

The Studies of Antifungal Properties of Steroidal Saponin

Ms. Rojalini Samanta¹, Mr. Abhishek Pandey², Mrs. Poonam Bhardwaj³, Bhupen Subba⁴

¹Assistant Professor, Department of Pharmacy, Usha Martin University, Ranchi- Jharkhand

²Assistant Professor, Department of Pharmacy, Himalayan University, Itanagar-Arunachal Pradesh

³Assistant Professor, Department of Pharmacy, Mangalayatan University, Aligarh, Uttar Pradesh

⁴Assistant Professor, Collage of Pharmacy, Sikkim Professional University, Gangtok, Sikkim

ABSTRACT

We examined the efficacy of 6 steroidal sapogenins and twenty-two saponins C-27 steroidal to stop the development of four prevalent opportunistic pathogens: *Aspergillus* species, *Cryptococcus* species, and *Candida* species. It has been revealed that the effect of antifungus of steroidal saponins' is associated type of single saccharide. Out of a total of ten steroidal compounds, four compounds entity showed activity equivalent the positive control. The cytotoxicity of these substances against mammalian cells was distinct from their antifungus influence. The probable Carbon-27 steroidal saponins as antifungus show the way for preclinical investigation.

Keywords: antifungal activity, saponins, pathogens

INTRODUCTION

Individuals with compromised immune systems, such as those with AIDS, cancer, transplants, are more vulnerable different kinds of infection related to fungus (21). When polynes, azles, allylmines, and echncandins interact with ergsterol, Squalene epoxidase, an enzyme and 14-lanosterol demethylase, an enzyme involved in ergosterol biosynthesis, are inhibited (27). Among the drugs included in one of the five categories are Caspofungin, Amphotericin B, Fluctsine Flucnazole, and Terbinfine, among others. Every kind of treatment has substantial drawbacks, such as the dose-limiting toxicity of AMB, the rapid development of resistance to nitrogen ring medications, the limited efficacy of terbinafine for treating dermatophytoses, with the inefficacy of caspofungin for treating cryptococcosis (20, 23, 24). Therefore, new kinds of antifungal medications are required.

C-27 steroidal saponins are used to produce steroid hormones. C-27 steroidal saponins consist of a C-27 aglycone molecule and one or more monosaccharides. The hexacyclic ABCDEF ring structure of spirostanol saponins, as opposed to the open F ring structure of furostanol saponins, is what gives them their soap-making powers. Certain steroid saponins have been proven to be effective against fungal infections in agriculture (5, 7, 33). Other purported advantages include cardiovascular disease, carcinoma, hypoglycemia, immune regulation and other healing (31, 34). Saponins, which are detergent-like surfactants, have been offered as inferior alternatives to conventional medication. During the last ten years, Chinese patients have acquired access to a number of steroidal saponin-based drugs for the treatment of heart and neurological disorders (6, 18). Rheumatism may be efficiently treated using an injectable medication produced from the Dioscoreanipponica plant called Chuan-shan-long (19). Due to their potential for treating liver dysfunction and fungal diseases, steroid saponins have been the subject of multiple patents (3, 4, 22, 28, 29). In some cases,

steroid-modified saponins may be advantageous and safe to use. The potential of these chemical family members as antifungal systemic drug candidates was investigated.

Typically, furostanol saponins lack antifungal activities, while spirostanol saponins have (30). In reaching this decision, the antifungal properties of saponins such as tigogenin, hecogenin, neotigogenin, neohecogenin, diosgenin, and chlorogenin were taken into account (1, 32, 30).

