A Review Article: The Importance of the Major groups of Plants Secondary Metabolism Phenols, Alkaloids, and Terpenes

Roaa M. H. Shoker
Department of pharmacology, Medicine Collage, Waist University, IRAQ

Corresponding Author: rmhasan@uowasit.edu.iq

ABSTRACT
Medicinal plants may be considered as a rich source of abroad diversity secondary constituents which may be utilized for developing and progress the drugs. Medicinal plants are an important to the health of human and community. They include medicine application such as antioxidants, anti-inflammatory, anti-tumor, anti-viral activities and other. Important identification and knowledge this constituent for preparation various drugs. Secondary Metabolism may be divvied to major groups: phenols, alkaloids, and terpenes. Phenolic compounds have an important role in medicine, act as antioxidant, and have protective properties from diverse disease. Medicinal utilized plants containing alkaloids from a long history, first alkaloids were separated in the 19th century, and they directly study their application in medical practice. Various alkaloids are still utilized as drugs against various sicknesses. Terpenoids are a group of secondary constituents that present in approximately every natural diet, terpenoids actually utilized in medicine application. This review aims to provide the interest to discover new bioactive constituents from plants which have pharmaceuticals and medicine application.

Keywords- Medicinal plants, Secondary Metabolism, Phenols, Alkaloid, Terpenes.

I. INTRODUCTION

Plants have a great source of secondary constituents show chief role in defense the plant from herbivory and other pathogen, but people usage them as drugs, flavouring and industries. Numerous diverse secondary constituents which derived from plants are widely utilized in current drugs in the world, due to perform a numeral of defend functions as enhancement the immune system, and defend the body from free radicals (1). Herbal medicines differ from the synthetic drugs in the preliminary point is an observation history of the plant effects on individuals, and it is usage crude extracts which contain mixtures of naturally compounds, as different to single pure compounds of synthetic source. Evidence increasing of many existing chemically synthesized drugs only suppress diseases symptoms and ignore the underlying causes, in contrast herbal medicines, having herbal seem to as therapeutic of the several diseases and produce superior medical results. Therefore, crude extracts of herbal plants more utilized by the population for treating of numerous illnesses (2). Primary metabolites (carbohydrates, proteins, fats, minerals, and vitamins) for plants growth and development (1). Secondary metabolites are compounds extant in particular cells that are not essential for basic respiratory or photosynthetic metabolism, but required for plants survival in the environment (3). The secondary metabolites do not have nutrient features for human but have therapeutic properties. The resent search an increasing replacement plant derived compounds instead synthetic drug (1). Natural drugs are much safer than synthetic drugs as plants and phytopharmaceutical products, this fact lead to increase the scientific attention in their biological effects (4). Therefore, fruit and vegetables role for human food and public health, many of researcher are recommendation them for nutrition. Fruit and vegetables have a richness of phenolic, terpenoids and other natural antioxidants compounds which have been related with defense and therapeutic the chronic diseases like heart or cancer disease (5). Medicine plants may involve whole parts or roots, seed, leaves, flowers, and bark of plants, may be administered orally, directly placed in the skin, or inhaled (6). Medicinal plants are knowledge in the oldest sciences in countries as India, China, Egypt, and Greece, they were usually utilized as a drug, aromatic agent, and disinfectant (7). Plant species over 50 000 species are utilized in cosmetic, and pharmaceutical products. However, medicinal plants distribution of through the world is not uniform (8, 9). Therefore, Medicinal plants are playing an important role in the progress of human culture, and medicine source (10). There are approximately half million medicinal plants about the world, most of them are not investigated for their remedial activities, and their evaluated for medicinal activities may be decisive in the healing of present, future studies (11). Several studies indicated that medicinal plants still play a great role in the providing of main health care for the society. Additional pharmacological studies should be carried out on the maximum of possible remedial plants utilized in herbal exercise so like to found their bioactivity capacities and probable development like drugs to contract with social and livestock healthiness problems (12). May be divided the secondary metabolite into three chief groups: Phenols, Alkaloid, and Terpenes (13).
II. PHENOLIC COMPOUNDS

Phenolic compounds are one of the main and diverse group of plants which contain in their structures, at least one aromatic ring and one or more hydroxyl groups, the simplest phenols, C₆H₅OH. (14, 15).

