

Investigation on Some of the Chemical Constituents and Antioxidant Activity of *Physalis minima* L. (Wild Gooseberry)

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Abstract

In the presence of research paper, the sample selected for the study is the fruit of *Physalis minima* L. (Wild gooseberry) which was collected from the campus of Yadanabon University, Amarapura Township, Mandalay Region. The study was conducted to determine the phytochemicals, nutrients, vitamin C, and radical scavenging activity. In the chemical analysis of *Physalis minima* L., the contents of moisture, ash, protein and crude fiber were determined by AOAC method. The contents of carbohydrate and vitamin C were measured by applying spectrophotometric method. Some mineral contents were evaluated by EDXRF method. In addition, the antioxidant activity was investigated from the ethanol extract of the fruit sample based on the ability to scavenge (DPPH) stable free radical.

Key words: *Physalis minima* L., nutrient, vitamin C, antioxidant activity

Introduction

Plants are the source of herbal medicine and medicinal value of the plants lies in the bioactive phytochemical constituents that produce definite physiological effects on human body. In recent years, multiple-drug resistance of pathogenic microorganisms has developed because of indiscriminate use of available antimicrobial drugs. In addition, these antibiotics are associated with undesirable adverse effects like hypersensitivity, allergic reactions. Natural products especially herbal medicines can offer an effective solution to these problems. *Physalis minima* L. is one of the most important medicinal plants in Indian Traditional System of Medicines.

Physalis minima L. is a widespread, quick-growing and high fruit yielding herb belonging to the family Solanaceae. It is an annual herbaceous plant having a very delicate stem and leaves. A plant of *Physalis minima* L. has been used since centuries ago in Ayurvedic traditional medicine. In Ayurveda, this plant is known as Chirpoti or Rasbhari, and it is used to treat some well known ailments and health problems. In spite most of the investigations and research on this wonderful fruit are focused on its anti-cancer properties. *Physalis minima* L. is a pan tropical annual herb 20 to 50cm high at its maturity. It is commonly found on the bunds of the fields, wastelands, around the houses, on roadsides, etc., where the soil is porous and rich in organic matter. The fruit of *Physalis minima* L. has a pleasant cherry tomato like flavor when fully ripe and has a characteristic yellow colour covered by paper like leaves. They are juicy, mildly astringent and sweet with a pleasant blend of acid. The fruit was popular for its effective diuretic properties, which led to its use in treating dropsy, urinary tract disorders, gout and gonorrhoea.

Aim and Objective

Aim

The aim of this research work is to evaluate the nutrition values, vitamin C content, and the antioxidant activity in fruit of *Physalis minima* L. (wild gooseberry).

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Objective

To achieve this aim, the research work was carried out according to the following objectives,

To investigate the phytochemical compositions

To determine the nutrition contents

To measure the contents of vitamin C

To detect the antioxidant activity of *Physalis minima* L.

Botanical Description



Figure(1) Plant and fruits of *Physalis minima* L

Botanical name	:	<i>Physalis minima</i> L.
English name	:	Wild gooseberry
Myanmar name	:	Bauk-thee
Family	:	Solanaceae
Part used	:	Fruits
Medicinal Uses	:	deopsy, urinary tract disorders, gout and gonorrhea

Antioxidant and Health Effects

Antioxidants are small molecules that frequently infiltrate cells, accumulate (at high concentrations) in specific compartments associated with oxidative damage, and then are generated by the cell. They are capable to either delay or inhibition processes which occur under the influence of atmospheric oxygen or reactive oxygen species. They can also inhibit the oxidation of other molecules. Antioxidants are absolutely critical for maintaining optimal cellular and systemic health and well-being. There are several antioxidant systems within the body that help to cope with the oxidative stress that results from regular metabolic processes.

Antioxidants are also possible treatments for neurodegenerative diseases such as Alzheimer's, Parkinson's disease and amyotrophic lateral sclerosis. Antioxidants are found in varying amounts in foods such as vegetables, fruits, grain cereals, eggs, meat, legumes and nuts.

The main characteristics of an antioxidant are its ability to trap, to stabilize or to deactivate free radicals before the attack cell. These free radicals may oxidize nucleic acids, proteins, lipids or DNA and can initiate degenerative disease. Antioxidant compounds like phenolic acids, polyphenols and flavonoids scavenge free radicals such as peroxide, hydro peroxide or lipid peroxy and thus inhibit the oxidative mechanisms that lead to degenerative diseases.

