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INVESTIGATION ON CHEMICAL AND PHYTOCHEMICALS CONSTITUENTS OF PHYLLANTHUS EMBLICA

Anjali Yadav[1], Dr. Deepal Agarwal[2]

[1]Research Scholar, Department of Chemistry, Dr. A.P.J. Abdul Kalam University, Indore, India

[2]Associate Professor, Dr. A.P.J. Abdul Kalam University, Indore, India

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ABSTRACT

The oldest medical system, Ayurveda, recognizes amla for its curative and preventative properties and employs it in its practice. Amla (also known as Emblica officinalis or emblic myrobalan) is referred to in Sanskrit as amalaki. The Indian subcontinent is home to Phyllanthus emblica, most often known as Indian gooseberry or amla. This fruit has been prized for ages due to its many purported health benefits. This article provides a concise summary of the pharmacology and traditional uses of the Emblica officinalis plant. Phytochemicals isolated from amla have been shown to have a wide range of biological activities, including antioxidant, antimicrobial, anti-inflammatory, anti-diabetic, radiation protective, chemopreventive, and wound-healing properties.

Keywords: Phyllanthus emblica, Chemical, Ayurveda, Phytochemicals, Diseases.

1. INTRODUCTION

Phyllanthus emblica, commonly known as Indian gooseberry or amla, is a remarkable botanical specimen that has captivated the attention of researchers (Yang, 2020) herbalists, and health enthusiasts for centuries. This small, green fruit, indigenous to the Indian subcontinent, has earned a distinguished reputation in traditional medicine systems like

Ayurveda for its multifaceted health benefits. A significant aspect of its therapeutic potential lies in its rich repository of phytochemicals and chemical constituents (Singh, 2015) which contribute to its wide-ranging medicinal properties. In this comprehensive introduction, we will delve deep into the intricate world of Phyllanthus emblica, exploring its phytochemical composition, its historical and cultural significance, and its diverse applications in modern healthcare and beyond.

Phyllanthus emblica has long held a prominent place in the pantheon of natural remedies (Gupta, 2013) not only for its flavorful taste but also for its profound therapeutic attributes. This ancient fruit has a history that spans millennia, with its use documented in ancient Indian texts dating back to over 2,000 years. Throughout the ages, it has been revered for its ability to promote health and well-being. Its botanical name, "Phyllanthus emblica," (Abdel-Hady, 2022) underscores its botanical lineage within the Phyllanthaceae family and its distinctive, embossed fruit.

At the heart of Phyllanthus emblica's therapeutic prowess lies its rich and diverse array of phytochemicals (Afrin, F, 2016) , which are naturally occurring compounds responsible for many of its health benefits. These phytochemicals encompass a spectrum of compounds, each with its unique properties and roles in promoting human health. The most renowned of these compounds is vitamin C (Ahmad B, 2021) an antioxidant known for its role in boosting the immune system and enhancing collagen production. Amla boasts one of the highest concentrations of vitamin C among all fruits, making it a potent ally in combating oxidative stress and bolstering the body's defenses against diseases.

Beyond its vitamin C content, Phyllanthus emblica harbors a treasure trove of phytochemicals, including polyphenols, flavonoids, tannins, and various bioactive alkaloids. These compounds collectively contribute to its anti-inflammatory, antimicrobial, and antioxidant properties (Akter, R, 2022) making it a versatile remedy in traditional medicine. Moreover, amla contains essential minerals like calcium, iron, and phosphorus, as well as a diverse profile of amino acids, further enhancing its nutritional value.

