

Pulses: A review on Antinutritional component

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Abstract

Pulses are rich in the supplementary protein which is the daily diets for a predominantly vegetarian population and also those who cannot afford expensive protein diet. Pulses deliver energy, essential minerals vitamins, and other essential compounds required for good health. Their cultivation enriches soil by adding nitrogen, and phosphorus and improves soil properties. The existence of a Trypsin inhibitor in Indian pulses and vegetables has also been reported by different workers. In sweet potato and in field bean.

Depending on their source the Trypsin inhibitor provides the major processes on seeds. For Example, in legumes (soybean and lima bean) the inhibitors which acts as the feeding deterrent for insects and disrupts the mid-gut proteases. This property of inhibitor is very important for the development of insect resistant transgenic plants e.g the pancreatic hypertrophy in rats has been found by Soybean inhibitors, again providing a feeding deterrent. The cancer preventing property is seen in the Bowman-Birk soybean inhibitor

Introduction

Pulses, the seeds which are the very important source of the protein in a vegetarian diet. The group supplies 350 cal/100g and has an average protein content of about 20% with the exception of Soybean (40%). Pulses are poor in sulphur containing amino acids whereas cereals are rich in Sulphur containing amino acids. This makes cereal pulse combination a complete source of protein.

In many countries, the Legumes of pulses inhabit a significant position in human nourishment as they are one of the essential foods. The sole nutritive worth is found in Bean seeds. Vegetables are acceptable establishment of esteemed proteins, saccharides, and a few micronutrients including minerals and nutrients, they are known as wealthy in dietary fiber and low in fat [1]. There are numerous gainful physiological impacts in the utilization of vegetables in day by day diet, as they grant to turn away common metabolic maladies, for example, diabetes mellitus, coronary illness and malignant growth [2]

The plasma cholesterol level is lowered by the regular intake of pulses or any pulse. Pulses with peas and chickpea are very good source of folate the vitamin which decreases the blood level of homocysteine .so the consumption of pulses have good correlation with reduction of the CHD [3]. In Legumes there are some naturally dynamic smaller scale constituents which are not supplements, yet having various advantageous properties, as antioxidative, mitigating, detoxicating, which might be helpful in specific infections avoidance. The job of vegetables as forestalling specialists in diet of people is picking up consideration in the metabolic issue, as having specific intrigue are safe starch, protein inhibitors, lectins and polyphenols.

1. TYPES OF PULSES

Some of most popular types of Pulses which is present throughout the world are:

Snake or Chinese bean – These green Pulses are similar to regular green Pulses, are long about 30 to 50 cm. They are traditionally used in Asian cooking.

Green bean - Also known as spherical or short height Pulses. They are usually about 12 to 55 cm in length and 1.2 cm in diameter; these pods are round in shape. The complete pod is used as food.

Butter bean - Similar in shape to the regular green bean but are very pale yellow or cream in colour. The complete pod is eaten as vegetable.

French or flat Pulses - Usually about 15 cm in length, they are flat pods with slightly ridges sides. Unless these Pulses are young, it may be necessary to remove the Strings that runs the length of the pod. The complete pod is taken as food.

Broad Pulses - If the Pulses are immature then the pods may be eaten as but as they grow and became mature the bean inside develop as a large, flat and hard seed which is generally not used for fooding purpose. In immature condition the inside of the pod is quite soft and furry.

2. PULSES COMPOSITION

Pulses are cultivated under refined climate conditions are very opulent in dietary constituents, such as proteins and starch, but they are plus rich in valuable non-nutritional components such as dietary fibre [4]

The carbohydrate matter in pulses is estimated as 60% and many of them are in complex form. Many oligosaccharides in pulses outflow from digestion and they are responsible for pomposity in few individuals. The polyunsaturated fatty acid is present in pulses in higher concentration [1.5%]. This make pulses not only quantitatively but also qualitatively better than meat. There are many minerals present in pulses like calcium, phosphorus, magnesium, sodium, potassium and iron. The Thiamine and Carotene content of pulses is similar to that of cereals [5] Pulses are rich in Niacin but devoid of vitamin C and poor in riboflavin. They are excellent source of vitamin A, B complex, C, D and K.

Legumes are having very high content of starch ranging from 22% to 45% and in bean seeds it reaches upto 40%. According to a study, there are various shapes and sizes in the granular form of legume starch [6] and in bean starch it is kidney like shaped. Around hilum the interior exocentric arrangement can be observed in a single starch granule, arising most likely as a significance of random starch hydration during granule formation. Starch contains two glucose polymers, one linear amylose and one branched amylopectin in its chemical composition and the third module called as intermediate fractions those do not have amylose nor amylopectin properties [7]. Starch is a mixed constituent and can be easily separated into digestion resistant (RS) and digested starch (DS) according to nutritional point. Dietary fibre is rich in Dry bean seeds and resistant starch. The higher amount of starch which do not hydrolyzed in the small intestine and reaches the large bowel and can be hydrolyzed in the colon [8] and therefore having opposite relation between intake of starch and risk of colorectal cancer and the authors assumed that the protection

is provided by the resistant starch.

