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RESEARCH ARTICLE

ASSESSMENT OF NUTRITIONAL VALUE AND PHARMACOLOGICAL IMPORTANCE OF PEEL EXTRACT OF SELECTED SPECIES BELONG TO CITRACEAE FAMILY GROWN IN ASSAM, INDIA

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ABSTRACT

Medicinal plants are believed to be used as first aid to treat people as primary medicine for several thousands of years. Among most of the people some plant species play an important role for their daily needs such as food, clothing, shelter and also economically. These plants have various bioactive compounds which exhibit diverse pharmacological activities and traditional medicines that effectively cure our primary health problems. Species of Citraceae family are commonly found in Assam. People largely used for the preparation of juice both locally and in industry level. Besides use as juice these are also use for other purposes. Various parts like leaf, root etc are frequently used as well as the fruit. They use different parts against leprosy, asthma, cough, mental aberration, epilepsy, constipation, colds, coughs, sore throats etc. Nowadays, fruit or vegetable peel or waste materials also used in various purposes as like other parts of the plants. This study also highlights the importance of waste material of *Citrus aurantifolia* fruit. Therefore, benefits of peels and the phytocomposition is important to study broadly. Present study is designed to analyze the phytochemicals and increase the value of peel part economically or as health benefit.

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INTRODUCTION

In spite of great progresses of scientific medicine, traditionally use medicine is still the primary treating diseases of majority of people in different countries including India, Maheswari S (2000). Medicinal plants are the Nature's gift to human beings to help them pursue a disease-free healthy life. Man relies on plants for their basis needs of food clothing and shelter, Cragg GM *et al*., (2013). As the people becoming aware of synthetic drugs, they pay attention from synthetic drugs to natural products of plants origin, Cragg GM *et al*., (2013). Because these type of medicine have been used since years in medical practices. Citrus plants belong to the Rutaceae family and genus *Citrus*. Majority of *Citrus* are found in Southeast Asian countries like Bangladesh, India, and China. The peels and seeds of these *Citrus* are highly rich in phenolic and flavonoid compounds, Alam M A *et al*., (2014). Species of citrus contain several other nutritional and nutraceutical coumpounds which are necessary for proper functioning of the body but some confer additional protection against chronic disease over and basic nutrition, Al-Snafi AE (2016). Based on these, the present study is mainly tested to highlight the nutritional value and pharmacological importance of peel of *Citrus aurantifolia*.

MATERIALS

Plant material*:* For this study a fresh fruit sample of *Citrus aurantifolia* was collected from the local market of kamrup district, Assam, India. Collected fruit was cleaned up thoroughly with normal water to remove the unwanted materials. The peel part was allowed to dry at room temperature for 20-25 days. After that dried peel was grinded individually using mixer grinder to make fine powder and ready for extract preparation (Photo Plate 1).

Photo plate 1. Photo of selected fruit peel

Extract preparation: Extraction is the first and commonly uses method to separate desired natural products or secondary metabolites that show active in treating various health related problems by using some selective solvents through standard procedures. The main purpose of the extraction is to separate different kinds of plant metabolites that present in soluble state, leaving behind the insoluble cellular residue. The dried fruit peel was extracted by hexane through maceration process. The solvents were filtered out using Whatmann No.1 filter paper. The crude extracts were then dried out using rotary evaporator.

METHODOLOGY

Qualitative analysis

Test for Alkaloid

Mayer's Test: 1 ml of extracts was put in a test tube followed by adding few drops of Mayer's reagent. Precipitation of Yellow colour indicated the presence of alkaloids.

Test for Glycoside: To 1 ml of filtered extracts 50 µl of glacial acetic acid followed by adding 100 µl of ferric chloride solution and 100 µl of concentrated H_2SO_4 was added. Appearance of brown colour indicated the presence of glycosides.

Test for Terpenoid: 1ml of extracts was taken in a test tube followed by adding 100 µl of chloroform and few drops of sulphuric acid. Appearance of radish brown color indicated the presence of terpenoids.