One of the standout phytochemicals in amla is ellagic acid, a potent antioxidant known for its role in neutralizing free radicals and reducing the risk of chronic diseases, including cancer and cardiovascular conditions. Amla also boasts a high concentration of gallic acid (Amir, D. 2014)., which has demonstrated anti-inflammatory and neuroprotective properties. The presence of quercetin, a flavonoid, further contributes to its antioxidant potential, while corilagin and phyllanthin, two unique tannins found in Phyllanthus emblica, have been shown to possess anti-diabetic and anti-inflammatory properties. Phyllanthus emblica's rich phytochemical composition has far-reaching implications for human health, extending well beyond its role as a vitamin C powerhouse. Its broad-spectrum antimicrobial activity has made it a valuable component in traditional remedies to combat bacterial and viral infections. Additionally, its anti-inflammatory properties have been harnessed to alleviate symptoms of inflammatory conditions, such as arthritis and inflammatory bowel disease.

Furthermore, Phyllanthus emblica has demonstrated its potential in managing metabolic disorders, such as diabetes and obesity, thanks to its ability to modulate blood sugar levels and promote weight loss. In the realm of skincare, amla's antioxidants and collagen-boosting properties have found applications in cosmetics and anti-aging formulations (Ansari P, 2022) offering a natural solution for maintaining youthful and radiant skin. The significance of Phyllanthus emblica extends beyond its phytochemical riches. It holds a special place in the cultural and culinary traditions of India and various Asian countries. In Indian culture, amla is revered not only for its medicinal properties but also for its role in various religious rituals and festivals. It is often used in traditional Indian cuisine, lending its unique tangy flavor to chutneys, pickles, and desserts.

The traditional use of Phyllanthus emblica in Ayurveda, the ancient Indian system of medicine, underscores its importance in holistic healing. Ayurveda classifies amla as a rasayana (Anto, E. J, 2022) a category of herbs and formulations known for their rejuvenating and longevity-promoting qualities. Amla-based preparations are prescribed to balance doshas (bioenergetic forces) within the body, enhance digestion, and fortify the immune system. As modern science delves deeper into the intricate world of Phyllanthus emblica (Asmilia, N., 2020) it continues to unearth a multitude of health benefits associated with this humble fruit. Clinical studies have corroborated its efficacy in reducing cholesterol levels, which is critical for heart health, and have highlighted its potential in managing hypertension. Its role in enhancing cognitive function and protecting against neurodegenerative diseases has also garnered attention from researchers.

Phyllanthus emblica's contributions to skin health are not limited to its antioxidant properties. Its rich nutrient profile (Bajgai, T. R, 2006) including essential fatty acids, has inspired the development of amla-based skincare products, promising to nourish and rejuvenate the skin. Moreover, amla extracts have shown promise in promoting hair growth and preventing hair loss (Bakr, E. H, 2020) making it a sought-after ingredient in the cosmetic industry. In recent years, Phyllanthus emblica (Balusamy S. R, 2019) has found its way into the global wellness and natural healthcare markets, where it is celebrated as a superfood and a versatile supplement. The burgeoning interest in amla-based products, including amla powder, capsules, and juices, reflects a growing recognition of its potential to enhance overall health and vitality.

I. REVIEW OF LITERATURE

Deshmukh, Chinmay & Choudhari, Shradha (2021) Amla, or Emblica officinalis (EO) (Family: Euphorbiaceae), is a medicinal plant native to India's deciduous woodlands that has been used medicinally for centuries. Phytochemical analysis suggests that emblicol contains vitamin C, ellagic acid, gallic acid, phyllemblin, tannin, phyllemblic acid, lipids, and emblicol. This plant's fruit is often used as a laxative, diuretic, and for its cooling effects. It's also used for patients with anemia, jaundice, or digestive issues. Seeds are used to treat a variety of respiratory conditions, including bronchitis, asthma, and stomach issues. Parts of this plant have been extracted and studied by many scientists and researchers for its potential medicinal applications and pharmacological effects. They have looked at this plant for its

potential protective effects on the liver, stomach, cells, against cancer, against yeast, and against ulcers. Ayurveda and other traditional treatments also attribute additional health benefits to this plant. This herb is easily accessible and extensively distributed. Many individuals in India regularly drink it. Cosmetics, shampoos, hair oils, colors, and the well-known health tonic Chyavanprash all use it. Even if there is already a wealth of material accessible on the plant and fruit in question, the present review study was conceived out of a desire to learn more about its applications, chemical make-up, pharmacological activity of extract and its separated constituents, and safety profile. Additional study of this species will benefit greatly from this data.

