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Potential of beta sitosterol in medicinal plants used in BPH: A review

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Abstract
Background: ß-Sitosterol, a main dietary phytosterol found in medicinal plants & food, may have the potential for prevention and therapy for human cancer, BPH, High cholesterol. Phytosterols are plant sterols found in foods such as oils, nuts and vegetables and medicinal plants such as arjuna, giloy, Varun etc. Prostatic hypertrophy (BPH), also known as benign prostatic hyperplasia is a non-cancerous growth of the prostate gland in men, which occurs with natural ageing. In Ayurveda, the Prostate gland, when affected by vitiated *Vatha, (Apaan Vayu)* causes a disease called *"Vathaashteela"* this condition is comparable to Benign prostate hypertrophy. In Ayurveda, it is a abnormalities of *tridoshas* (mainly vitiated *vata dosha*).
Objective: Explored to medicinal plants which contain ß-sitosterol shows the anti BPH properties as Arjuna(Terminalia arjuna), haridra (Curcuma longa), Kummari (Aloe vera), Shatavari(Aperagus racemosus), Pippili (Piper longum) etc. to assess and find out the anti-BPH activity.
Material & Method: In the present study, we collected and compiled references regarding Ayurvedic classical text, Pharmacological classical text., previous work, research papers, review articles, research gate, google scholar etc. done on anti-BPH effect of beta-sitosterol found in above-mentioned medicinal plants.
Discussion & Conclusion: Based on literary review it is concluded that ß-sitosterol is responsible for significant anti-BPH effect. This article will discuss the benefits with use of ß-sitosterol. The current review focuses on uses of Beta-sitosterol and medicinal plants which contain ß-sitosterol.

Keywords: ß-sitosterol, Benign prostastic hyperplasia, medicinal plants

Introduction

What is ß sitosterol?

ß sitosterol is probably the most important active ingredient in phytosterols, which are found in medicinal plants and are thought to be useful in treating urinary problems related to BPH, High cholesterol, cancer etc.. ß-Sitosterol, a main dietary phytosterol found in food & medicinal plants, may have the potential for prevention and therapy for human cancer, BPH, High cholesterol. Phytosterols are plant sterols found in foods such as oils, nuts and vegetables and medicinal plants such as arjuna, giloy, Varun etc. Phytosterols, in the same way as cholesterol, contain a double bond and are susceptible to oxidation, and is characterized by anti-carcinogenic, anti-inflammatory and anti-atherogenic properties. ß-sitosterol is a phyto-pharmacological extract containing a mixture of phytosterols, with smaller amounts of other sterols, bonded with glucosides. The purported active constituent is termed ß-sitosterol. Additionally, the quantity of ß-sitosterol-ß-d-glycoside is often reported. Although the exact mechanism of action of ß-sitosterols are unknown it may be related to cholesterol metabolism or anti-inflammatory effects (via interference with prostaglandin metabolism). Compared with placebo, ß-sitosterol improved urinary symptom scores and flow measures. A plant food-based diet modifies the serum ß-sitosterol concentration in hyper androgenic postmenopausal women. This finding indicates that ß-sitosterol can be used as biomarker of exposure in observational studies or as compliance indicators in dietary intervention studies of cancer prevention. ß-sitosterol induces apoptosis and activates key caspases in MDA-MB-231 human breast cancer cells.

History

Plant sterols were chemically described in 1922. Later in the 1950s, it was noted that these sterols lower cholesterol concerations by reducing the absorption of cholesterol from the gut. However, by the 1980s, stains were introduced to the market, so the role of plant sterol in lipid lowering was diminished. Subsequently, it has been recognized that, as naturally occurring substances, plant sterols can be added to foods. Margarine appears to be an ideal vehicle. Over the last 15 years, there also have been several reports in the literature indicating that phytosterols have some immunological activity.

Chemistry

Sterols are essential components of cell membranes, and both animals and plants produce them. The sterol ring system is common to all sterol, the differences are in the side chain. They are 28- or 29- carbon alcohols. ß-sitosterol is the most

common plant sterol and is structurally similar to cholesterol. Because of this structural similarity, ß-sitosterol can replace cholesterol in the human body. ß-sitosterol is 4-desmethyl sterol. It has a double bond at the C-5 position in the ring and it is usually esterifies with fatty acids for incorporation into margarine

Benign prostatic hyperplasia

Benign prostatic hypertrophy (BPH) - also known as benign prostatic hyperplasia, is one of diseases frequently seen in men above 45 years old. This condition attracts more and more consideration as the life-span is increasing, especially in developing countries, the prevalence of the disease is also gradually increasing with age and reaches 86% by the age of 81-90 years old.

Prostate size increases gradually leading to benign prostatic hyperplasia (BPH) in most men older than 45 years. Benign prostatic hyperplasia is a non- malignant enlargement of the prostate that is due to excessive cellular growth of both the glandular and the stromal elements of the gland in the peri-urethral zone of the prostate. BPH is nearly universal result of the aging process in men. The growth / neoplastic changes in the prostatic gland occur due to the changes in the level of hormones especially androgens and estrogens seen in men over 50 years of age. The principal hypothesis for the hypertrophic reaction of prostate tissue is steroid mediated cellular proliferation and inflammatory response to local infection. Also inefficiency of apoptotic machinery and aberrant stromal- epithelial interactions are also suggested to probably contribute to the abnormal growth of prostate.

