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Pharmacognostic Study and Phytochemical Investigation of *Lycopersicon esculentum* (Tomato) Flower Extracts.

Mohammed Rafiqkhan[1]*, Ranjini K[1], Godan T K[1], Srinivasapuram Natarajan Suresh[1], Uma Devi Pongiya[2] and Yalaga Rama Rao[2].

[1]Department of Biotechnology, Sree Narayana Guru College, K G Chavadi, Coimbatore-105, Tamil Nadu.
[2]Department of Biology, School of Natural Science, Madawalabu University, Ethiopia.

ABSTRACT

Plant based medicines have been a part of traditional healthcare in most parts of the world for thousands of years. Many medicinal plants are used daily in Ayurvedic practices. In India more than 7,000 medicinal plant species are known. The medicinal plants find application in pharmaceutical, cosmetic, agricultural and food industry. Starting from the ancient time, medicinal plants have been used to prevent and treat various health problems. There is an increasing demand for the herbal drug treatment of various ailments and many plant drugs from ayurvedic system are being explored globally. Tomato (*Lycopersicon esculentum* L.) is one of the most widely consumed vegetable, and is known for various medicinal properties in traditional medicinal system and use to cure a variety of diseases. In last few decades, *Lycopersicon esculentum* is extensively studied for its medicinal properties by advanced scientific techniques and a variety of bioactive compounds have been isolated from the different parts of the plant and were analysed pharmacologically. In our present investigation phytochemical analysis of flowers of *Lycopersicon esculentum* has been evaluated for the presence of bioactive compounds using various polarity solvents including hexane, chloroform, methanol and water. The study revealed the presence of alkaloids, flavonoids, terpenoids, phenolic compounds, sterols, carbohydrates, glycosides and tannins. The results suggest that methanolic extract of *Lycopersicon esculentum* flower has promising therapeutic potential, its pharmacological properties which if properly harness can be used in the management of various diseases and can serve as a base for the development of novel potent drug.

Keywords: Tomato, *Lycopersicon esculentum*, phytochemical analysis, bioactive compounds

Corresponding author

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INTRODUCTION

From time immemorial, man depended on plants as medicine. From a historical perspective, it is evident that the fascination for plants is as old as mankind itself. The plant kingdom represent a rich store house of organic compounds, many of which have been used for medicinal purposes and could serve as lead for the development of novel agents having good efficacy in various pathological disorders in the coming years. Plants are still an independent source of medication in the contemporary health care delivery system. Their role is twofold in the development of medicines and served as a natural blue print for the development of new drugs, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceutical intermediates and chemical entities for synthetic drugs [1]. An impressive number of modern drugs have been isolated or derived from natural sources, based on their use in traditional medicine [2]. According to World Health Organization medicinal plants would be the best source to obtain a variety of drugs [3]. Recently much attention has directed towards extracts and biologically active compounds isolated from popular plant species. In the present era of drug development and discovery of newer drug molecules, many plant products are evaluated on the basis of their traditional uses [4].

Tomato (*Lycopersicon esculentum* L.) is one of the most widely consumed vegetables, being the second most important vegetable crop worldwide. It is a key component in the so-called "Mediterranean diet", which is strongly associated with a reduced risk of chronic degenerative diseases [5]. Tomato is a major source of antioxidants contributing to the daily intake of a significant amount of these molecules. It is consumed fresh or as processed products such as canned tomato, sauce, juice ketchup, stews and soup [6]. In fact, epidemiological studies have shown that consumption of raw tomato and its tomato based products is associated with a reduced risk of cancer and cardiovascular diseases [7].

Tomato antioxidants include carotenoids such as β-carotene, a precursor of vitamin A, and mainly lycopene, which is largely responsible for the red color of the fruit, vitamins such as ascorbic acid and tocopherols, and phenolic compounds such as flavonoids and hydroxycinnamic acid derivatives [8-11]. These compounds may play an important role inhibiting reactive oxygen species responsible for many important diseases, through free-radical scavenging, metal chelation, inhibition of cellular proliferation, and modulation of enzymatic activity and signal transduction pathways [12].