Sriwatcharakul, Suttijit (2020) The Indian gooseberry, or Phyllanthus emblica, is widely used as a medicinal plant in Thailand, and its extract from both its seeds and its fruit is the focus of this study. The maximum antioxidant activity was seen at 10 mg/ml, and both fruit and seed extracts had the same insignificant percentage of reduction as -tocopherol when tested in a DPPH radical scavenging assay for free radicals. In terms of tannin and flavonoid content, the phytochemical analysis showed that seed extract had greater concentrations than fruit extract (126.71 mg TAE/g extract and 1016.25 mg QE/g extract, respectively). Seed extract was shown to be more harmful than fruit extract, with cytotoxicity values of 68.98% and 35.57%, respectively, in an MTT experiment against a human breast adenocarcinoma cell line at the maximum concentration of 10000 g/ml. From what we can tell about its bioactivities, Phyllanthus emblica's seed might easily stand in for the fruit and increase the plant's worth in the medicinal sector.

Jhaumeer Laulloo, Sabina et al., (2018) The phytochemical analysis of Phyllanthus emblica (Amla) dried fruit demonstrated the presence of phenols, flavonoids, non-flavonoid, tannins, alkaloids, saponins, and phytosterols in the various extracts (diethyl ether, ethyl acetate, butanol, and aqueous). UPLC-MS/MS analysis of the fruit revealed the presence of low-molecular-weight aliphatic acids, phenolic acids, methyl/ethyl gallate, phytosterols, and tannins. Both the 1,1-diphenyl-2-picrylhydrazyl (DPPH) and 2,2′-azinobis-3-ethylbenzothiazoline)-6-sulfonic acid (ABTS) tests were used to measure the radical-scavenging capacity of Amla. The DPPH and ABTS tests both demonstrated that the ethyl acetate extract had the best antioxidant capacity, with a SC50 of 1.33 ± 0.77 and 4.13 ± 0.99 g/mL, respectively. There was strong evidence that the local Amla might be used as an antioxidant supplement because to the extracts' high phenolic, flavonoid, and antioxidant activities.

Patil, Dasrao et al., (2018) The purpose of the research was to examine the flavonoid, carbohydrate, protein, sapponin, terpenoid, tannins, glycosides, alkaloids, and resin content of a methanolic extract of Emblica Officinalis leaves. All of these checks may be verified using the method described in the cited study. Identifying the constituent chemicals of Emblica Officinalis. This research demonstrated the necessity of testing presence and making verifications. The present study set out to investigate the presence and absence of phytochemical agents in Embalica Officinalis by conducting an ethanolic extract of the plant's leaves using invitro methods (such as a test for glycosides, a test for flavonoid

alkaloid, a test for tannins, and a test for carbohydrates and proteins). The purpose of this study is to validate many strategies for determining the presence of phytochemical agents. Several Ayurvedic remedies for improved health and extended life span use the fruit prominently. Amla is well-known for being rich in many bioactive substances including polyphenols, flavonoids, tannins, and others. These compounds are powerful antioxidants, which may explain why Amla has beneficial health effects.

