

56. V Simoben, C., Ibezim, A., Ntie-Kang, F., N Nwodo, J., & L Lifongo, L. (2015). Exploring cancer therapeutics with natural products from African medicinal plants, part I: xanthones, quinones, steroids, coumarins, phenolics and other classes of compounds. *Anti-Cancer Agents in Medicinal Chemistry (Formerly Current Medicinal Chemistry-Anti-Cancer Agents)*, *15*(9), 1092-1111.

57. Lemilemu, F., Girmay, S., Shenkute, K., & Endale, M. (2020). Antibacterial steroids from roots of Bersama abyssinica. *Ethiopian Journal of Sciences and Sustainable Development*, *7*(1), 27-34.

58. Soares, M. B. P., Brustolim, D., Santos, L. A., Bellintani, M. C., Paiva, F. P., Ribeiro, Y. M., ... & Dos Santos, R. R. (2006). Physalins B, F and G, seco-steroids purified from Physalis angulata L., inhibit lymphocyte function and allogeneic transplant rejection. *International Immunopharmacology*, *6*(3), 408-414.

59. Roy, A. (2017). A review on the alkaloids an important therapeutic compound from plants. *IJPB*, *3*(2), 1-9.

60. Ain, Q. U., Khan, H., Mubarak, M. S., & Pervaiz, A. (2016). Plant alkaloids as antiplatelet agent: drugs of the future in the light of recent developments. *Frontiers in Pharmacology*, *7*, 292.
61. Matern, U., & Kneusel, R. E. (1988). Phenolic compounds in plant disease resistance. *Phytoparasitica*, *16*, 153-170.
62. Asif, M. (2015). Chemistry and antioxidant activity of plants containing some phenolic compounds. *Chemistry international*, *1*(1), 35-52.
63. Sumbul, S., Ahmad, M. A., Mohd, A., & Mohd, A. (2011). Role of phenolic compounds in peptic ulcer: An overview. *Journal of pharmacy and bioallied sciences*, *3*(3), 361.
64. Dimitrios, B. (2006). Sources of natural phenolic antioxidants. *Trends in food science & technology*, *17*(9), 505-512.

Estimation of steroids and phenol phytochemicals in the common plants.

A DISSERTATION

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE AWARD OF THE DEGREE

OF

Master of Science

In

Biotechnology

Submitted by:

Km. Sakshi

2K10/MSCBIO/09

Under the supervision of:

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CANDIDATE'S DECLARATION

I Km Sakshi, Roll Number: 2K20/MSCBIO/09, student of M.Sc. Biotechnology, herebydeclare that the work which is presented in the Major Project entitled 'Estimation of steroids and phenol phytochemicals in the common plants' in the fulfillment of the requirement for the award of the degree of Master of Science in Biotechnology and submitted to the Department of Biotechnology, Delhi Technological University, Delhi, is an authentic record of my own carried out during the period from February - May 2022, under the supervision of Dr. Navneeta Bharadvaja.

The matter presented in this report has not been submitted by me for the award for any other degree of this or any other Institute/University. The work has been accepted in SCI/SCI expanded /SSCI/Scopus Indexed Journal OR peer-reviewed Scopus Index Conference with the following details:

Km. Sakshi

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Author Names: Km. Sakshi, Nidhi Solanki, and Navneeta Bharadvaja

Name of Conference: ASIAN SOCIETY FOR ACADEMIC RESEARCH International Conference on Nutrition and Health science by Asian society academic research.

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CERTIFICATE

I hereby certify that the project dissertation titled "Estimation of steroids and phenol phytochemicals in the common plants" which is submitted by km sakshi, Roll number 2k20/MSCBIO/09, Department of Biotechnology, Delhi Technological University, Delhi in partial fulfillment of the requirement for the award of the degree of Master of Science, is a record of the project work carried out by the student under my supervision. To the best of my knowledge this work has not been submitted in part or full for any degree or diploma to this university or elsewhere.

Place: Delhi

Date: 6 May, 2022

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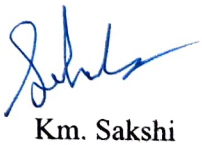

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