



## Steroidal Saponins: An Overview of Medicinal Uses

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### Abstract

Modern study in drug discovery from medicinal plants is a versatile approach with a number of biological, phytochemical, molecular and botanical methods. Drug discovery is providing latest, significant and principal leads against various medical purposes like malaria, cancer, pain, HIV/AIDS and Alzheimer's disease. Numerous natural drugs of plant sources have either recently been purposed. Saponins are varied compounds broadly spread in the plant territory consist of steroid or triterpene aglycone and sugar chains. Saponins are commercially important compounds with increasing utilizations in cosmetics, pharmaceutical and food industries. Plant saponins have an extensive range of biological properties such as antifungal, antitumor, cytotoxic and anti-inflammatory.

**Key words:** Plants, saponins, antifungal, antitumor, cytotoxic

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### 1. Introduction

Plants are consumed as antibiotic since ancient times. These antibiotics primarily acquire the appearance of unfinished drugs like that of tinctures, powders, poultices, teas and new herbal formulations. Extraction of active compounds that can be used as medicines from plants continues even today [1-6]. Minimum 7,000 medical compounds used in drug production in the modern array are derived from plants and 80% of them show optimistic relationship between new traditional use and therapeutic use of the plants from which they are extracted [7].

Saponin is a compound formed from a simple sugar. They consist of more than one sugar chains that may be present on a steroid and triterpenoidal aglycone frame. Backbone of saponin (aglycone) is known as sapogenin [8]. The functional groups depend upon the sapogenin, fraction of sugars; quality of the aglycone and nature of the sugars can differ significantly and conclude as very assorted compounds. The occurrence of saponins has been reported in more than 100 plants families [9, 10]. The saponin substance of plant resources is affected by the section of plant being observed, plant species, agronomic and environmental circumstances related to the plant growth and standard by-product analysis such as processing or storage. The term saponin is derivation of the Latin word "sapo" meaning soap [11, 12].

Steroidal saponins are normally occurring glycosides that have properties such as producing foam, complex formation with cholesterol. Steroidal saponins are found as plant secondary metabolites or a compound that helps proteins go through cellular membranes [13].

### 2. Chemical Composition

Steroidal saponins are extracted from the *Tribulus terrestris* plant. *Tribulus terrestris* contain a number of nutritional supplements along with 45% and 95% steroidal saponins. Protodioscin is the most important among them. Protodioscin is assumed to raise androgen receptor concentrations in cellular structures, encouraging those structures to become more susceptible to androgens like testosterone [14-18]. About 67 steroidal saponins were recognized on the basis of disintegration behaviors and reservation times of reference steroidal saponins (represented by sixty one peaks), including clusters of isomers. From them, fourteen saponins are new compounds [19]. Steroidal saponin are subgroup of steroids which are important class of organic compounds in which the substitution of cholesterol has modified to form 2 special frameworks, one is C-26 furostane (five ring structure) and another is C-27 spirostane (six ring structure, as dioscin). In case of spirostanols, spirokatal arrangement is linked at C-22 and sugar chain is attached at carbon-3. Furostanol has the skeleton such as that of spirostanol although in it sugar chain is not only linked to position C-3 but often also to carbon-26 and it is with open side chain [12].

### 3. Medicinal uses

Steroidal saponins could noticeably nourish the cardiac muscle, slow down platelet aggregation, increase coronary flow, improve peripheral circulation as well as show decline in cholesterol level and triglyceride in blood [13]. *Polygonatum* is a widely known popular Chinese medicine that is broadly used in Japan, Korea and China. In the last decade, it is reported that genus components have steroidal saponins, amino acids, lignins, alkaloids, flavones and carbohydrates, some of them show variable effects on the immune system [14]. Saponins like dioscin and its prosapogenins or gracillin have been recognized from yam. It has been accounted for diosgenin stifled cholesterol assimilation, expanded cholesterol discharge through biliary discharge, initiated segregation of lipoxygenase activity and furthermore actuated the programmed cell death process and cell cycle [15].

The rhizomes of *Dioscorea zingiberensis* are used for the isolation of diosgenin, sapogenin and its glycoside dioscin to produce steroid hormone, for example, sex hormone, progesterone and cortical hormone [20-22]. Then, steroidal saponins can likewise initiate troublesome responses, for example, normal weakness and cardiopalmus response [23]. The rhizome of *Anemarrhena asphodeloides* (Liliaceae) is used to prevent or reduce fever in traditional Chinese medicines. S. saponins are the better critical bioactive compounds in *A. asphodeloides*. It has antimicrobial action, represses carcinoma, diminishes radiation damage, minimizes the blood glucose level and is antagonistic to dementia [24-26]. Sarsasapogenin and its proto structures are viewed as the important aglycones and ordinary sugars display in S. saponins are glucose, xylose and galactose [24, 27, 28]. Polyphyllin D, a steroidal saponin is present in *Paris polyphylla*, a customary Chinese therapeutic herb of Liliaceae family. *Paris polyphylla* displays spermicidal, hemostatic, antibacterial and pain relieving effects. The seed of *Paris polyphylla* are used for the treatment of inflammation, sour throat, abdominal pains, meningitis, respiratory tract tumors and leukemia [29-31].

A S. saponin isolated from *Agave attenuata* (Agavaceae) leaves inhibited increase in vascular permeability and destruction of red blood cells. Steroidal saponin from *Yucca schidigera* showed antifungal and antidermatophytic potency. A saponin division, containing principally mono desmosidic saponins had anti-yeast and antifungal action [32-34]. CAY-1, a S. saponin isolated from the products of *Capsicum frutescens* L. (Solanaceae) appeared to be an intense fungicide and anti-yeast agent [35]. A steroidal saponin, furcraestatin, in ethanolic leaf extract of *Furcraea foetida* (L.) gave specific cytotoxicity in mouse fibroblasts [36]. S. saponins have both cytostatic and cytotoxic activities in leukemia [37-42]. Mimaki et al.

(1998) tested eleven new saponins from *Ruscus aculeatus* L. (Liliaceae). Only two, ruscogenin diglycoside (spirostanol saponin) and its relating 26-glycosyl-oxy-furostanol saponin indicated cell growth inhibitions. Mimaki et al. (1999) tested steroidal saponins of *Dracaena Draco* L. (Dracaenaceae) for their cytostatic activity. Only two saponins indicated cytostatic potential against the leukemia cells [36, 39].

*Yucca schidigera* is a Mexican herb with diverse therapeutic impacts. It has abundant steroidal saponins that may have antihypercholesterolemic and anti-arthritis potentials [43-46]. Various studies emphasized the influence of steroidal saponins on treatment of giardiasis, hypertension, hypercholesterolemia, arthritis, rheumatoid and malignant diseases [47-53]. S. saponins from *Paris polyphylla* have antitumor, antifungal and anthelmintic potentials [54-56]. Plant-determined items have indicated guarantee for the treatment across leishmaniasis [57]. Racemoside A, a water-solvent S. saponin refined from the products of shatavari, is a strong hostile to leishmanial particles [58].

### 4. Conclusions

Many plants contain rich source of S. saponins. Steroidal saponins isolated from different plants have many pharmacological uses. Therapeutic applications involved anti-inflammatory, antifungal, cytotoxic and antitumor, anti-arthritis, antihelmintic and anti leishmanial activities. Pharmaceutical industry now prefers the development of herbal medicines due to their easy availability and low cost.

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