Vijayanand, Subramanium (2017) The purpose of this research was to analyze the antioxidant activity and phytochemical composition of Momordica charantia, Ananas comosus, and Phyllanthus emblica extracts, and to determine whether or not they may be used as a preservative. The radical scavenging activity of the antioxidant effects was measured by FRAP, with some adjustments made. The Momordica charantia choloform extract showed the strongest free radical scavenging activity. Similar scavenging power may be seen in Phyllanthus emblica ethanolic preparations. The total phenolic content of Phyllanthus emblica, Ananas comosus, and Momordica charantia extracts was calculated using a modified version of the Follins Ciocalteau technique. Antioxidant activity was shown to have a positive relationship with the total phenolic content of the extracts. Based on the results of the phytochemical analysis, it appears that the phenols and flavonoids included in these extracts may have significant antioxidant potential. The antioxidant vitamin C content of Phyllanthus emblica ethanol extract was determined using the high performance liquid chromatography (HPLC) technique. Phyllanthus emblica, Ananas comosus, and Momordicacharantia all contain high vitamin C concentrations and might be used as a natural preservative if added to commercial goods.

Hasan, Md et al., (2016) Plants have always been incredibly important to the progress of humanity, serving as an excellent source of natural medicine. Researchers throughout the world are focusing on medicinal plant research as a solution to the growing health concerns associated with and prohibitive cost of chemically based medicine formulations. About 5,000 plant species in Bangladesh are thought to have considerable medical properties, making the country a veritable treasure trove of flora and fauna. Recent decades' worth of published research on medicinal plants detail the many ways in which diverse plant bioactive chemicals are put to use in the treatment of human illness. Tannins, flavonoids, saponins, terpenoids, ascorbic acids, and many other bioactive compounds have been found in Emblica officinalis, and these compounds have been shown to have a wide range of pharmacological effects, including antimicrobial, antioxidant, anti-inflammatory, radio-protective, hepatoprotective, antititissuive, immunomodulatory, and hypolipedemic effects. Anticancer, anti-HIV reverse transcriptase, anti-diabetic, anti-depressant, anti-ulcerogenic, wound healing, and other actions have been attributed to this medicinal plant. This article reviews the pharmacological properties, traditional applications, and phytochemical components of the plant Emblica officinalis.

Zhang, Yao et al., (2014) From the Phyllanthus emblica fruit, 25 compounds were isolated, including two novel ones (1-2) and 23 recognized ones (3-5). The new compounds include a bisabolane-type sesquiterpenoid (1) and a diphenyl ether derivative (2). Spectroscopic

examination provided insight into their structures. All of the isolated compounds were tested for their ability to quench DPPH and protect PC12 cells from damage caused by hydrogen peroxide. The IC50 values for compounds 12–15 in the DPPH scavenging assay ranged from 3.25 to 4.18 M, indicating that these compounds are effective antioxidants. Compound 14 showed promise as an antioxidant since it increased the number of PC12 cells that survived after being exposed to H2O2 without causing any cytotoxicity at the doses used in this study.

Gupta, Jaya et al., (2014) The leaves of Phyllanthus emblica were the subject of a phytochemical analysis. Different chromatographic techniques were used to separate the chemical compounds, and spectroscopic approaches such as nuclear magnetic resonance and mass spectrometry were employed to elucidate the structures of the compounds. Two substances, quercetin and β-sitosterol, were separated and named.

Zhao, Q. et al., (2013) The goal of this research is to identify the chemical components found in Phyllanthus emblica roots. Methods: We used mass spectrometry, infrared spectroscopy, and nuclear magnetic resonance to identify the compounds that we extracted using column chromatography. Conclusions: Seven compounds, including 3, 20-dioxo-dinorfriedelane (1), lupeol (2), β-sitosterol (3), stigmasterol (4), daucosterol (5), 4-O-methylellagic acid-3'--rhamnoside (6), and phyllaemblic acid (7), were isolated from the 95% ethanol extract of P. emblica roots. chemical 1 (phyllaemblicone A) is a novel chemical, whereas compounds 2–6 are reported for the first time from the roots of P. emblica.