Cause of BPH

The concept of nodular hyperplasia in pathology of BPH has been established but its exact cause is still unknown.

Symptoms of BPH

Symptoms of BPH can be either irritative or obstructive. Obstructive symptoms include straining, hesitancy, weak stream, intermittency, and sense of incomplete bladder emptying and irritative symptoms include urgency, frequency, and nocturia.

Incidence of BPH

The overall incidence rate of BPH is 15per 1000 men per year. The incidence of BPH is at least 50 % for all men at the age of 40 years and above. In India BPH is a common pathological condition with an incidence of 92.97% and 93.3%.

BPH correlate in ayurveda -vatastheela

The vitiated vata gets lodged between the bladder and rectum and produces the stony hard swelling i.e. enlargement of prostatic tissue. On examination–A vrutta granthi which is slightly movable, elevated and hard to firm in consistency. Leading to Retention of urine, faeces and flatus with Distension of the urinary bladder, and Excruciating pain in the bladder.

Objective

Explored to ß-sitosterol found in medicinal plants shows the anti BPH properties as Arjuna (Terminalia arjuna), haridra (Curcuma longa), Kummari (Aloe vera), Shatavari (Aperagus racemosus), Pippili (Piper longum) etc. to assess and find out the anti-BPH activity.

Material & method

ß-sitosterol has been shown to improve urinary symptoms and flow. It has been suggested that ß-sitosterol may be useful for men with mild to moderate BPH, particularly those who would like to avoid the adverse effects of prescription medication.

Anti -BPH action

This non-malignant enlargement of the prostate can lead to obstructive and irritative lower urinary tract symptoms. It use of plants and herbs for the treatment of BPH symptoms has been steadily growing in most countries. ß-sitosterol has a long history of use in Europe for treating an enlarged prostate. According to a report in the June 2005 issue of "Life Extension" magazine, studies have found that ß-sitosterol reduced symptoms of enlarged prostate, such as reduced urinary flow. β-sitosterol improved urinary symptoms and flow measures and was generally well tolerated. Beta-sitosterol can bind to the prostate to help reduce swelling and inflammation. β-sitosterol may be a useful treatment option for men with mild to moderate BPH, particularly those who would like to avoid or are at increased risk for adverse effects from alpha-adrenergic receptor blockers. These agents (eg, prazosin) selectively block alpha-1-adrenergic receptors. The degree of smooth muscle tone in the prostate and bladder neck is mediated by the alpha-1-adrenergic receptor, which is present in high density in the prostatic stroma, prostatic capsule, and bladder neck. Blockade of the alpha-$_1$-adrenergic receptor decreases urethral resistance and may relieve the obstruction and improve urine flow and BPH symptoms. Beta-sitosterol appears to act like the prescription drug Proscar (finasteride), which inhibits activity of 5-alpha-reductase. Many men take natural treatment to treat enlarged prostate due to benign prostatic hyperplasia (BPH). Sometimes men with urinary symptoms of chronic prostatitis/chronic pelvic pain syndrome(CP/CPPS) take Proscar and similar medications, but Proscar has many negative side effects such as erectile dysfunction and other sexual problems. Patients looking for a natural approach to prostatitis and urinary health may turn to beta-sitosterol instead, because Beta-sitosterol works in a similar way to the drugs without causing undesirable sexual side effects.

When taken at high doses and along with other sterols, beta-sitosterol has been shown to reduce levels of total cholesterol and low-density lipoprotein (LDL) cholesterol by reducing the amount of cholesterol the body absorbs. This may inhibit the production of dihydrotestosterone (DHT). There is also some evidence that beta-sitosterol may boost immunity.

Beta-sitosterol found in many medicinal plants. I explored in these medicinal plants which contain ß-sitosterol.

Table 1: Medicinal plants which contain beta-sitosterol

S.N.	Sanskrit Name	Latin Name	S.N.	Sanskrit Name	Latin Name
1	Arjun	Terminalia arjuna	45	Shirish	Albizzia lebbeck
2	Ashok	Saraca asoca	46	Vibhitak	Terminalia bellerica
3	Agnimanth	Clerodendrum phlomidis	47	Kusmand	Benincasa hispida
4	Gambhari	Gmelia arborea	48	Mandukparni	Centella asiatica
5	Dronpuspi	Leucas cepholotes	49	Shatpuspa	Anethum sowa
6	Punarnava	Boerhavia diffusa	50	Mishriya	Foenieulum vulgare
7	Pippili	Piper longum	51	Puskarmool	Inula racemosa
8	Udumber	Ficus glomerata	52	Chitrak	Plumbago zeylanica
9	Talishpatra	Abies webbiana	53	Estrikutaj	Wrightia tinctoria
10	Haridra	Curcuma longa	54	Karvir	Nerium indicum
11	Kumari	Aloevera tourn	55	Ark	Calotropis procera
12	Shatavari	Asparagus racemosus	56	Shariva	Hemidesmus indicus
13	Mustak	Cyperus rotundus	57	Kiratatikta	Swertia chirayita
14	Chavya	Piper retrofroctum	58	Shankhpuspi	Convolvulus pluricaulis
15	Chammpak	Magnolia sativus	59	Brihati	Solanum indicum
16	Kasthadaru	Polyalthia longifolia	60	Dhatura	Datura metel
17	Khubkala	Sismbrium irio	61	Brahmi	Bacepa monnieri
18	Mulak	Raphanus sativus	62	Syonak	Oroxylum indicum
19	Tilparni	Gynandropsis gynanndra	63	Vasa	Adhatoda vasica
20	Punnag	Colopfiyllum inophyllem	64	Nirgundi	Vitex negundo
21	Surpunag	Mammea longifolia	65	Bilv	Aegle marmelos
22	Khatmi	Althoea officinalis	66	Nimba	Azadirachta indica
23	Gangeruki	Grewia tenax	67	Ativisha	Aconitum heterophylum
24	Atsi	Linum usitatissimum	68	Guduchi	Tinospora cordifolia
25	Kanku	Corchus fascicularis	69	Varun	Crataeva nurvala
26	Arlu	Ailanthus excels	70	Nagkeshar	Mesua ferrea
27	Shallaki	Boswellia serrata	71	Sala	Shorea robusta
28	Draksha	Vitis vinifera	72	Atibala	Abutilon indicum
29	Tinduk	Diospyros peregrine	73	Goksur	Tribulus terrestris
30	Shanpuspi	Crotalaria verrucosa	74	Jyotismati	Celastrus panniculatus
31	Asmantak	Ficus rumphii	75	Karkatsringi	Pistacia integerrima
32	Asthisrikhala	Cissus quadrangularis	76	Aparajita	Clitoria termatea
33	Virtaru	Dichrostachys cineria	77	Sharpunkha	Tephrosia purpurea
34	Kukundar	Blumea lacera	78	Kanchnar	Bauhinia variegate
35	Parijat	Nyctanthes arbortristis	79	Chirbilv	Holoptelea integrifolia
36	Slesmatak	Cordia dichotoma	80	Katphala	
37	Saireyak	Barleria prionitis	81	Bhurj	Betula utilis
38	Medasak	Litsea glutinosa	82	Ananas	Ananas comosus
39	Bandak	Dendrophthoe falcate	83	Dipantarvacha	Smilax china
40	Jayapal		84	Langali	Gloriosa superb
41	Vata	Ficus bengalensis	85	Ketaki	Pandanus odorotisstmus
42	Asvattha	Ficus religiosa	86	Suran	Amorphophallus campanulatus
43	Plax	Ficus lacor	87	Mayurshikha	Adiantum caudatum Linn
44	Kakodumbar	Ficus hispida			

Pharmacological actions

1. **Cholesterol-lowering effects:** Plant sterol in fortified margarine reduce the absorption of cholesterol from the gut by about half. This reduced absorption lower serum cholesterol concentrations despite the compensatory increase in cholesterol synthesis that occurs in the liver and other tissues.
2. **Immunomodulatory effects:** ß-sitosterol can increase the proliferation of peripheral blood lymphocytes and enhance the cytotoxic effect of natural killer cells. It is use in chronic inflammatory conditions. It can prevent the typical neutrophilia, lymphopenia and total leukocytosis.
3. **Anticancer properties:** ß-sitosterol has demonstrated effects on tumor cell lines in vitro. Growth is inhibited in human colon, prostate and breast cancer cell lines. It has been postulated that cell death (Apoptosis) is initiated, probably by activation of the protein phosphatase A2 pathway. The report also noted that ß-sitosterol reduced the growth and spread of prostate cancer cells and induced apoptosis the process where cancer cells self-destruct. These studies involved animals or isolated prostate cancer cells, however, and do not firmly establish the therapeutic benefit in humans.

Other Benefits

Drugs.com notes beta-sitosterol might enhance immune function. They include treating colds and flu, asthma, hair loss, gallstones, enhancing sexual function and relieving symptoms of menopause.

What is the recommended dosage?

Beta sitosterol is incorporated in margarine, yogurt, or other foods to give a daily intake of 1.5 to 3 g. To lower cholesterol, you require about 2 grams of beta-sitosterol daily. ß-sitosterol for enlarged prostate used between 130 milligrams and 180 milligrams daily

Regular consumption of beta-sitosterol could lower levels of carotenes and vitamin E and you might require supplementation.

Side effects

High levels of β-sitosterol concentrations in blood have been correlated with increased severity of heart disease in men having previously suffered from heart attacks.

Conclusion

β-sitosterol is usually used for heart disease, BPH, hypercholesterolemia, modulating the immune system, prevention of cancer, as well as for rheumatoid arthritis, tuberculosis, cervical cancer, hair loss. Some of the above medicinal plants are sources of ß-sitosterol. Regarding to the importance of β-sitosterol as the most abundant of them, the main pharmacological and biological activities is reviewed here. These Above Medicinal plants are mainly use in Heart diseases, BPH and cancers.

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