



Overview on Common Active Compounds Present in Medicinal Plants

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Abstract: Plant kingdom is a treasure residence of potential drugs. Medicinal plants would be the quality source to obtain variety of drugs. Drugs from plant are safe, less expensive, and efficient with less side effects. Phytochemicals from medicinal plants serves as lead compounds in drug discovery and design. Phytochemicals can be found in a different plant parts, such as the roots, stems, leaves, flowers, fruits, and seeds. In the present study, we are discussed about the medicinal plant's organic compounds [phytochemicals] and their actions in human body, and the major class of phytochemicals.

Key words: Medicinal plants, phytochemicals, bioactive compounds

Introduction

Humans have relied on Nature for their basic requirements for food, shelter, clothes, transportation, fertilizers, flavours and fragrances, and, last but not least, medicine, throughout history. The significance of plant is understood to us well. The plant kingdom is a treasure residence of potential drugs and in the recent years there was an increasing awareness about the significance of medicinal plant. Drugs from the plants are available, safe less expensive and efficient and less side effect. The plants are used for medicinal purpose over thousands of years constitute the most obvious choice of examining the current search for therapeutically powerful new drugs which includes anticancer drugs, antimicrobial drugs, antihepatotoxic compounds. According to World Health Organization (WHO), medicinal plants would be the quality source to obtain variety of drugs. About 80% of individuals in the world use traditional medicines, which has compounds derived from medicinal plants. However, such plants should be examined to better understand their properties, safety and efficiency(Arunkumar & Muthuselvam, 2009; Hanumantharaju et al., 2020). In addition to providing nutrients, plants have continuously been an important source of medicinal purpose.

Medicinal plants are part and parcel of humans since the first light of civilization. In India they form the








backbone of many indigenous traditional systems of medicine. Pharmacological studies have recognized the value of medicinal plants as potential source of bioactive compounds (Prusti, 2008). Phytochemicals from medicinal plants serve as lead compounds in drug discovery and design(Ebi & Ofoefule, 2000). Medicinal plants are rich source of novel drugs that forms the ingredients in conventional systems of medicine, modern medications, nutraceuticals, food supplements, pharmaceutical intermediates, bioactive principles and lead compounds in synthetic drugs(Hanumantharaju et al., 2019; Ncube et al., 2008). Medicinal plants contain some organic compounds that provide definite physiological action on the human body and these bioactive substances include tannins, alkaloids, carbohydrates, terpenoids, steroids and flavonoids. These compounds are synthesized by primary/secondary metabolism of living organisms. Secondary metabolites are chemically and taxonomically extraordinarily numerous compounds with obscure function(Mann, 1978). Based on the above background the review work has been undertaken to study the common phytochemicals present in the medicinal plants.



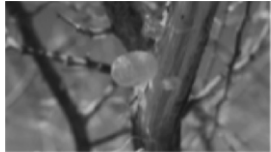
Biologically Active Phytochemicals

Phytochemicals (from the Greek word Phyto, meaning plant) are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits

for humans, also gives macronutrients and micronutrients. They protect plants from disease and harm and contribute to the plant's color, aroma and flavor. Phytochemicals are plant chemicals that protect plant cells from environmental hazards like pollution, stress, drought, ultraviolet light exposure and pathogenic attack in plants (Gibson et al., 1998). They place an important role in the protection of human health, when dietary intake is significant.

Phytochemicals are classified on the basis of protective function, physical characteristics and chemical characteristics (Meagher & Thomson, 1999). Phytochemicals can be found in a different plant parts, such as the roots, stems, leaves, flowers, fruits, and seeds. Some of the plant parts and their utilities are listed in the below table 1.

Sl.No.	Plant Part	Common Name	Uses
1		Root	Roots are the fleshy/ woody part of many species and are used medicinally. Roots may be fibrous, solid/ fleshy. Mainly used for cough, cold, bronchitis. E.g. liquorice, Gum Arabic tree
2		Rhizome	Rhizome is a woody or fleshy elongated stem that grows horizontally beneath the ground, producing leaves above ground and roots into the soil. Mainly used for the treatment of diabetes, inflammation, chest pain etc. E.g. Kava and Ginger
3		Bulb	Bulb is a fleshy structure made up of many layers of leaf bases called bulb scales. E.g. Onion, garlic etc.
4		Bark	Bark is the tree trunk's outermost protective layer, formed by layers of living cells just above the wood itself. E.g., Cinnamon, neem etc.
5		Wood	The wood is the thick stem/ the wood itself. e.g., Sandalwood.
6		Leaf	The leaves can sometimes be used alone or mixed with the petiole. E.g., Gingko, tulsi etc.
7		Flower	Flowers are widely used in traditional medicine. E.g. Clove, Chamomile flower etc.

