

Processing of Soy Products and Food Allergies

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ABSTRACT

Soya also called soybean a legume which is low in saturated fat and rich in protein, vitamin C, calcium, potassium, iron, thiamin and healthful because it contains all the essential amino acids and iso-flavones. Most of the places it is used as a food and as a protein supplements. Soy is also used to extract oil and this soy oil if used for various purposes such as engine lubricant, crayons, candles and ecologically friendly fuel. The nutritional value of soy and their products is based on how it is processed and what type of ingredients are added. There are so many benefits of taking soy in our diet such as it reduces the risk of breast cancer, Diarrhoea, Kidney diseases, High blood pressure, manages obesity, lower the risk of heart diseases, osteoporosis, diabetes. Soy can be processed into many products such as soy milk, soy fiber and soy protein. A compound called isoflavone is present in the soy which changed to phytoestrogens in the body which is similar in structure to oestrogen hormone. Phytoestrogens affects the normal functioning of the oestrogen by blocking its effects because in some cases phytoestrogens mimics the effects of oestrogen. Soy has so many benefits but in some cases it causes side effects such as mild constipation, nausea, bloating and some allergic reactions such as itching, tightness in throat, stomach cramps, vomiting, rashes, dizziness, swelling and breathing problems because soy allergens affects immune system to overreact to soy proteins. There are some allergenic proteins in soy which may cause allergy are: Gly m 1, Gly m 2, Gly m 3, Gly m 4, Gly m 5, Gly m 6, Gly m 7 and Gly m 8. To attain the desirable properties soy ingredients are processed by various processes such as enzymatic hydrolysis and heat treatments which may leads to reduce the allergenicity in some cases but in most of the cases heat treatments increase the allergenicity.

Keywords: Soy; Allergy; Effects; Processing

Introduction

Soybean (*Glycine max*) is a legume crop rich in protein. In the food industry soybean is the most important crop in Asian countries and North and South America on the basis of economically and increasing trends of cultivation and processing of food. USA, Argentina and Brazil are the largest soybean producing countries in the world which is around 380 million metric tons. Soybean is very rich in protein because it contains around 400 g/kg of high quality proteins that is 36 to 56% of total soybean content and 200 g/kg oil [Luthria, et al. [1-5]]. Soybean is used in various food products such as it is used in many infant formulas, vegetarian dishes, industrially processed foods, soybean milk, lactose free foods, flavour enhancers, bakery products, yoghurts, chocolate, sausages, pastry, soybean sauce, cereals etc. Soybean is also used in cosmetic products because soybean also contain macromolecules such as minerals (4%), unsaturated fatty acids (24%), fiber (23%), vitamins, carbohydrate (6%) and other biologically active compounds such as Phytic acid saponins, phytochemi-

cal isoflavones, tocopherols and phytosterols which are very high in nutritional value and have so many health benefits such as these compounds act as anticancer, antimicrobial, anti inflammatory and antioxidant effects [L'Hocine, et al. [6-15]]. Seeds of soybean are also very helpful to reduce body weight and fat and also improves insulin efficacy. It reduces the risk of osteoporosis and lower the levels of triglycerides and plasma cholesterol which improves the cardiovascular diseases. Soybean has so many health benefits but it is an allergenic food and it can be harmful for people who are soybean sensitive [Velasquez et al. [16-20]].

Soybean and Its Nutritional Value

Soybeans are rich in proteins, vitamin C and folate and have various nutritional uses in the form of food, drink and supplements. It contains all the essential amino acids. It is also a good source of calcium, magnesium, phosphorus, iron, thiamin and potassium. Soybean contains around 40% of protein, 23% of carbohydrates, 20% of

soy oil and some amounts of vitamins, minerals and fibre. Soybean is the good source which helps to enhance nutritional status at low cost. Soybean has so many health benefits. It helps to lower the risk of heart diseases because it lowers the levels of tri-glycerides, total cholesterol and low density lipoprotein (LDL) and increases the level of high density lipoprotein (HDL) in the blood. Soybean contains isoflavones which helps to reduce risk of cancers such as breast cancer and prostate cancer by reducing the growth of hormone associated with cancers. Soybean isoflavones also reduce the risk of type 2 diabetes by improving the sensitivity of insulin hormone so that blood sugar enters the cells and release energy. Soybean isoflavones are effective for restoring bone density for the patients of osteoporosis and it is effective as hormone replacement therapy. It is also helpful in relaxing constipation, menopause.