The bean seeds are high reason for protein holding from 17 up to 39% with grains, in which the substance of proteins changes from 5 to 20%, [9]. Most beans are neither of infertile of any synergist movement nor assume any auxiliary job in the improvement of cotyledons. These capacity proteins, which are put away in layer bound organelles, stockpiling vacuoles or protein bodies, which give free amino acids, smelling salts and carbon skeleton to the seedlings by endure drying up in seed development and experience proteolysis at germination. [10]. The other vegetable stockpiling proteins are having high substance of lysine however low in methionine and tryptophan so these are otherwise called a dietary addition of oat proteins, for the most part insufficient for this amino corrosive. The potential estimation of proteins are all around anticipated by the amino corrosive profile, however the edibility and accessibility is the primary determinants of their nutritive worth. The variables which limit the natural charge of bean proteins are uncommon. One of them is the protection from processing. [11]

The plant proteins are progressively safe or less defenseless against proteolytic break in vivo than creature proteins, deciding the conformational changes because of warmth of Phaseolin which is the principle section of bean seeds stockpiling proteins, suggested that the interruption of its tertiary and quaternary structure following warming is the essential advance to upgrade its obligation or powerlessness to Trypsin. The absorbability of moth bean is improved by the Microwave cooking (*Phaseolus aconitifolius* Jacq) protein [12]

The obstruction of bean proteins to proteolysis recommended in vitro tentatively is because of the auxiliary solidness of S-S securities and starch moiety, additionally the antinutritional mixes have job in the proteolytic opposition. Different innovative preparing are associated with refining the dietetic pace of vegetable proteins. The physicochemical allotment of vegetable seeds can direct the negative impact of antinutritional segment on their protein's absorbability [13]

2.1 Antinutritional Compounds of Bean Seeds

There are various antinutritional compounds in Bean seeds which may contain protein or non-protein amino acids. These compounds are difficult to categorize as their morphology and physiology varies with respect to different proteins. Various antinutritional components are like enzyme inhibitors, phytates, lectins, phenolic compounds, other are more specific, as some complex glycosides components. The antinutrients are showing profound effect on the digestive system, like inhibition of various digestive enzymes, damaged the breakdown processes and also of transport at the enterocytic region as done by lectins, reduction of accessibility of various nutrients (phytates, polyphenols). Similarly, α -galactosidase causes the formation of gas in the colon [14]

The protein and carbohydrate utilization have been limited by antinutrients in Bean seeds. But the effect is seen negative only if these compounds are taken raw and unprocessed seed or flour in humans and animals' bodies, as ordinarily heat denaturation inactivate antinutritional components which are sensitive to high temperature.

2.1.1 Proteinaceous Antinutritional Compounds

In pulses there are proteinase inhibitors which are proteins having low molecular weight forming even developments with digestive enzyme, and impeding their activity. The Trypsin inhibitor are well known protein inhibitors of legume seeds, though the protease inhibitor is present in other grain legume seeds [15]. The amylase inhibitor in the bean seed contains two glycopolyptide subunit, alpha and beta, is well characterized [16] and its complete amino acid arrangement was recognized by Kasahara *et al.* starch digestion is reduced by amylase inhibitor. In *in vitro* the starch digestion was lowered by the partially purified amylase inhibitor derived from white Pulses, and amylase activity is rapidly deactivated in the human intestinal lumen, and may decline the intra luminal digestion of starch in humans at acceptable oral doses [18]. Besides, amylase inhibitor reduces the postprandial plasma glucose and eliminates it and also decreases the postprandial plasma concentration of insulin, C –peptide by decreasing the amylase activity. The α -amylase inhibitor has also anti-diabetic role which has been printed recently and many researchers are about to the habit of nutrition holding appropriate amounts of α -amylase inhibitors for the treatment of diabetes and control of obesity have appeared [19]. These researchers concluded that the alpha amylase inhibitor should be used as a nutraceutical compound. In different legumes, the effect depends on the level of all the enzyme inhibitors and on the quantity and regularity of consumption.

The two thermo labile factors are present in pulses that are concerned with the toxic effects. They are the Trypsin inhibitors and haemagglutinins. The amino acid release is lowered by the Trypsin inhibitor so making it unavailable and may also enhances the production of Trypsin which leads to a loss of pancreatic activity [20]. Haemagglutinins present in pulses may combine with haem and result in destruction of Hemoglobin.

