



BETA-SITOSTEROL MEDICINAL PROPERTIES: A REVIEW ARTICLE

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ABSTRACT

Beta-sitosterol (BS) is a phytosterol, widely distributed throughout the plant kingdom and known to be involved in the stabilization of cell membranes. β -sitosterol is an ancient molecules in plants kingdom. Simple sterols have evolved into more complex forms from single cellular organisms to vascular plants. BS has been reported to have beneficial effects in different diseases as lower urinary tract infection; hypercholesteremia, immunosuppression and inflammation, rheumatoid arthritis and androgenetic alopecia.

Keywords: Beta-Sitosterol, plants, bioactivities

INTRODUCTION

Phytosterols are a subgroup of the steroids, as an important class of bioorganic molecules, widespread in plants, animals, marines as well as fungi and have similarity to cholesterol in structure. These compounds have a long history of consumption as food or pharmaceutical products, and generally recognized as safe without undesirable side effects. Beta-sitosterol (BS) is one of the several phytosterols with a chemical structure similar to that of cholesterol [1]. BS has been reported to be present in various dietary and non-dietary plants. reported regarding its membrane stabilizing effect on cell membrane. It is a natural micronutrient in higher plants and is found in the serum and tissues of healthy individuals at a concentration 800–1000 times lower than that of endogenous cholesterol. Its glycoside, sitosterolin, is also present in serum, but in lower concentration [2]. BS is generally considered as a safe, natural, and effective nutritional supplement and has been shown to have many potential benefits. Administration of BS in rats is found not to cause genotoxicity and cytotoxicity [3]. BS has antioxidant, antimicrobial, angiogenic, antioxidant, immunomodulatory, antidiabetic, anti-inflammatory, anticancer, and antinociceptive activities without major toxicity [4, 5]. There are some nutraceutical preparations available on the market which contain BS. Their manufacturers claim many beneficial effects without substantial experimental evidence [4, 5]. The aim of this review is to give the significance as well as the information of Beta-sitosterol (BS).

BIOLOGICAL ACTIVITIES

Beta-Sitosterol as anti-Cancer agent:

Beta-sitosterol has anticancer effects against breast cancer, prostate cancer, colon cancer, lung cancer, stomach cancer, ovarian cancer, and leukemia. Studies have shown that BS interfere with multiple cell signaling pathways, including cell cycle, apoptosis, proliferation, survival, invasion, angiogenesis, metastasis and inflammation. Most of the studies are incomplete partly due to the fact that BS is relatively less potent. But the fact that it is generally considered as nontoxic, the opposite of all currently available cancer chemotherapeutics, is missed by almost all research communities. To offset the lower efficacy of BS, designing BS delivery for “cancer cell specific” therapy hold huge potential. Delivery of BS through liposome is one of such demonstrations that has shown to be highly promising. But further research did not progress neither in the field of drug delivery of BS nor in the field on how BS mediated anticancer activities could be improved, thus making BS an orphan nutraceutical [6].

Antioxidant Activity:

Several studies suggest that BS has antioxidant effect [7]. It has also been shown to modulate antioxidant enzymes and human estrogen receptor. It has been reported from a study that BS reduced Oxygen free radical and Hydrogen Peroxide levels in Phorbol myristate acetate (PMA) stimulated RAW 264.7 cells but does not function as a radical scavenger [8].

Anti-Diabetic Effect:

Oral treatment with BS increases the fasting plasma insulin levels. There is a corresponding decrease in fasting glycemia when BS is administered orally. In addition, it improves the oral glucose tolerance test with an increase in glucose-induced insulin secretion. These effects are comparable to that of the standard anti-hyperglycemic drug Glibenclamide [9].

Antimicrobial Activity:

BS obtained from different plants proved antibacterial and antifungal effects without toxicity in brine shrimp lethality assay [10]. The formulation or plant extract containing BS shows mosquito larvicidal activities and antitrypanosomal activities [11]. BS has been reported to have antibacterial activity with a comparable zone of inhibition to other standard antimicrobial agents [12].

Anti-Inflammatory Activity:

BS had anti-inflammatory activity in human aortic cells (Loizou et al., 2010) as well as in rats. Several studies in animals have indicated that BS reduces the secretion of pro-inflammatory cytokines, as well as edema and increases anti-inflammatory cytokines [13].

Immune Modulation and Anti-HIV Effect:

BS has been shown to act as a powerful immune modulator [14]. BS exhibits immune-modulating activities in HIV-infected patients [15]. It has also been reported that BS targets specific T-helper (Th) lymphocytes, increasing Th1 activity and improving T-lymphocyte and natural killer (NK) cell activity [16]. In another study it was observed that BS maintains stable CD 4 cell counts in AIDS, declines apoptosis of CD 4 lymphocytes slightly, thereby slowing HIV. A significant decrease in IL-6 levels in the same study leads to a further claim that there is slowing down of viral replication rates in infected cells thereby decreasing viral load [17].

Anti-Pulmonary Tuberculosis Effect:

BS has been found to have a significant improvement in weight that is lost due to pulmonary tuberculosis. The same study showed that patients receiving BS exhibit notable differences in certain hematological parameters, including increased lymphocyte, eosinophil, and monocyte counts. The detailed mechanism of this effect has not yet been studied. The efficiency of BS as immune modulating agent in case of multi-drug-resistant tuberculosis needs further investigation [18].

Anti-Arthritic Activity:

It has been reported from a study that the plant extract containing BS has significant anti-arthritic activity. BS decreases the activation of NF-B transcription factor in PMA-stimulated macrophage cells. However, further investigations are required regarding the therapeutic potential of BS to treat arthritis [19].

Antipyretic Activity:

The antipyretic effect of BS is comparable to that of aspirin. The preparations and extracts of plants containing BS have also been shown to have antipyretic activity. This effect is comparable to that of the standard antipyretic drug, aspirin [20].

CONCLUSION

This review showed the pharmacological effects of Beta-Sitosterol.

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