Test for Flavonoid: Poured 1 ml of extracts in a test tube with adding dilute ammonia solution and concentrated sulphuric acid. Appearance of yellow color indicated presence of flavonoids.

Test for Phenolic compounds: Poured 2ml of stock solution in a test tube, few ml of neutral 5% FeCl3 solution added to it. Appearance of dark green color indicated the presence of phenolic compounds.

Test for Carbohydrate: Few ml of extracts were hydrolyzed with HCL and then heated with Fehling's solution 'A' and 'B. Appearance of red precipitate indicated the presence of carbohydrate.

Test for Tannin: The extract was taken in a test tube, 0.1% of ferric chloride was added to that solution. Appearance of brownish green color indicated the presence of tannin.

Test for Saponin: 2ml of extract was taken in a test tube and was shaken vigorously for 10 min. A layer of foam was obtained on the top of the test tube. It indicated the presence of saponin.

Test for Phlobatannin: 2ml of 1% HCL was added to the extracts and allowed to boil. Red precipitation indicated the presence of Phlobatannin.

Test for Anthraquinone: 2ml of stock solution was taken in a test tube and was shaken by adding 3ml of benzene and then it was filtered. After that 2ml of 10% ammonia solution was added to the filtrate and the mixture was shaken well. Formation of violet color indicated the presence of anthraquinone.

Test for Amino acid: 2ml of stock solution was taken in a test tube, few drops of ninhydrin solution was added to it and allowed to heat. Appearance of violet color indicated the presence of amino acid.

Nutritional Analysis

Estimation of Ascorbic acid (Vitamin C): For vitamin C determination, Ayekyaw method is applied where ascorbic acid is used as standard for making a standard calibration curve, Ayekyaw (1978). Briefly, to 2ml of each sample, an equal volume of phosphotungstic acid was added and left to react for 15 minutes. The mixture was centrifuged at 3000 rpm for 10 minutes to collect the aliquot. Absorbance was measured at 700 nm.

Estimation of Carbohydrate Content: Poured 0.5 ml of in a test tube, to which 4 ml of anthrone reagent and 0.5 ml of water were added. Sample was kept for 30 minutes at normal room temperature. A standard curvature was prepared using the solution of D-glucose. Absorbance was recorded at 630 nm and concentration was determined.

Estimation of Protein Contents: Estimation of total protein presents were determined by using Protein Kit manufactured by Coral Clinical Systems. To 0.02 ml of sample, 1ml of biuret reagent was added into it and mixed well to make a reaction. After storing for 30 mins at normal room temperature, absorbance was measured at 550 nm. The standard curve was prepared using different concentration of protein.

Nutraceutical Analysis

Estimation of Phenol Content: To 0.1 ml of sample was taken in a test tube and added 1 ml of folin-ciocalteu reagent solution. To this, 0.8 ml of 1 M sodium carbonate was added and reacted for 15 minutes. A standard curve was prepared using different concentrations of gallic acid in ethanol. Absorbance was measured at 765 nm, taking 0.005 gm of Gallic acid in 20 ml of ethanol. Gallic acid equivalent phenol content was thereby determined, Mallick and Singh 1980).

Estimation of Flavonoid: Poured 1 ml of extract in a test tube and added 0.5ml of 10% aluminium chloride before incubating for 5 minutes. To this, 0.05 ml of 1M potassium acetate was added and kept for 6 minutes. Then, 1.4 ml of distilled water was poured into it. After storing for 30 minutes at room temperature, absorbance was measured at 415 nm against quercetin as a standard solution. A calibration curve was prepared using different concentrations of quercetin solution and flavonoid content was determined.