Phytochemicals are natural and non-nutritive bioactive compounds produced by plants that act as protective agents against external stress and pathogenic attack [13]. Plants are rich in a wide variety of secondary metabolites (phytochemicals), such as tannins, terpenoids, alkaloids, and flavonoids, which have been found *in vitro* to have antimicrobial properties. In many cases, these substances serve as plant defense mechanisms against predation by microorganisms, insects, and herbivores. Some, such as terpenoids, give plants their odors; others (quinones and tannins) are responsible for plant pigment. Therefore, basic phytochemical investigation of plant extracts for their phytoconstituents were also vital. Based on their biosynthetic origin, phytochemicals can be divided into several categories: phenolics, alkaloids, steroids, terpenes, saponins, etc. Phytochemicals could also exhibit other bioactivities such as antimutagenic, anticarcinogenic, antioxidant,

antimicrobial, and anti-inflammatory properties [14]. To promote the proper use of herbal medicine and to determine their potential as sources of new drugs, it is essential to study the medicinal plants which have folklore reputation in a more intensified way. In response to the mounting importance of phytochemicals, the present study was carried out in order to reveal the bioactive compounds present in the flowers of *Lycopersicon esculentum* L.

MATERIALS AND METHODS

Collection and identification of plant material

The specimen was collected from Coimbatore and authenticated by Botanical Survey of India, Coimbatore, India. The flowers of *Lycopersicon esculentum* were washed thoroughly 2-3 times with running tap water and once with sterile distilled water, air dried at room temperature on a sterile blotter. After complete drying, young leaves were powdered well using a mixer. Then the powdered material was weighed and kept in air tight container and stored in a refrigerator for future use. About 10g of this powdered sample was refluxed with hexane, chloroform, methanol and water in the ratio of 1:10 (w/v). The crude extracts were collected in amber coloured sample bottles and stored. All chemicals and reagents used including the solvents were of analytical grade.

Pharmacognostic Profile

Extractive values

Extract of the powdered leaves were prepared with different solvents for the study of extractive values.

Fluorescence Analysis

A small quantity of dried and finely powdered material was placed in a clean grease-free microscopic slide, treated with 1-2 drops of the freshly prepared reagent solution, mixed gently by tilting the slide and waited for 2-4 minutes. The slide was then viewed day light and ultraviolet radiations (365 nm). The colours observed on application of different reagents in different radiations were recorded.

Phytochemical Analysis

Chemical analysis was carried out in the hexane, chloroform, methanolic and water extracts of the flowers of *Lycopersicon esculentum* using standard procedures to identify constituents, as described by Harborne, Trease and Evans, and Sofowara [15-17].

Test for alkaloids

Dragendroff's test

To 5 mL of the extract few drops of Dragendroff's reagent was added for the formation of orange coloured precipitate.

Mayer's test

To 5 mL of the extract few drops of Mayer's reagent was added for the formation of cream coloured precipitate.

Wagner's test

To 5 mL of the extract few drops of Wagner's reagent was added for the formation of reddish brown coloured precipitate.

Hager's test

To 3 mL of the extract few drops of Hager's reagent was added for the formation of prominent yellow precipitate.

Test for flavonoids

To 3 mL of the extract few magnesium ribbons are dipped and conc. HCl was added over them and observed for the formation of magenta (brick red) colour indicating the presence of flavonoids.

Test for proteins

Biuret test

To 3 mL of the extract few drops of 10% sodium chloride and 1% copper sulphate was added for the formation of violet or purple color. On addition of alkali, it becomes dark violet.

Millon's test

To 3 mL of the extract few drops of Millon's reagent was added for the formation of red colour.

Test for carbohydrates

Molisch's test

To a small amount of the extract few drops of Molisch's reagent was added followed by the addition of conc. H_2SO_4 along the sides of the test tube. The mixture was then allowed to stand for 2 min and then diluted with 5 mL of distilled water. Formation of red or dull violet colour at the inter phase of two layers indicates the presence of carbohydrates.

Fehling's test

The extract was treated with 5 ml of Fehling's solution (A and B) and kept in boiling water bath. The formation of yellow or red color precipitate indicates the presence of reducing sugar.

Test for tannins

A fraction of the extract was dissolved in water and then it was subjected to water bath at 37°C for 1 hour and treated with ferric chloride solution and observed for the formation of dark green colour.

Test for sterols

Liebermann-Burchard test

To a small amount of the extract few drops of chloroform, acetic anhydride and H_2SO_4 was added along the sides of the test tube to observe the formation of dark red or pink colour.

Test for glycosides

Baljet's Test

To 5 mL of the extract few drops of sodium picrate was added to observe yellow to orange colour.

Keller-Killiani test

To 5 mL of the extract few drops of ferric chloride solution was added and mixed, then sulphuric acid containing ferric chloride solution was added, it forms two layer showed reddish brown while upper layer turns bluish green indicates the presence of glycosides.

Test for phenols

Ferric chloride test

A fraction of the extract was treated with 5% ferric chloride solution and observed for the formation of deep blue or black colour.