Soybean Allergies

In industrialised countries food allergies are common health issue because industrialisation affects the quality of life and cause severe life threatening allergic reactions like anaphylaxis. Around 2-10% of general population are affected by food allergies (Umasunthar, et al. [21-23]). Food allergies are adverse health effects of immunological mechanisms. Most common allergenic foods are peanuts, egg, fish, shellfish and soybean. In food allergy specific food proteins resulting in allergic sensitisation. Allergic reactions may be elicited if sensitised subjects encounter sufficient levels of the allergens in the diet (Hefle, et al. [24-27]). Soybean contains more than 30 allergens. Out of 30 allergens there are two major soybean proteins causes allergy and causes allergic symptoms like asthma, shock and death. First is Gly m Bd 30K also called P34 and second is Gly m Bd 28K also called P28. P34 shares approximately 70% protein sequence homology with peanuts allergen that is Ara h 1 and 50% to 70% with cows milk allergen 2-S1-casein. Because of this homology IgE antibodies of peanut proteins react with soybean proteins (Xiang, et al. [28]). Gly m Bd 30K identified as major allergen and Gly m Bd 28K identified as minor allergen. Major allergen Gly m Bd 30K also known as soybean vacuolar protein P34 because it has 34-kDa oil body and cysteine protease. It is a monomeric insoluble glycoprotein of 257 amino acids. Around 65% of allergic reactions are because of this protein. Minor allergen Gly m Bd 28K a glycoprotein shows around 25% of allergic reactions (Ogawa, et al. [29-33]).

Processing of Soy Products

Soybean can be processed into soy oil, soy meal, soy paneer (tofu), soy flour, soy milk, soy snacks and some bakery products. Approximately 60% of processed food contains ingredients of soybean in the form of unprocessed soy flour, Soy protein concentrate and protein isolate which contains 40%-50%, 70% and 90% protein respectively (Hou, et al. [34-36]). There are some processing techniques by which one can reduce the allergenicity of soybeans which includes fermentation, thermal processing, sprouting, glycosylation, high hydro-static

pressure, irradiation and enzyme catalysis and degradation. Enzymatic degradation, fermentation and thermal processing destruct the epitopes by reducing the allergenicity induced by protein degradation.

Effects of Processing on Nutritional Value of Soybean

Soybean processing can affect the nutritional value of soybean if it is inadequately processed which impacts negatively to the feeding value of humans due to presence of anti nutritional factors. These anti-nutritional factors affect the normal process of digestion in the humans and also affects the utilisation of nutrients in the body. The processing of soybean may vary with different conditions and processing procedures (Liener, et al. [37]). For destroying anti nutritional factors in soybean and to produce hypoallergenic foods different methods have been used for the processing. There are some methods for the processing of soybean

1. Thermal processing i.e., dry and moist heat application
2. Non- thermal processing i.e., germination, fermentation, ultrafiltration and enzyme hydrolysis. Processing of soybean inactivate or destruct the structures of epitopes, it forms the new epitopes and it improves the access of hidden epitopes which leads to alter the allergenicity of the soybean (Thomas, et al. [38,39]).

Effects of Heat and Chemicals on Soybean Protein

Improper thermal treatment for the processing of soybean can affect the nutritional value negatively. Proper thermal treatment to the processing of soybean inactivates the anti nutritional factors which leads to maintain the bioavailability of essential amino acids. Proper soybean processing is the combination of correct time, ideal temperature proper particle size and good moisture content (van Barneveld, et al. [40,41]). For the manufacturing of soy based products such as soy milk 90°C temperature has been used which increase the dispersion stability of soy proteins. Due to increment in the dispersion stability of soy proteins leads to the denaturation of beta conglycinin and glycinin (allergenic proteins) by the formation of soluble aggregates due to the formation of disulphide bonding. Due to the denaturation of these allergenic proteins of soy milk leads to the decrement of the allergenic properties of soy milk (Shimoyamada, et al. [42,43]).

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