Materials and Methods

Chemicals

The antifungal saponins and saponinogens of American aloe, *Polyanthes lily*, woodlanders, and *Dioscorea parviflora* were evaluated. Examples: (25R) 5-spirost-3-hydroxy-3-0 rhamnopyranosylglycopyranosyl-D-xylopyranosyl-glycopyranosyl-galactopyranoside (10), agamenocside G (10), degalactytigonin (15). 5 α -spirost-3 β -hydroxy-3-0 - β -D-xylopyranosyl-(1-3) (1-2)- (1-3) —D-glycopyranosyl - β -D-glycopyranosyl- (1-4) —D-galactopyranoside (compd 4), agamenside C (compd 5), cantalsaponin (compd 6), agamenside A (compd 7), agavosides A (compd 8) (11), (compd 9) (11), spirost-hydroxi-12-oxo-3-O - β -D-glycopyranosyl-(1-2) - β -D-glycopyranosyl-(1-4) —D-galactopyranosidespirost-3-oxo-12-O - β -D-glycopyranosyl-(1-2) -[β -D-xylopyranosyl-(1-3)] -D-glycopyranosyl (1-4) —D-galactopyranoside (11) agamensides D (12) and E (13) spirost-3 β -hydroxi-12-oxo-3-0 - β -D-xylopyranosyl-glucopyranosyl-xylopyranosyl-(1-3)] - β -D-glycopyranosyl-galactopyranoside (15), agamenside F (11) spirost-3,6-diol-6-0—D-glucopyranoside spirost,diol-3-0-xylopyranosyl- glycopyranosyl-(1-2) -[β -D-xylopyranosyl-glycopyranosyl--galactopyranoside (17), prsapgenindiscin (18), deltnin (19), dioscin (20), collettside I (21), polygonatoside A (22) (16), tigogenin (23), agavegenin A (24), honuanggenin (25), hecogenin (26), chlorogenin (27), and 9(11)-dehydroxyhecogenin (28). Ohio-based ICN Biomedicals provided AMB and doxorubicin as antifungal and cytotoxicity controls, respectively. Pfizer, based in Morris Plains, New Jersey, donated influenza for antifungal testing.

Antifungal assay

Reference strains included *Candida albicans* ATCC 90028, *Candida glabrata* ATCC 90030, *Candida krusei* ATCC 6258, *Cryptococcus neoformans* ATCC 90113, and *Aspergillus fumigatus* ATCC 90906. CLSI (formerly NCCLS) were revised (25, 26). *Candida* species and *Cryptococcus neoformans* were inoculated. Transferring blue agar and incubation allowed for the determination of MFCs. MFC is the least amount in the test that inhibits agar growth.

Cytotoxicity screening.

Five human cancer cell and one noncancerous cell line comprised a panel of ATCC (Manassas, VA) mammalian cells. Positive control for cytotoxicity test was doxorubicin.

Result

Antifungal hongguanggenin saponins were detected in compounds 5-7, antifungal compds 16 to 21. (compound 22). 23 (9(11)-dehydrohecogenin, 23 (tigogenin), 24 (agavegenin A), 25 (hongguanggenin), 26 (hecogenin), and 23 (chlorogenin) were detected in detectable concentrations (compound 27). 28th component The 28th piece of material is as follows: Hecogenin saponins 8–21 demonstrated have no effects on the yeast species *Piriculariaoryzae* and *Candida*. (3, 5, 7, 30). Comparing the hecogenin saponin series will provide similar information on activity important drugs, depending on the amount and structure of monosaccharide units (compounds 8 to 15).

A broad range of fungus species, including *Aspergillus*, others, are susceptible to the antifungal steroid saponins 1-4, 6-11, and 14-20. The antifungus properties of compound 23, together with those of the other saponins and sapogenins of steroid. 5, 7, 8, 9, 10, 12, 13, 15, 16, 18, 21 and, 22 compds. sapogenins' of the steroids lack of antifunguseffectivity is consistent with recent findings that similar compounds are ineffective against *P. oryzae* and *Hansenulaanomala* (7). At MFCs equal to the positive control AMB (1.25 g/ml), the tiggenin saponins showed outstanding. The range of *Aspergillus* three MICs was 2.5–5 g/ml. 19,20compd, for instance, demonstrated efficacy in opposition to *Candida albs* and *Candida glabrat* at a concentration of 20 g/ml, but not against *Candida spand Aspergillus sp.* This is an important result given the lack of efficient antifungal treatments (17,33).

The quantity and kind of monosaccharide componentof theglucose chains of saponins of the steroids, also known as steroidal saponins, affect these compounds' antifunguseffect. These compounds differ from the four tigognin sapogenin in terms of their antifungal activities due to 1,2,3,4 compd.

Each sapogenin's antifungus properties are governed by the sugar chain. Heconin8, 9,10,11,12,13,14,15, also known as sapogenins, exhibit antifungus effects as a result of the structure of their sugar moiety. With as little as two monosaccharide units, the saponin sugar moiety may be inhibited. Tetraglycoside 11 and pentaglycoside 14 are both capable of killing *A. fumigatus*. The antifungal properties of compounds 1-4 in the tigogenin saponin family are controlled by their sugar moiety. 1Compd, which is created by compd 2, has less antifunguseffectivityin opposition to *Candida* than 4Compd, which is created from compound 3.