8		Fruit	Fruits are widely used in medicinal purpose some of them are, Anis seeds, Fennel fruit. In some cases, the fruit peel is also used for medicinal purposes. e.g., Pomegranate, long pepper etc.
9		Seed	Seeds are contained in the fruit and in some instances are used by themselves. E.g., Castor oil, water lily etc..
10		Gum	Gums are solids made up of polysaccharide mixtures. They are partially digested by humans and are water soluble. Gums flow from a damaged stem as a protection mechanism or as a protection system against bacterial and fungal rots. e.g., Gum Arabic, drumstick etc.

Phytochemicals

Phytochemicals are biologically active, naturally occurring chemical compounds found in plants, which provide health benefits for humans, also gives macronutrients and micronutrients. They protect plants from disease and harm and contribute to the plant's color, aroma and flavor. Phytochemicals are plant chemicals that protect plant cells from environmental hazards like pollution, stress, drought, ultraviolet light exposure and pathogenic attack in plants (Gibson et al., 1998). They place an important role in the protection of human health, when dietary intake is significant. Phytochemicals are classified on the basis of protective function, physical characteristics and chemical characteristics (Meagher & Thomson, 1999). Phytochemicals can be found in a different plant parts, such as the roots, stems, leaves, flowers, fruits, and seeds.

Phytochemicals are not essential nutrients and are not required by the human body for sustaining life, but have important properties to prevent against some diseases. Because of this property phytochemicals helps in the prevention and treatment of diseases. Phytochemicals help to reduce the chance of coronary heart diseases by preventing the oxidation of low-density lipoprotein (LDL) cholesterol, normalizing blood pressure, improving arterial elasticity or reducing the absorption of cholesterol (Mathai, 2000). Phytochemicals also detoxify substance that cause cancer. They appear to be neutralized free radicals, inhibit enzymes that activate carcinogens and activate enzymes that detoxify carcinogens (Meagher & Thomson, 1999). Phytochemicals have also been promoted as a treatment for diabetes, high blood pressure, and macular degeneration (Saxena et al., 2013).

Classification of Phytochemicals

The classification of phytochemicals could have not been completed so far, because of the extensive variety of them. Phytochemicals are presently classified as primary or secondary constituents, based on the function in plant metabolism. Primary constituent includes the common sugar, amino acids, proteins, purines and pyrimidines of nucleic acids, chlorophylls etc. Secondary constituents ate the plant chemicals such as alkaloids, terpenes, flavonoids, lignans, plant steroids, saponins, phenolics and glucosides (Hahn, 1998).

Phenolic Compounds

Phenolic compounds are the most important and diverse group of phytochemicals, and they are most broadly distributed in the plant kingdom (Walton et al., 2003). Phenol (C_6H_5OH) is the simplest class of natural compounds. They are important defensive chemicals since they are a secondary metabolite. Phenolics have several properties that are useful to humans, and their antioxidant properties are important in determining their role in protecting disease caused by free radicals. Flavonoids, phenolic acids, and polyphenols are the three most important types of dietary phenolics (Walton et al., 2003).

Flavonoids

Flavonoids are polyphenolic compounds that are seen in nature and occur as glucosides or methylated derivatives. Flavonoids seem to have played a major role in successful medical treatments in the past, and their use has persisted to this day (Pridham, 1960). The majority of flavonoids are found in conjugated form in nature and can be characterised as monoglycosidic, diglycosidic etc. The glycosidic linkage is normally located at the position 3 or 7 and the carbohydrate unit can be L-rhamnose, D-glucose, glucorhamnose, galactose or arabinose (Pretorius, 2003). Flavonoids have recently gained a lot of attention due to their wide range of biological and pharmacological activities. The flavonoids have been reported to exert multiple biological properties including anti-inflammatory, anti-microbial, cytotoxic, and anti-tumor activities; but the best-described property of almost every group of flavonoids is the capacity to act as powerful antioxidants which can protect the human body from the dangerous free radicals and reactive oxygen species (ROS) (Teiten et al., 2013).