RESULTS

The crude drugs of *Citrus aurantifolia* peel powder were extracted using the maceration process. The present study carried out on the crude extract revealed the possession of medicinal activities as well as nutritional, nutraceutical and phytochemical analysis. A considerable amount of Terpenoids, Cardiac glycosides, Flavonoids, Tannins and Anthraquinons were found in hexane extract of the plant. *Citrus aurantifolia* is rich in phenol of about (1.09±0.41 mg/dl) and flavonoids of about (0.78±0.61 mg/ml). Flavonoids are known as natural biological modifiers that present Nutritionally, *Citrus aurantifolia* is found more significant having more amounts of carbohydrate and vitamin C (0.02±0.12 mg/dl; 0.10±0.02 mg/dl). The test for saponin, phlobatannin, carbohydrate, alkaloid, phenolic compound, amino acid has shown weak positive result.

Table 1. Showing Results of qualitative test to see naturally occurring medicinal organic compounds

Components	*Citrus aurantifolia*
Tannins	+
Saponins	−
Terpenoids	+
Cardiac glycosides	+
Flavonoids	+
Phlobatannins	−
Carbohydrate	−
Alkaloids	−
Phenolic compound	−
Anthraquinons	+
Amino acid	−

Table 2. Nutritional value analysis

Properties	*Citrus aurantifolia*
Carbohydrate(mg/dl)	0.02±0.12
Vitamin C(mg/dl)	0.10±0.02
Protein(gm/dl)	0.03±0.01

Table 3. Nutraceutical composition

Properties	*Citrus aurantifolia*
Phenol(mg/dl)	1.09±0.41
Flavonoid(mg/ml)	0.78±0.61

DISCUSSION

Plants have received significant focus due to their bioactive substances like antioxidant, hypoglycemic, hypolipidemic factors. They have exemplary source of drugs and a number of drugs happen to be derived from directly or indirectly from them, Madhu *et al.,* (2016). Therefore, characterization and determination of phytochemical components of the selected fruit peels studied showed that the peels were rich in flavonoids, cardiac glycoside, tannin, terpenoids, saponin, carbohydrate, phenolic compound. These compounds are isolated from fruit peels extract which are prepared from selected fruits (*Trichosanthes dioica, Trichosanthes cucumerina, Solanum ovigerum, Musa splendida*) using different solvents. Solvents are hexane, acetone, ethyl acetate, and methanol. Flavonoids are most commonly known coumpounds among others for its antioxidant nature. Flavonoids are major compounds that present in edible plants as glycosides and several phenolic hydroxyl groups make the compound in ring shaped structures. Due to the presence of these groups flavonoids are strong antioxidants and capable of effectively scavenging the reactive oxygen species, Garg *et al.,* (2019). Saponin helps in reducing blood cholesterol by preventing its reabsorption that makes useful in cardiovascular diseases, Ajiboye *et al.,* (2013). Carbohydrates are widely dominantin the plant kingdom. Therefore presence of carbohydrate is not appreciated when any plant is considered for therapeutics, Ajiboye *et al.,* (2013). Phenolic compounds are most widespread molecules which act as natural antioxidants, Madhu *et al.,* (2016). Phenolic compounds present in plants are popularly known to act as antioxidants because they are stable radical intermediates that prevent various food ingredients from oxidation, Madhu *et al.,* (2016). Terpenoids are one of the most important chemical compounds and have been reported in redction of oxidative stress, induction of apoptosis, and regulation of cell cycle. Cardiac glycosides are the compounds help in treating heart failure, cardiac arrhythmia.

CONCLUSION

Fruit and vegetable waste recycle method is one of the most important means of utilizing it in a number of innovative ways yielding new products. The phytocompositions and other chemical constituents of medicinal plants account for their medicinal value. The phytochemical evaluation can be used for further assessment of secondary metabolites. The preliminary qualitative tests are helpful in finding chemical constituents in the plant material that may lead to their quantitative estimation and also in locating the source of pharmacologically active chemical compound. The selected plants have been traditionally used in the management of several diseases and have the prospects of being developed into useful drugs. Subsequent the traditional and folk claims, very little efforts have been made by the researchers to discover the therapeutic, nutritional potential of Citraceae.

Species of *Citraceae* can be regarded as a promising nutraceutical due to their safety and effective nature against various diseases. From this study, one can evaluate in scientific manner by further experiments, clinical trials and animal models to understand their exact molecular mechanism.

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