May be divided in two categories, first category involves soluble compounds like flavonoids, phenylpropanoids, quinones, which occurrence in vacuole of plant cell, second category involves insoluble compounds like lignins, hydroxyl cinnamic acid, and condensed tannins which are presented in bound of cell-wall (16). Higher plants produce numerous thousand from diverse phenolic compounds, and the number of those completely characterized is constantly increasing. Vascular plant leaves include glycosides, and esters amides of hydroxycinnamic acids, glycosylated flavonoids, particularly proanthocyanidins and flavonols. Lignin, pollen sporopollenin, and suberin are examples of phenolic-having polymers. Many of soluble phenolic compounds broadly distributed, like chlorogenic acid, which distribution of several other structures is limited in specific genera or families, creation them biomarkers for taxonomic studies (17, 18). Flavonoids compounds the major group of plant phenolics with low molecular weight and have been considered greatest broadly (19). Diverse phenolic compounds related with the gene expression regulation in cell proliferation and apoptosis, both in vitro and in vivo. Numerous in vitro and in vivo reported display the flavonoids can interrupt diverse stages of carcinogenesis (20). Flavonoids have been described as receptors, and modulate key enzymes contained in signal transduction pathways of cellular proliferation, inflammation, differentiation, metastasis apoptosis, angiogenesis, and reversal multidrug resistance (21). Phenolic compounds may be also used in several fields like antioxidant, anti-inflammatory, antimicrobial, antiviral, antitumor, antipyretic, and analgesic (22, 23).

Phenolic compounds and flavonoids are recognized as antioxidant and various other important bioactive compounds which have long been attentive due to their assistances for human healthiness, therapeutic and avoiding several diseases. Many studies attempted to determine an overview of phenolic compounds and flavonoids as other sources for pharmaceutical applications. Like of these phytochemicals compounds from numerous medicinal plants are showed applications in pharmaceutical and medical filed, particularly for healthiness promote as antioxidant, anticancer, antibacterial, cardioprotective, promoting of immune system, skin protecting effect from UV radiation, and anti-inflammatory (25). The defense effect through the consumption of plant foods like vegetables, fruits, and legumes is generally related with the incidence of the phenolic compounds (26). Therefore, considered phenolic compounds a great important in medicine due to may be consider as alternate sources for medicinal and pharmaceutical applications.
III. ALKALOIDS COMPOUNDS

Alkaloids are organic heterocycle constituents with nitrogen, plant secondary metabolism, most of them toxic in nature; they contain at least one atom of heterocycle nitrogen.

Alkaloids structure

Alkaloids are the main secondary metabolites which have medical properties. Alkaloids are can to avoid the several degenerative sicknesses by scavenging free radical or binding with catalyst the oxidative reaction. Several studies indicated the alkaloids from several plants have a wide range of pharmaceutical application (27). Various compounds of alkaloids like coniine, atropine, nicotine, cocaine, codeine, morphine, quinine, strychnine, papaverine, and caffeine, the effects these constituents on human are healthiness (28). Alkaloids constituents basis on their biosynthetic precursor and heterocycle ring system, include indole, tropane, piperidine, purine, imidazole, pyrrolizidine, isoquinoline, pyrrolidine and quinolozidine alkaloids (27). Alkaloids are broadly spread from vegetation, plants which rich in alkaloids involve Papaveraceae family (Poppy), Solanaceae crops (tobacco, potatoes), and Rubiaceae (the quinine tree) (29), numerous European scientists discover and isolated compounds including the isolation of xanthine (1817), strychnine (1818), atropine (1819), quinine (1820), and caffeine (1820) (30). Alkaloids include neuroactive molecules, like nicotine, and caffeine, and the antitumor vinblastine and vincristine. Alkaloids play as defense compounds in plants, well-organized against predators and pathogens due to their toxicity. Diverse strategies are utilized to study alkaloid accumulation and metabolism. The effective method is gene expression monitor, concentration of precursors, and enzyme activities of the alkaloid itself through controlled occurrences the pathogens and herbivores or simulation of their occurrence by chemical, physical stimulation (31). Natural products of plants have been used through humans for years thousands, as drugs, foods, antioxidants, fragrances, flavors, insecticides, dyes, and pheromones, enhancing the health. Alkaloids are among the major groups of secondary metabolites, existence really diverse in terms of biosynthetic pathways, and structure involving more than 20,000 diverse molecules occurrence almost 20 % of recognized vascular plants (32). Mechanism of action of the alkaloid is complex, meaning that is observed the toxicity in insects, such as is not necessary the similar to other animals. Key aspects associated to symptoms of toxicity involve the active metabolite amount, the organ which it is in contact, and specific features of the target organism. Understanding the metabolism and action of alkaloid may lead to beneficial molecules for human healthiness and harvest production. Important drugs of the healing of plant alkaloids involved morphine for treating severe pain; cephaeline and emetine like antidotes for intoxication; caffeine to stimulant effect; quinine used to antimalarial; antitumoral vinblastine, vincristine; camptothecin as antiarrhythmic and ajmalicine as antimicrobials; sanguinarine and berberine antitussive (32). Therefore, alkaloids compounds have a great importance in medicine, can be uses as drugs against various sicknesses.