Phenolic Acids

Phenolic acids form a diverse group that consists of the widely distributed hydroxy-benzoic and hydroxycinnamic acids. Phenolic polymers, commonly known as tannins, are compounds of high molecular weight that are divided into classes, they are hydrolyzable tannins and condensed tannins. Naturally occurring phenolic acids include two different carbon frameworks they are the hydroxycinnamic and hydroxybenzoic structures. Simple esters with glucose or hydroxy carboxylic acids are used to make hydroxycinnamic acid molecules. The molecular structure of plant phenolic compounds differs from that of animal phenolic compounds, and they are distinguished by hydroxylated aromatic rings (Balasundram et al., 2006). These compounds have been researched mainly for their anti-oxidant properties, which are related to a various degenerative disease including cardiovascular disease, inflammation, and cancer. Indeed, tumour cells, such as leukaemia cells, have larger quantities of reactive oxygen species than normal cells, making them especially vulnerable to oxidative stress (Mandal et al., 2010).

Tannins

Tannins are a group of polyphenolic compounds with a high molecular weight that can form reversible and irreversible complexes with proteins, polysaccharides, alkaloids, nucleic acids, and minerals (Mueller-Harvey et

al., 1992). On the basis of their structural characteristics, it is therefore possible to divide the tannins into 4 major groups: Gallotannins, ellagitannins, complex tannins and condensed tannins. The consumption of tannins has been linked to a number of health benefits, along with a decrease in the frequency of chronic diseases, according to epidemiological studies (Serrano et al., 2009). Plant extracts containing tannins are used as astringents, against diarrhea, as diuretics against stomach and duodenal tumors and also anti-inflammatory, antiseptic, antioxidant, and homeostatic pharmaceuticals (De Bruyne et al., 1999). In food industry tannins are used to clarify wine, beer and fruit juice. The tannins have attracted scientist's curiosity, partially as a result of the increasing incidence of deadly diseases like AIDS and cancer. The search for new lead chemicals for the development of novel pharmaceuticals has become more important, especially now the biological effect of tannin-containing plant extracts has been well characterized (Mueller-Harvey & McAllan, 1992).

Alkaloids

Alkaloids are natural products contain heterocyclic nitrogen atoms and they are naturally synthesised by a large number of organisms, including plants, animal, bacteria and fungi (Mueller-Harvey & McAllan, 1992). Alkaloids are so numerous and have such a wide range of molecular structures that classifying them is difficult. The best solution to the problem, though, is to classify them into families based on the type of heterocyclic ring system present in the molecule, they are pyrrolidine alkaloids, pyridine alkaloids, pyrrolidine-pyridine alkaloids, pyridine-piperidine alkaloids, quinoline alkaloids, isoquinoline alkaloids (Molyneux et al., 1996). Alkaloids are important for plant protection because they protect them against microorganisms (antibacterial and antifungal activity), insects and herbivores (feeding deterrents), and other plants (allelopathically active compounds). Alkaloids have a wide range of pharmacological effects, including antihypertensive, antiarrhythmic, antimalarial, and anticancer properties (Wink et al., 1998).

Terpenoids

Terpenoids are natural products and derived from five-C isoprene units. Terpenoids are commercially interesting because they are used as flavorings and fragrances in foods and cosmetics, such as menthol and sclareol, or because they are essential for agricultural product quality (Harborne & Tomas-Barberan, 1991).

Terpenes are seen in nature, primarily in plants as essential oil. Terpenoids are the structurally most prevalent type of plant secondary metabolites; they function as phytoalexins in direct plant defense or as signals in oblique defense responses involving herbivores and natural enemies. Many plants create volatile terpenes in order to attract particular insects for pollination or to drive away animals to eat the plants. Some plants are protected from being eaten by animals by terpenes which are less volatile but bitter-tasting or poisonous (Degenhardt et al., 2003). Medicinal properties of terpenoids are anticarcinogenic, antimalarial, anti-ulcer, hepaticidal, antimicrobial, or diuretic activity (Dudareva et al., 2004).

Saponins

Saponins are secondary metabolites of plant kingdom and are stable in aqueous solutions. Saponins are classified on the bases of aglycone structure into triterpenoids and steroids saponins. Saponin mixtures found in plants and plant products have a variety of biological effects when it enters the body of an animal. Many saponins are hemolytic and toxic to cold-blooded animals, particularly fish. The steroidal saponins are essential precursors for steroid drugs including anti-inflammatory agents, androgens, oestrogens and progestins (Takechi et al., 1999).

Conclusion

Nature is a unique source of phytochemicals with a wide range of biological activity and medicinal properties. From the above discussion we are discussed about the medicinal plant's organic compounds [phytochemicals] and their actions in human body, and the major class of phytochemicals or bio active substance. Nature must still have many more phytochemicals in store, based on the number of phytochemicals identified so far. Many new phytochemicals may be identified as lead compounds in pharmaceutical development for various diseases of developments in synthetic methodology and the development of more advanced isolation and analytical techniques.

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