Conclusion

Experimental tests were performed to determine whether substance was more efficient in eliminating malignant cells using the carcinoma and non carcinoma. Diosgenin saponins 19, 20 have been shown to be cytotoxic. Selectivity for four saponins with antifungal action derived from tigogenins (compounds 1 to 4). At doses up to 20 g/ml, none of the saponins were cytotoxic to cancer cells, but they were to Vero cells (IC₅₀ values of 15, 3, 7, and 7.5 g/ml). With the exception of second substance, which exhibited inhibition concentration in HepG2 cells 7.0 g/ml, this was the case. The most ideal action profile for saponin 1 is suggested by its selectivity indices of 4.9, 5.2, 2.5, 39.5, and 11 *Candida* species and *Aspergillus* species. It is exciting to look at the medicinal potential of these antifungal

substances and the SAR of other steroidal saponins as prospective leads for antifungal therapy.

REFERENCES

- [1]. Bedir, E., I. A. Khan, and L. A. Walker.2002. Biologically active steroidal glycosides from *Tribulus terrestris*. *Pharmazie*57:491-493.
- [2]. Borenfreund, E., and J. Puerner.1985. Toxicity determined in vitro morphological alterations and neutral red absorption. *Toxicol. Lett.*24:119-124.
- [3]. Chen, H., Y. Xu, Y. Jiang, H. Wen, Y. Cao, W. Liu, and J. Zhang. July 2003. Application of *Tribulus terrestris* spirosteroidal saponin to prepare the antifungal medical preparations. Faming ZhuanliShenqingGongkaiShuomingshu. China patent 1428349.
- [4]. De Lucca, A. J., J. M. Bland, C. B. Vigo, M. C. P. Selitrennikoff. October 2001. Fungicidal saponin, CAY-1, and isolation thereof from *Capsicum* species fruit. U.S. patent 6,310,091.
- [5]. Dimoglo, A. S., I. N. Choban, I. B. Bersuker, P. K. Kintya, and N. N. Balashova.1985. Structure-activity correlations for the antioxidant and antifungal properties of steroid glycosides. *Bioorg. Khim.*11:408-413.
- [6]. Feng, Z. Y.1994. Phase II clinical trial of Di-ao-xin-xue-kang in treating angina pectoris. *New Drug Clin. Remed.*13:152-155.
- [7]. Imai, S., S. Fujioka, E. Murata, M. Goto, T. Kawasaki, and T. Yamauchi.1967. Bioassay of crude drugs and oriental crude drug preparations. XXII. Search for biologically active plant ingredients by means of antimicrobial tests. 4. Antifungal activity of dioscin and related compounds. *Takeda Kenkyusho Nenpo*26:76-83.
- [8]. Jin, J. M., and C. R. Yang.2003. Two new spirostanol saponin from fermented leaves of *Agave americana*. *Chin. Chem. Lett.*14:491-494.
- [9]. Jin, J. M., X. K. Liu, and C. R. Yang.2002. A new C-27 steroidal saponin from fermented leaves of *Agave Americana*. *Zhongguo Zhong Yao Za Zhi*27:431-434.
- [10]. Jin, J. M., X. K. Liu, and C. R. Yang.2002. New steroidal saponin from fermented leaves of *Agave Americana*. *Acta Bot. Yunnanica*24:539-542.
- [11]. Jin, J. M., X. K. Liu, and C. R. Yang.2003. Three new hecogenin glycosides from fermented leaves of *Agave americana*. *J. Asian Nat. Prod. Res.*5:95-103.
- [12]. Jin, J. M., X. K. Liu, R. W. Teng, and C. R. Yang.2002. Two new steroidal glycosides from fermented leaves of *Agave americana*. *Chin. Chem. Lett.*13:629-632.
- [13]. Jin, J. M., X. K. Liu, R. W. Teng, and C. R. Yang.2002. Enzymatic degradation of parvifloside. *Acta Bot. Sin.*44:1243-1249.
- [14]. Jin, J. M., Y. J. Zhang, and C. R. Yang.2004. Four new steroid constituents from the waste residue of fiber separation from *Agave americana* leaves. *Chem. Pharm. Bull.*52:654-658.
- [15]. Jin, J. M., Y. J. Zhang, and C. R. Yang.2004. Spirostanol and furostanol glycosides from the fresh tubers of *Polianthes tuberosa*. *J. Nat. Prod.*67:5-9.