IV. TERPENES COMPOUNDS

Terpenes or terpenoids are the major diverse group occurrence in plants naturally, depended on isoprenes units number, can be classified in to mono, di, tri, tetra, and sesquiterpenes. They are mostly present in plants and make the chief constituent of essential oils from plants source, commonly plant terpenes sources are tea, cannabis, thyme, citrus fruits, and Spanish sage (33). Terpenes have several functions in plants like a signaling functions, pigments, solvents, flavoring, and have several medicinal applications (34). Terpenes contains several remedial properties such as antioxidant, antimicrobial, antiviral, antifungal, analgesic, antihyperglycemic, antiparasitic, and anti-inflammatory, it is also utilized to improve skin penetration, avoid inflammatory sicknesses. In medicine used terpene for several medical drugs (35). Also against pathogens, herbivores, and organisms as mycorrhiza, and pollinators (36). Other researcher indicated the terpenes have a broad range of therapeutic uses as antiplasmodial, antimalarial drug. Monoterpenes exactly are broadly studied for their antiviral, antidiabetic, and anticancer in modern world. many terpenes were broadly utilized in natural folk medicine. One like terpene is curcumin which evaluated as anti-inflammatory, antioxidant, antiseptic, antiplasmodial, diuretic, digestive, and other properties (33). All plants produce several of hundred terpenoid compounds with characters that involve phytohormones, anti-oxidants, protein modification reagents, and more. Phylogenetically terpenoids are restricted and implicated the organisms attraction (37). Humans used several of terpenoid compounds to produce important compounds such as vitamin A from b-carotene. Generally, terpenes in foods contain a main effect on our eating practice. Terpenoid as pigments, like bixin, astaxanthin, and lycopene, are utilized in the food manufacturing. Volatile compounds of terpenoid produce specific flavors to foods, ginger flavor is produced
through zingiberene. Many herbs (as lemon grass), and spices (as saffron) have volatile terpenoids as chief flavor components, and alcoholic drinks (38). Globally sales pharmaceuticals drugs which deepened on terpene were 2002 nearly US $12 billion. Among these pharmaceuticals, antimalarial drug Artemisinin, and anticancer drug Taxol®. Terpenoids show a broad range of biological application against cancer, inflammation, malaria, and a diversity of infectious illnesses (bacterial and viral). Natural product from the marine environment has hundreds of terpenoids compounds with different structures and has bioactivities, with more to be discovered in the future. Although total chemical synthesis plays chief role in the making of some terpenoid drugs, which contributed significantly to the progress of terpene-based drugs (39). terpenes or isoprenoids are organized in a regular head to tail. Squalene (unsaturated hydrocarbon present in humans, shark), the side chains of Vitamin A, E, K, are all compounds of terpenes. Terpenes produce fragrances which utilized as cosmetics, insect repellants, pollination, perfume preparation, and have several therapeutic values (40). many of these compounds are present in nature at low levels, biology and metabolic engineering method which provides approaches to produce sufficient amounts of terpenoids for drug product (41).

REFERENCES

production strategies of plant medicinal alkaloids. *Natural Product Reports*, 27(10), 1469. https://doi.org/10.1039/c005378c