II. CHEMICAL CONSTITUENTS OF EMBLICA

It is difficult for pharmaceutical companies to determine the precise genotype of medicinal plants. The most up-to-date standards for controlling the quality of plants need the use of morphological and authentication-related precincts. The EO DNA marker has been generated using the RAPD method to find putative markers (1.1 kb) specific to EO detection. In addition (Bashir, 2018) the RAPD application is used to develop a SCAR (sequence characterized amplified region) marker, which is important for identification purposes in commercial samples of EO. The EO is mostly made up of phenolic chemicals, amino acids, tannins, alkaloids, and carbohydrates. When combined with additional fruits, the vitamin C content of the juice increases to an astounding 478.56 milligrams per one hundred milliliter. Many types of beneficial compounds such as quercetin (Bayat, P, 2021) ellagic acid, gallic acid, corilagin, chebulinic acid, 1,6-di-O-galloyl beta-D glucose, 3,6-di-O-galloyl-glucose, 3 ethylgallic acid (3 ethoxy 4,5 dihydroxy benzoic acid), 1-O-galloyl-beta-D-glucose, chebulagic acid, and isostrictiniin, isolated from it. Additionally, they include flavonoids such as 3-O-alpha-L-(6-ethyl)-kaempferol and 3-O-alpha-L-(6-methyl)-rhamnopyranoside. Also isolated from the methanol extract of the Phyllanthus emblica leaves was a novel acylated apigenin glucoside (apigenin 7 O (6 " butyryl beta glucopyranoside), as well as the well-known compounds gallic acid, 1,2,3,4,6-penta-O-galloylglucose, methyl gallate, and luteolin-4'-Oneohesperiodoside. Table 1 provides a breakdown of the various chemical components of amla.

Table 1: Chemical Constituent from Different Plant Parts of Amla

Fruit pulp	**Leaves**	**Seed**
Moisture	Gallic Acid	Fixed Oil
Mineral	Chebulic Acid	Phosphatides
Crude Cellulose	Ellagic Acid	Essential oil
Albumin	Chebulinic Acid	
Gum	Amlic Acid	
Tannin	Alkaloids Phyllantine	
Gallic Acid	Phyllantidine	

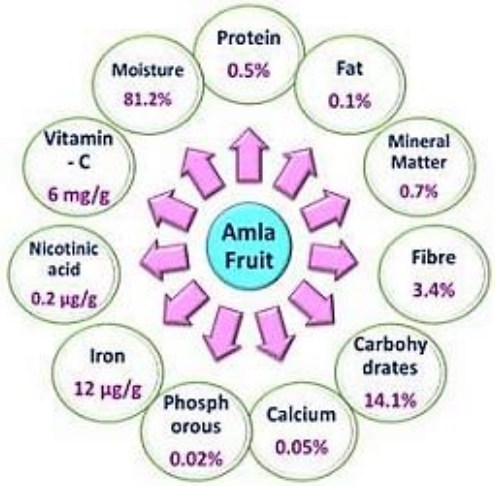

Figure 1: Composition of Amla fruit pulp

III. PHYTOCHEMICALS CONSTITUENTS & ACTIVE INGREDIENTS

Indian researchers have identified "Phyllemblin" as the active element in amla responsible for its notable pharmacological activity. The fruit is packed with healthy nutrients including vitamin C, pectin, tannins, flavonoids, gallic acid, and flavonoid (Acharya, C. D. 2016)., not to mention polyphenolic compounds like quercetin and phyllaemblic compounds. Terpenoids, alkaloids, flavonoids, and tannins are only few of the phytochemicals that have been found to have beneficial biological effects in studies. Tannins may be found in abundance in the fruits, leaves, and bark. Ellagic acid and lupeol are found in the root, while leucodelphinidin is found in the bark. Brownish-yellow oil (15%) is extracted from the seeds. Linolenic acid (8.5%), linoleic acid (45.0%), oleic acid (28.5%), stearic acid (2.0%), palmitic acid (4.0%), and myristic acid (2.0%) are all present. Alkaloids (phyllantidine and phyllantine), flavonoids (Kaempferol 3 O alpha L (6" methyl) rhamnopyranoside,

Kaempferol 3 O alpha L (6" ethyl) amnopyranoside), and hydrolyzable tannins (Emblicanin A, Emblicanin B, punigluconin, pedunculagin) are all present in this plant.