- [16]. Jin, J. M., Y. J. Zhang, H. Z. Li, and C. R. Yang.2004. Cytotoxic steroidal saponins from *Polygonatumzhanlanscianense*. *J. Nat. Prod.*67:1992-1995.
- [17]. Keating, G. M., and D. P. Figgitt.2003. Caspofungin: a review of its use in esophageal candidiasis, invasive candidiasis and invasive aspergillosis. *Drugs*63:2235-2263.
- [18]. Li, B. G., and Z. Z. Zhou.1994. Chemistry of the new drug Di-ao-xin-xue-kang treating angina pectoris. *New Drug Clin. Remed.*13:75-76.
- [19]. Li, T. K., R. Zhou, S. H. Zhao, and L. G. Hu.2000. Clinical studies on Zu-shi-ma injection. *New Trad. Chin. Med. Clin. Pharmacol.*11:266-268.
- [20]. Liang, B. B., and R. Wang.2004. The adverse reaction and advances in study on antifungal drugs. *Clin. Med. J.*2:5-12.
- [21]. Liu, W. D., and C. H. Lian.2003. The early stage diagnosis of deep-seated fungal infections. *Chin. J. Lab. Med.*26:583-584.
- [22]. Magota, H., K. Okubo, M. Shimoyamada, M. Suzuki, and M. Maruyama.March 1991. Isolation of steroidal saponin as antifungal agent. Japan patent 03048694.
- [23]. Marr, K. A., C. N. Lyons, K. Ha, T. Rustad, and T. C. White.2001. Inducible azole resistance associated with a heterogeneous phenotype in *Candida albicans*. *Antimicrob. Agents Chemother.*45:52-59.
- [24]. Marr, K. A., C. N. Lyons, T. Rustad, R. A. Bowden, and T. C. White.1998. Rapid, transient fluconazole resistance in *Candida albicans* is associated with increased mRNA levels of *CDR*. *Antimicrob. Agents Chemother.*42:2584-2589.
- [25]. NCCLS.2002. Reference method for broth dilution antifungal susceptibility testing of yeasts; approved standard M27-A2. National Committee on Clinical Laboratory Standards, Wayne, Pa.
- [26]. NCCLS.2002. Reference method for broth dilution antifungal susceptibility testing of filamentous fungi; approved standard, M38-A. National Committee on Clinical Laboratory Standards, Wayne, Pa.
- [27]. Ren, L. J.2004. The clinical application of common antifungal drugs. *China New Med.*3:63-64.
- [28]. Saito, S., and Y. Nagamura.March 1996. Therapeutic agents for hepatitis. Japan patent 8059476.
- [29]. Sashida, Y., Y. Mitsumaki, A. Kuroda, T. Takashi, and K. Sudo.July 2001. Antifungal steroid saponin. Japan patent 2001181296.
- [30]. Sautour, M., A.-C. Mitaine-Offer, T. Miyamoto, A. Dongmo, and M.-A. Lacaille-Dubois.2004. Antifungal steroid saponins from *Dioscoreacayenensis*. *Planta Med.*70:90-92.
- [31]. Sparg, S. G., M. E. Light, and J. V. Staden.2004. Biological activities and distribution of plant saponins. *J. Ethnopharmacol.*94:219-243.
- [32]. Singh Ramgopal,. Seth Rupsa. 2021. Discussing Current Knowledge On Saponins: Structure, Sources And Cytotoxicity. *Drugs and Cell Therapies in Hematology*, 10(3), 229–233.

- [33]. Ahmad FerozShergojri, Saxena Akanksha Anand. (2021). Studying Design Structure And Categories Of Antimicrobial Peptides (Amps). *Drugs and Cell Therapies in Hematology*, 10(3), 312–317.
- [34]. Upadhyay Akash, Shalini Suchita. (2021). Significance Of Secondary Prevention Of Cardiovascular Diseases And Related Lifestyle Intervention. *Drugs and Cell Therapies in Hematology*, 10(3), 263–267.