Test for saponins

Foam test

To a small amount of the extract few drops of distilled water was added and shaken vigorously until persistent foam was observed.

Test for terpenoids

Chloroform test

To 5 mL of the extract few drops of chloroform and conc. H_2SO_4 was added carefully along the sides of the test tube to form a layer and observed for the presence of reddish brown colour.

RESULTS AND DISCUSSION

Extractive values

Extractive values of the successive extracts of flowers of *Lycopersicon esculentum* are given in Table 1.

Table 1: Percentage of successive extracts of *Lycopersicon esculentum* flowers

Solvents	Extract values (% w/w)
Hexane	6.04
Chloroform	8.27
Methanol	12.85
Water	10.93

Fluorescence analysis

The powdered sample of *Lycopersicon esculentum* flowers was subjected to fluorescence analysis, results are tabulated in Table 2.

Table 2: Fluorescence analysis of *Lycopersicon esculentum* flowers

Plant sample	Day light	UV light (365nm)
Powder	Green	Dark green
Powder+ NaOH	Dark green	Light green
Powder+Acetone	Pale green	Yellowish green
Powder+HCl	Light green	Dark Green
Powder+HNO_3	Light green	Yellowish green
Powder+Acetic acid	Brown	Greenish brown
Powder+$CHCl_3$	Yellowish green	Pale green

Phytochemical Analysis

Powdered *Lycopersicon esculentum* flowers were subjected to various qualitative tests for the identification of phytochemical constituents includes tests for alkaloids (Dragendroff's test, Mayer's test, Hager's test, Wagner's test), saponins, glycosides (Baljet's test, Kellar-Killiani test), carbohydrates (Molisch's test, Fehling's test), proteins (Biuret test, Xanthoprotein test, Millon's test), tests for tannins, flavonoids, steroids (Liebermann-burchard test), phenols, terpenoids were performed using specific reagents and results are tabulated in Table 3.

Phytochemical screening results of the powdered sample of *Lycopersicon esculentum* flowers extracted in water and methanol showed the presence of all the constituents whereas the hexane and chloroform extracts showed the presence of very few bioactive compounds. Chemical investigation on the different parts of the plant has resulted in the isolation of a large number of novel and interesting metabolites [18].

Table 3: Phytochemical screening of *Lycopersicon esculentum* flowers in various extracts

Phytochemicals	Hexane	Chloroform	Methanol	Aqueous
Alkaloids	+	-	+	+
Flavonoids	-	+	+	+
Proteins	-	-	+	+
Carbohydrates	-	+	+	+
Tannins	+	-	+	-
Sterols	-	+	-	+
Glycosides	+	-	+	-
Phenols	-	+	+	+
Saponins	-	+	+	+
Terpenoids	-	-	+	-

'+' present, '-'absent

Increasing evidence suggests that a single serving of tomatoes or tomato products ingested daily may contribute to protect from DNA damage. As DNA damage seems to be involved in the pathogenesis of prostate cancer, the regular ingestion of tomatoes or tomato products might prevent the disease [19]. Numerous phytonutrients in tomatoes have been shown to help prevent excessive clumping of our platelet cells. This ability is usually referred to as an anti-aggregatory effect [20]. Presence of flavonoid, a class of phenolic compounds is present in *Lycopersicon esculentum* shows anti inflammatory activity. Presence of cardiac glycosides has been scientifically proved to have some anti-inflammatory effects on conjunctivitis [21].

CONCLUSION

Plants which have been selected for medical use over thousands of years constitute the most obvious choice for examining the current search for therapeutically effective new drugs such as anticancer drugs, antimicrobial, antioxidant and anti-hepato toxicity compounds. About 80% of individuals from developed countries use traditional medicine, which has compounds derived from medicinal plants. Therefore, such plants should be investigated to better understand their properties, safety and efficiency. In our prospective study, the methanolic extract of the flowers of *Lycopersicon esculentum* has revealed the presence of alkaloids, flavonoids, glycosides, phenols, Terpenoids, tannins and carbohydrates. The use of traditional medicine is widespread and plants still present a large source of novel active biological compounds with different activities, including anti-inflammatory and cardioprotective activities. Researchers are increasingly turning their attention to folk medicine, looking for new leads to develop better drugs. The current drugs in the market have several side effects and an effective means to sustain is still a challenge. Several studies have to be conducted with new or modified versions of existing drugs. Hence, the present study confirms the credible of the plant rich source of therapeutic value. Extensive study will provide a good source of medicinally important drugs in future.

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