Experimental Works

Sample Preparation

The fruit of *Physalis minima* L. used for this investigation was collected from the campus of Yadanabon University, Amarapura Township, Mandalay Region. The dry and fresh samples were prepared for the respective analysis.

Instrument and Material Used

Jenway-754 UV spectrophotometer was used for the determination of carbohydrate, vitamin C. UV-visible spectrophotometer (UV-1800) was used for

the measurement of antioxidant activity. Commercial grade reagents and solvent were used.

Preliminary Phytochemical Test for *Physalis minima* L.

Phytochemical screening on the fresh fruit of *Physalis minima* L. were carried out according to the reported methods of Harbone.

Determination of Nutritional Values of *Physalis minima* L.

The nutrients of moisture, ash, fiber and protein values were measured by AOAC method and the value of carbohydrate content was determined by phenol sulphuric acid colorimetric method using glucose as a standard. The amount of vitamin C was determined by spectrophotometric method using standard MPF cevit. The reducing sugar and total sugar contents from fresh fruit of sample were determined by iodometric titration method using Somogyi's reagents. The mineral contents were measured by EDXRF Spectrophotometric method.

Quantitative Test for Vitamin C by Spectrophotometric Method

The amount of ascorbic acid (mg/100 g) in fruit of *Physalis minima* L. was measured by spectrophotometric method using MPF cevit as a standard. In this determination, the maximum absorbance and wavelength (λ_{max}) of vitamin C contained in MPF cevit were measured. The measured absorbencies for the standard ascorbic acid (vitamin C) of MPF cevit were shown in Table 5. The resulting maximum wavelength was used to measure the absorbance of sample solution. The amount of ascorbic acid (mg/100 g) in fruit of *Physalis minima* L. was calculated from the measured values of absorbance.

$$\frac{\text{Ascorbic acid mg}}{100 \text{ mg}} = \frac{100 \times \text{vitamin C mg}}{\text{g of sample}}$$

Determination of Antioxidant Activity of Fruit of *Physalis minima* L. by DPPH Method

Screening of antioxidant activity of fruit sample was carried out by DPPH assay. This assay has been widely used to evaluate the free radical scavenging effectiveness of various flavonoids and polyphenols in food system. The absorbance of the test solutions was measured at 517 nm by using UV-7504 spectrophotometer. Absorbance measurements were done in triplicate for each concentration and then mean values so obtained were used to calculate percent inhibition of oxidation by the following equation. The capability to scavenge the DPPH radical was calculated using the following equation:

$$\% \text{ Inhibition} = \frac{A_{\text{Control}} - A_{\text{Sample}}}{A_{\text{Control}}} \times 100$$

Where, A_{Control} = absorbance of control solution

A_{Sample} = absorbance of tested sample solution

IC₅₀ value was calculated by linear regressive excel program.

Results and Discussion

The phytochemicals of the physalis were studied by preliminary phytochemical tests and the results are tabulated in Table 1.

Table (1) Phytochemical tests of *Physalis minima* L. (Wild gooseberry)

No.	Test	Reagents	Observation	Remark
1	Alkaloid	Dragendroff's	Orange ppt	+
2	Flavonoid	Hydrochloric acid and magnesium turning	Pink colour	+
3	Phenolic compound	10 % FeCl ₃	Purplish colour	+
4	Polyphenol	1 % FeCl ₃ and 1 % K ₃ [Fe(CN) ₆]	Greenish-blue	+
5	Steroid	Acetic anhydride and conc: H ₂ SO ₄	no green colour	-
6	Terpene	Acetic anhydride and conc: H ₂ SO ₄	Pink color at lower layer	+
7	Glycoside	10 % lead acetate	White ppt	+
8	Carbohydrate	Benedict's solution	Red coloration	+
9	Protein	NaOH and CuSO ₄ solution	Pink coloration	+
10	Tannin	10% FeCl ₃ and H ₂ SO ₄	No red colour	-
11	Saponin	Water	Not Froth	-
12	Lipophilic	0.5 % M KOH solution	Deep colour	+
13	Amino acid	Ninhydrin	Purple colour	+

(+) = presence of constituents, (-) = absence of constituents

In accordance with the preliminary phytochemical tests, phytochemicals such as alkaloid, flavonoid, terpene, glycoside, phenolic compound, polyphenol, lipophilic, carbohydrate, protein and amino acid were present in the *Physalis minima* L. (wild gooseberry). These may support the *Physalis* to have protective and disease preventive properties. Especially, the presence of phenolics and alkaloids suggest that the fruit of *Physalis* could be a potent source of antimicrobial and antineoplastic agents.

Table (2) Absorbance of standard ascorbic acid in MPF cevit

Wavelength (nm)	Absorbance
360	0.102
380	0.201
400	0.278
420	0.221
440	0.145
460	0.113
480	0.105
500	0.101

Figure (2) UV spectrum of standard MPF cevit**Table (3) Nutritional values of *Physalis minima* L.**

Test Parameter	Content (%) and mg
Extractable juice	63.80 % (fresh)
moisture content	82.62%
Ash	3.40%
Crude fiber	0.71%
Protein	2.27%
Carbohydrate	9.20%
Total sugar	4.86% (fresh)
Reducing sugar	1.99% (fresh)
Vitamin C	28.24 mg (fresh)

The experimental results show that the fruit is juicy, containing 63.80% extractable juice, 82.62% moisture content, 9.20% total carbohydrate, 2.275% protein, 4.86% total sugar, 1.99% reducing sugar, 0.71% crude fiber. It also contains a good amount of vitamin C which is 28.24 mg of fresh sample.

The mineral contents were measured in Department of Physics, University of Mandalay by EDXRF Spectrophotometry. The results are tabulated in the Table (4) and Figure (2).

Table (4) Contents of mineral in fruit of *Physalis minima* L.

Elements	Concentration (%)
K	3.031
Cl	0.6615
P	0.1817
Ca	0.1341
Al	0.0584
S	0.05484
Fe	0.03383
Si	0.0305
Zn	0.03383
V	0.00299
Mn	0.00223
Cu	0.00151
Cr	0.00085

From the results of minerals, it is observed that the relatively highest amount of potassium was occurred in the sample. Significant amount of chlorine, phosphorus, calcium, and low amount of aluminium, sulphur, iron, silicon and zinc were also observed in the sample.

Table (5) % RSA and IC₅₀ values of ethanol extract of *Physalis minima* L.

Tested sample	% RSA (mean±SD) in different concentration (µg/mL)						IC ₅₀ (µg/mL)
	2.5	5	10	20	40	80	
ethanol extract of sample	32.26 ± 0.79	44.91 ±0.24	48.79 ±0.24	57.80 ±0.75	61.82 ±0.64	74.50 ±0.52	11.37
Ascorbic acid	60.43 ± 0.32	72.07 ±0.60	77.20 ±1.15	83.09 ±0.12	90.23 ±0.72	97.16 ±0.32	1.22

From the antioxidant activity investigation, the higher the concentration of juice, the lower the absorbance of solution which in turn reveals that high percent inhibition of sample. The antioxidant activity of sample is exhibit with the value of IC₅₀ which is the concentration at which the curve passes through the 50% inhibition level. This value states that the amount of concentration of sample required producing 50% free radical scavenging activity. The observed IC₅₀ value of ethanol extract of sample is 17.37µg/mL.

Conclusion

In this research, the composition of phytochemical groups, some potent nutrients, vitamin, minerals and antioxidant activity in fruit of *Physalis minima* L. (Wild gooseberry) were analyzed.

According to the preliminary phytochemicals screening, it was observed that *Physalis* contained the phytochemical groups of alkaloid, flavonoid, glycoside, sugar, phenolic, polyphenol, lipophylic, terpene, carbohydrate, protein and amino

acid. These may support the *Physalis* to have protective and disease preventive properties.

From the experimental value of nutrients, consuming 100 g (about 50 of ripe fruit) this fruit could be supplied 63.80% of juice, 82.62 % of moisture, 3.4 % of ash, 0.71 % of fiber, 2.27 % of protein, 9.20 % of carbohydrate, 4.86 % of total sugar, 1.99 % of reducing sugar. It is not only a great source of potassium which helps controlling heart rate and blood pressure but also a significant source of phosphorus and calcium which are necessary for formation of bone. In addition, the value of vitamin C is found to be 28.24 mg/100 g. Therefore, the fruit of *Physalis minima* L. is a good source of vitamin C which has health benefits ranging from the common cold to deadly disease like cancer and has known benefits to fight ageing.

Moreover, the result of the investigation of radical scavenging activity, the value of half maximal inhibitory concentration (IC₅₀) in sample was observed at 11.37 µg/mL. IC₅₀ value is inversely related to the free radical scavenging activity. From the present finding, it is observed that, the ethanol extract of *Physalis* possess relatively high free radical scavenging activity.

The research can be concluded that the fruit of *Physalis minima* L. is a good source of vitamin C and antioxidant activity. Hence, it is a good for healthy diet and can also be used as medicinal plant.

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