From the Phyllanthus emblica fruit, the following compounds were extracted: gallic acid, ellagic acid, 1OgalloylbetaDglucose, 3,6-diOgalloylDglucose, chebulinic acid, quercetin, chebulagic acid, corilagin, and isostrictinnin. The methanolic extract of P.emblica leaves yielded a novel acylated glucoside. Apigenin-7-O-(6"-butyryl-beta)-glucopyranoside, gallic acid, methyl gallate, 1,2,3,4,6-penta-O-galloylglucose, and luteolin-4'-O-hesperiodoside are their chemical names.

Fixed oil, phosphatides, and a trace amount of essential oil may all be found in P. emblica seed. The leaves also include chebulagic acid, chebulinic acid, gallic acid, and ellagic acid. Isolation of phyllaemblic acid, a new highly oxygenated norbisabolane, and complete characterization of its structure by spectroscopic and analytical methods confirmed its origin in the roots of P.emblica. The roots of P.emblica contain ellagic acid and lupeol.

Table 2 Phytochemical contents in P. emblica extracts

	Seed extract	**Fruit**
a). Total phenolic contents (mg GAE/g extract)	4.53 ± 0.18	6.00 ± 0.18
b). Tannins (mg TAE/g extract)	126.71 ± 0.92	52.96 ± 1.04
c). Flavonoids (mg QE/g extract)	1016.25 ± 16.50	865 ± 34.28

Table 3 Phytochemical analysis of P. emblica using different solvent

Phytochemical constituents	**Petroleum ether**		**Chloroform**		**Alcohol**	
	Leaves	**Fruits**	**Leaves**	**Fruits**	**Leaves**	**Fruits**
1. Alkaloids	-	+	-	+	+	+
2.Oil and Fats	+	+	+	+	+	+
3.Glyceroids	-	-	-	-	+	+
4.Carbohydrates	-	-	-	-	+	+
5.Phenolics	+	+	+	+	+	+
6.Tannins	+	+	+	+	+	+
7.Lignin	-	+	-	+	+	+
8.Saponins	+	+	+	+	+	+
9.Flavonoids	-	-	-	-	+	+
10.Terpenoid	-	-	-	-	-	+

IV. NUTRITIVE VALUE

Amla is well known for its nutritional qualities. It is rich in polyphenols, minerals and is regarded as one of the richest source of vitamin C (200-900 mg per 100 g of edible portion). Major components of nutritional importance are reported in table 4.

Table 4: Nutritional Value of fruit of Phyllanthus emblica (% or per 100g)

Chemical components	**Percentage**
Fruits: Moisture	81.5%
Protein	0.5%
Fat	0.2%
Mineral matter	0.3%
Fibre	3.3%
Carbohydrate	14.2%
Bulk elements Mg/100g,	Net weight
Calcium	0.05%
Phosphorous	0.02%
Iron	1.2 mg/100g
Vitamin C	600mg/100g
Nicotinic acid	0.2mg/100g

V. CONCLUSION

As we reflect on the rich tradition of Ayurveda and its utilization of Amla as a therapeutic agent, we are reminded of the enduring wisdom encapsulated in this ancient healthcare system. Amla continues to stand as a testament to the timelessness of Ayurvedic practices and the enduring relevance of natural remedies in the modern world. In our quest for holistic well-being and a deeper understanding of the healing potential of nature's bounty, Amla remains a symbol of the age-old connection between traditional wisdom and contemporary science. Its continued exploration and utilization offer a promising path towards improved health and vitality, bridging the gap between ancient traditions and modern healthcare.

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