2.1.2 Non-Proteinaceous Antinutritional Components

In Bean seeds there are some components like saponins, alkaloids, and phytates which are called non-protein antinutritional components having different chemical structure and properties, that impairs the biological utilization of their nutrients. The tannins are most studied among polyphenols. In dry seeds the tannins may be of 0.00 to 0.93% (Deshpande *et al.*, 2001). The tannins are having high molecular weight (up to 30,000 Da). They are commonly found in the seed coat of bean seed, and low amount in the cotyledons. Tannins interrelate with the proteins and forming developmental processes and then drops the solubility of proteins, makes them vulnerable to the proteolytic attack [21]

3. TRYPSIN

Trypsin is a protease enzyme having substrate specificity which is based upon presence of arginine and lysine side chains This enzyme is secreted by the pancreas and plays an important role in the digestion of proteins in the small intestine. Trypsin belongs to class of globular protein and is produced in inactivated trypsinogen [22]

Trypsin helps in breakdown of various peptides at C-terminal side of lysine and other amino acid residues. In case there will be a side chain of proline residues on the COOH- face of the cleavage site, the breakdown will not occur

Applications:

- Harvesting Of cells by “trypsinization”
- Dissociation of tissues when combining with enzymes like elastase and collagenases.
- Isolation of mitochondria
- studies of proteins
- Hemagglutination of lectins
- Flow cytometric DNA analysis

PROTEASE INHIBITOR

Serpins the group of proteins having same conformation or structure as the proteins that inhibits the protease enzymes. The serpin usually inhibits chymotrypsin-like serine proteases.

There are almost 1000 serpins which have been identified, 36 are human proteins, and also found in plants, fungi, bacteria. Serpins are thus the largest family of protease inhibitors [23]

The serine proteases are mostly targeted by inhibitory *serpins*. The catalytic site of these enzyme is filled with serine residues. Examples include thrombin, Chymotrypsin and elastase. The serpin function and biology is being well understood by the Structural biology. There are over eighty serpins with different conformations are been determined to date. Serpins have multiple functions and these share a common structural similarity.

Serpins contains a domain or an exposed region known as the reactive Centre loop (RCL) which acts as the determining region in the inhibitory molecules, thereby targeting the protease enzyme for interaction. In antitrypsin, the RCL is not pre-inserted into the β -sheet.

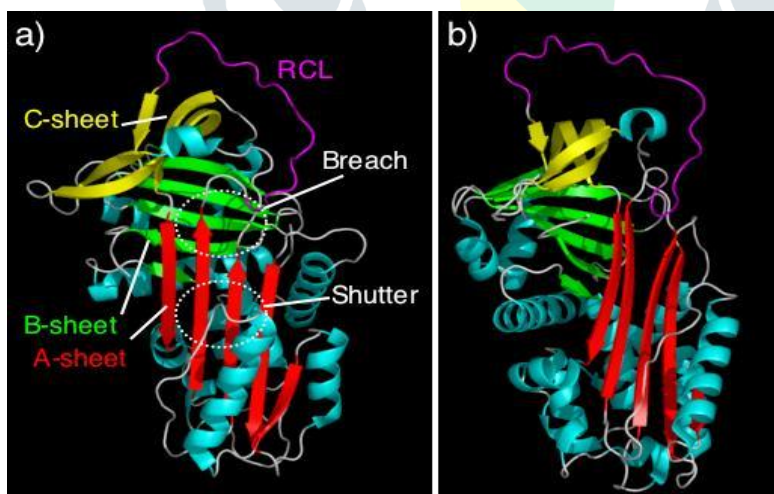


Figure 1: The X-ray structure of human antitrypsin

4. TRYPSIN INHIBITOR

The trypsin inhibitor which is likewise called as serine protease inhibitors (serpins), which are the biggest and most differed group of protease inhibitors. The pancreatic hypertrophy is seen as constrained by the Soybean inhibitors, and giving a nourishing impediment. The malignant growth forestalling specialist is considered in Bowman-Birk soybean inhibitor [24]

The Trypsin inhibitor gives particular courses relying upon their establishment. For instance, inhibitors in the seeds of vegetables (soybean and lima bean) acts as a nourishing impediment for creepy crawlies by disturbing midgut proteases.

Different nutritionist proposes to manage the overweight by protein distillates from *Phaseolus vulgaris*, or kidney bean, which contains significant levels of α -amylase inhibitor, that lessens the adsorption and represses the absorption of starches. The kidney bean likewise having critical degrees of antinutritional factors, for example, lectins and trypsin inhibitors. The 20 concentrates of kidney bean inactivate lectins and trypsin-inhibitor action yet protecting significant α -amylase inhibitor action.

Studies have also shown that *Phaseolus vulgaris* from hilly areas was grown and were inspected for trypsin inhibitor activity. It has been reported that trypsin inhibitor causes inhibition of gut trypsin enzyme isolated from *Spodoptera littoralis* larvae. The molecular weight of purified protein was reported to be 14.13kd and was found to be formed of single subunit by SDS-PAGE. The purified protein was found to be heat stable at 100°C. It has also been found that the purified inhibitor appears to be inhibitor. However, the inhibitor was found to loss its activity when treated with mercaptoethanol. The inhibition kinetics was of non-competitive type. The K_M value of trypsin enzyme against BAPNA was 2.2. Mm [25]

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