

## Anti-Nutritional Factors in Pulses

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### INTRODUCTION

Pulses are one of the earliest domesticated plants by humans, and they have played an important role in human nutrition, particularly throughout the shift from hunting and gathering to agriculture. Pulses have a variety of health benefits, including protection against cardiovascular disease due to dietary fibre content, and improved iron absorption and bone health when paired with vitamin C. They are high in complex carbohydrates, minerals, folate, and other B-vitamins, as well as protein. In addition, whole pulses provide a good source of iron, zinc, selenium, phosphorous, and potassium, as well as high-quality oil, folic acid, isoflavones, and tocopherol.

Anti-nutritional factors (ANFs) are biological components reported in meals that might limit nutrient utilisation or food intake, resulting in gastrointestinal problems and metabolic dysfunction. These are harmful chemicals found in grains that prevent biomolecules from being absorbed and thus limiting their bioavailability in humans and monogastric animals. These substances impair nutritious quality of foods. Pulses are high in ANFs in addition to protein, carbohydrates, vitamins, and minerals. Amylose inhibitor, trypsin inhibitor, saponins, agglutinins, and other ANFs are found in pulses. Trypsin inhibitor is the most concerning of these inhibitors because it limits the availability of proteins by limiting the digestibility of particular amino acids.

Pulses are typically heat-treated or boiled with water to minimise ANF. Protease inhibitors, lectins, cyanogens, total free phenolics, tannins, phytic acid, saponins, toxic amino acids, antivitamin, and oxalate are all anti-nutritional elements found in legumes. Flatulence is caused by complex sugars found in legumes, such as raffinose, stachyose, and verbascose.

These chemicals are anti-nutritional factors because they diminish protein digestion and availability. However, because several anti-nutritional components in legumes have been shown to provide health benefits, these secondary metabolites are now labelled as functional foods and nutraceuticals.

### Anti-nutritional factors

Protease inhibitors (trypsin inhibitors), amylase inhibitors, lectins, saponins, phytic acid, and the oligosaccharides of the raffinose family are all examples of anti-nutritional factors (ANFs). They differ significantly from one pulse to the next, as well as from one variety to the next, and are impacted by the season, processing method, storage, and level of insect infestation. Trypsin inhibitor is one of the most dangerous protease inhibitors since it inhibits protein digestibility and is responsible for lowering sulphur-containing amino acids like methionine and cysteine in pulses. It also has insecticidal properties. The trypsin inhibitor in moth bean is abundant. The Raffinose family of oligosaccharides (RFO) includes raffinose, stachyose, and other sugars that are often present in pulses and are linked to flatulence (abdominal gas production).

RFOs also obstruct the absorption of other nutrients. RFOs also obstruct the absorption of other nutrients. Lectins are glycoproteins that bind to distinct sugar moieties in the intestinal wall to block the absorption of digestion end products in the small intestine. When lima beans with a lot of lectins (hemagglutinins) are eaten raw or in excessive amounts, it might cause red blood cells to clot (RBCs). Saponins are responsible for the soap-like appearance of pulses. RBC haemolysis can be caused by a high concentration of saponin in the diet. They interact with biomembranes, generating pores and holes in them, which eventually lead to cell death. Amylase inhibitors reduce the rate of starch digestion and change the sugar response to insulin. Mineral bioavailability is reduced by phenol compounds (zinc). They form complexes with protein molecules, lowering their solubility and, as a result, their digestibility.

Phenol molecules, on the other hand, have anti-cancer and anti-atherosclerotic properties. *Lathyrus sativus* contains a neurotoxic known as  $\beta$ -N-oxalyl diaminopropionic acid (BOAA) (khesari dal). Men's lower limbs can be paralysed after consuming it in significant amounts for more than six months. