Soy - A Hidden Treasure For Therapeutic, Cosmetic And Pharmaceutical Use

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Abstract

Soy is a legume from the family Fabaceae. In many countries it is one of the most important food crop. Soyabean is the seed obtained from the pod of the plant and is classified as oilseeds. It is rich in protein carbohydrates, saponins, phytiacid and oil but has lower levels of calcium. It has wide range of therapeutic as well as pharmaceutical applications. It has sedative, anti-spasmodic, diaphoretic, anti-pyretic properties, with hormonal balancing effects, can be used to prevent breast cancer, prostate cancer, endometrial cancer and baldness and has great benefit to the liver and circulation. It acts as a component of easy release jelly and also as an agent that provides good hardness and disintegrating property. It has application in sunscreen cream, moisturizing cream, and anti-wrinkle cream. Although it has many advantages and use but it is not without risk such as it can increase the rate of tumor growth in persons already suffering from cancer.

INTRODUCTION

Soy is believed to be derived from Glycine ussuriensis, a legumes that performs nitrogen fixation symbiotically. It is from Kingdom: Plantae, Phylum: Magnoliophyta, Class Magnoliopsida, Order: Fables, Family: Fabaceae, Subfamily: Faboideae, Genus: Glycine and Species:G.max. China considers soyabeans as one of its sacred plants. During World War II, soybeans became important in both North America and Europe chiefly as substitutes for other protein foods and as a source of edible oil. Cultivation is successful in climates with hot summers, with optimum growing conditions in mean temperatures of 20°C to 30°C; temperatures of below 20°C and over 40°C retard growth significantly.[1] They can grow in a wide range of soils, with optimum growth in moist alluvial soils with a good organic content. Beans are usually classified as pulses whereas soyabean classed as oilseeds. Soybeans occur in various sizes, and in many hull or seed coat colors, including black, brown, blue, yellow, green and mottled. The hull of the mature bean is hard, water resistant, and protects the cotyledon and hypocotyl (or “germ”) from damage.[2] The scar, visible on the seed coat, is called the hilum (colors include black, brown, buff, gray and yellow) and at one end of the hilum is the micropyle, or small opening in the seed coat which can allow the absorption of oil.

CHEMICAL COMPOSITION OF THE SEED

The oil and protein content together account for about 60% of dry soybeans by weight; protein at 40% and oil at 20%. The remainder consists of 35% carbohydrate and about 5% ash.[3]

Soybean cultivars comprise approximately 8% seed coat or hull, 90% cotyledons and 2% hypocotyl axis or germ.[4]

The principal soluble carbohydrates, saccharides, of mature Soya beans are the disaccharide sucrose (range 2.5–8.2%), the trisaccharide raffinose (0.1–1.0%) composed of one sucrose molecule connected to one molecule of galactose, and the tetrasaccharide stachyose (1.4 to 4.1%) composed of one sucrose connected to two molecules of galactose.[5]

It also contains saponins. Soybeans, as a major source, have a saponin content of five to six percent by weight. Saponins bind cholesterol and bile acids in the gut,lowers the cholesterol .Also they appear to inhibit or kill cancer cells without killing normal cells.[6],[10] It also contains phytiacid acid which has the chelating property of phytiacid is seen with zinc, iron and calcium. The deficiency of zinc, iron and calcium ratio increases hypercholesterolemia.[7]

While the oligosaccharides raffinose and stachyose protect the viability of the Soya bean seed from desiccation, they are not digestible sugars therefore contribute to flatulence and

abdominal discomfort in humans and other monogastric animals; compare to the disaccharide trehalose.[8],[9] Undigested oligosaccharides are broken down in the intestine by native microbes producing gases such as carbon dioxide, hydrogen, nitrogen, methane, etc. On the other hand it encourages indigenous bifidobacteria in the colon against putrefactive bacteria.[11] The insoluble carbohydrates in Soya beans consist of the complex polysaccharides cellulose, hemicellulose, and pectin. The majority of its carbohydrates can be classed as belonging to dietary fiber.[10]

The majority of soy protein is a relatively heat-stable storage protein.[12] This heat stability enables Soya food products requiring high temperature cooking, such as tofu, soymilk and textured vegetable protein (Soya flour) to be made.[13]

Soy carbohydrates are found mainly in the whey and are broken down during fermentation, thus Soy concentrate, Soy protein isolates, tofu, Soy sauce, and sprouted Soya beans are without flatus activity.[14]-[17]

THERAPEUTIC USES OF SOYA

Seeds and oils are mainly used. Soybean is a sweet, cooling and slightly bitter herb and sedative, anti-spasmodic, diaphoretic (causes sweating) and anti-pyretic properties, with hormonal balancing effects and has great benefit to the liver and circulation.

Used in Chinese medicine for a variety of ailments such as fever, headache, insomnia, restlessness, and chest discomfort associated with colds and measles.

Soy lecithin lowers serum cholesterol levels, and the soy phospholipids are useful in combating chronic liver disease as well as chronic hepatitis.[18]

Oil has multitude of benefits for the skin, it has a regenerative effect on the cutaneous tissues due to the presence of unsaturated fatty acids, and therefore enhances local circulation in the area treated to bring about revitalization of the dermis.[19]

Soy diet is the low fat diet that can generate the positive impulse in the atherosclerosis. Formations of artery blocking blood clots are reduced.

The oil is extracted from the beans and is a good source of vitamin E as well as lecithin. It has anti-oxidant activity. [20]

The presence of sugars and amino acids cooperate in moisturizing the moisture of the horny layer of the skin and give it back the elasticity and flexibility that are characteristic of normal skin.[21]

Tofu contains, the soy isoflavones, genistein and daidzein, that remains bound to the soy protein. Firm tofu contains about 35 mg isoflavones per 100g.) Soy improves bone health. Soy products, such as soy milk, do not contain a lot of calcium but the soy isoflavones may help to reduce the osteoporosis risk. Several studies have suggested that soy isoflavones may be a factor in helping to prevent bone loss. The isoflavone genistein seems to inhibit bone breakdown and may have similar effects than estrogens in maintaining bone tissue. Soy can also indirectly improve bone health. Diets which are high in animal protein cause more calcium to be excreted in the urine. Replacing animal protein with soy protein may help to prevent calcium loss from the bones.[22]

Soy relieves menopausal symptoms. Epidemiological data show that Asian women suffer less from hot flashes and night sweats compared to Western women. These symptoms of menopause are caused by low estrogen levels. Estrogens play a role in the body temperature control. Soy isoflavones can through their estrogen-like effect control these menopausal symptoms.[23]

Soy reduces risk for heart diseases. In countries where soy products are ingested regularly, the rates of cardiovascular diseases are low. Research suggests that soy may help to prevent heart disease by reducing total cholesterol, low density lipoprotein cholesterol and preventing plaque buildup in the arteries, which could lead to stroke or heart attack. These health benefits are also mainly attributes to the soy isoflavones. The soy isoflavone genistein may also increase the flexibility of blood vessels.[24]

Soy reduces endometrial cancer. This protective effect of soy was particularly significant among obese women, who are at high risk for endometrial cancer. Soy foods may be protective because they are rich in isoflavones, which act like estrogen in the body but are not as potent as natural estrogen. Isoflavones alter the endogenous estrogen concentrations by binding competitively to estrogen receptors, thereby inhibiting important steroid biosynthetic enzymes, increasing the clearance of steroids from the circulation and stimulating the production of sex hormone binding globulin.[25]

Soy reduces breast cancer risk. Eating soy-rich foods could reduce a woman's risk of developing breast cancer. A study

has found that women who eat soy-rich diets have less “high risk” dense tissue. This study showed for the first time how the amount of soy a woman eats may have an effect on breast tissue and in turn may potentially reduce risk of breast cancer. The health benefits of soy may therefore be dependent upon the amounts of the various hormonally active phytochemicals present. It has been found that increased biosynthesis of the isoflavonoid phytoalexin compounds, glyceollins I, II and II, in soy plants grown under stressed conditions (elicited soy) which exhibit marked anti- estrogenic effects on ER function. The glyceollin (I-III) compounds may represent an important component of the health effects of soy as well as represent novel anti-estrogens useful in the prevention or treatment of breast carcinoma.[27]

Soy may prevent baldness. Equol is showing promise as a powerful blocker of a potent male hormone involved in prostate cancer[26], male baldness and even acne. During digestion the two soy isoflavones, genistin and daidzin, are metabolized to form genistein and daidzein. Finally daidzein is metabolized to equol. Equol seems to block the bad function of DHT. It is known that DHT also causes loss of hair follicles resulting in baldness. If equol can block DHT this means that soy isoflavones have a tremendous potential in preventing male baldness.[2] These finding are very interesting because other current treatments for prostate cancer involve decreasing or blocking the production of testosterone,resulting in fatigue and low libido. Equol, on the other hand, does not interfere in the production of DHT but prevents it from functioning.[28]

PHARMACEUTICAL USE

Soy polysaccharides, which are substantially high molecular weight cell wall structural components of soybean cotyledons, are mixed with a therapeutically-active substance and the mixture can be made into a tablet by conventional means such as wet or dry granulation or direct compression procedures.[29] The tablets obtained by this method have sufficient hardness and highly beneficial disintegration properties.

It is a component of easy-release jelly which comprises of an emulsified polyunsaturated fatty acid such as -linolenic acid or derivative thereof in an amount greater than 10% wt, an emulsifying agent, and a gelling agent. “easy release” indicates that the polyunsaturated fatty acid contained in the jelly composition is rapidly released and absorbed within the digestive tract when the jelly composition is administered.[30] It has excellent disintegrability, excellent active ingredient releasability within digestive tract and the active ingredient and the preparation itself has long-term stability, excellent ease of operation such as manufacturability and filling into containers, easy to be swallowed and rapid absorptivity from digestive tract.

COSMETIC USE

The soy oil contains a high proportion of phytosterols which promotes good skin care. Also used in sunscreen products due to their anti-oxidising and anti-inflammatory action.[31]

It can be used as massage carrier oil in aromatherapy. It is used as a fixative to extend the short duration of action of essential oils such as geranium oil in several commercial products.[32]

A topical composition comprising soy molasses extract containing soy phytochemicals, is useful in the treatment and amelioration of dermatologic disorders and for cosmetic purposes.[33]

In a recent study, a soy formulation containing protease inhibitors that were not heat denatured, was tested for it's possible usefulness in improving skin tone and lightening skin dyspigmentation.[34]

It can be used for preparation of moisturizing cosmetic preparation in which basic component is a soyabean derivative as phosphatidylcholine. The basic proportion of the composition is Phosphatidylcholine -0.0 to 20.0%, Lipophilic substance, e.g., oil- 0.0 to 25.0% ; Basic substance-0.1 to 20.0%. basic substance alone can produce vesicles and can be combined with lipophilic substances without the addition of phosphatidylcholine.[35],[36] It can be employed for daily facial and body care, particularly for the treatment of dry skin, for the treatment of skin blemishes and for the re-establishment of optimal linoleic acid levels in the deeper layers of the skin.

HEALTH RISK OF SOYA

Soybeans contain isoflavones called genistein and daidzein, which are one source of phytoestrogens in the human diet. Another phytoestrogen in the human diet with estrogen activity is coumestans, which are found in beans, split-peas, with the best sources being alfalfa, clover, and soybean sprouts. Coumestrol, an isoflavone coumarin derivative is the only coumestan in foods.[37] Soybeans and processed soy foods do not contain the highest “total phytoestrogen” content of foods. Plant lignans associated with high fiber

foods such as cereal brans and beans are the principal precursor to mammalian lignans that have an ability to bind to human estrogen sites. Soybeans are a significant source of mammalian lignan precursor secoisolariciresinol containing 13–273 μg/100 g dry weight. Women with current or past breast cancer should be aware of the risks of potential tumor growth when taking soy products, based on the effect of phytoestrogens to promote breast cancer cell growth in animals.[38] Soy may prevent breast cancer, but cautioned that the impact of isoflavones on breast tissue needs to be evaluated at the cellular level in women at high risk for breast cancer.[39]

The mimicry of estrogen by the phytoestrogens in soy has introduced a controversy over whether such a replacement is harmful or helpful to the brain. Several studies have found soy to be harmful for rats.[40]

Raw soy flour is known to cause pancreatic cancer in rats. Whether this is also true in humans is unknown.

Soy products and more specifically the phytoestrogen it contains might lower a man's sperm count.[41]

Soy Allergy may cause cases of urticaria (hives) and angioedema (swelling), usually within minutes to two hours of ingestion of the food, rarely severe cases of true anaphylaxis may occur, a condition that is much more common with allergy to foods such as peanut and shellfish.[42][43]The consumption of soybean oil, which only contains traces of soy proteins, does normally not produce allergic reactions.[10]

CONCLUSION

Soy as most commonly known in the form of soybean is the plant of multipurpose use. It is not only the source of protein as it is famous of; but it is also rich in other nutrients such as vitamins, carbohydrates, oils, fibers, etc. Apart from this its end products after the extraction process such as molasses are useful in pharmaceutical industries. It is economical but its use is not without controversy as it may lead to increase in cancer risk in post-menopausal women also its excessive use may cause constipation in some patients but benefits are many a fold times more than risk as it can prevent various cancers, lower the bad cholesterol level, prevent hair loss, its anti-ageing property etc. Although it has some negative effects also but if properly exploited for its beneficial use it can become the treasure of future for the nutritionist, medical practitioner and pharmaceutical industries as well as for the common man.

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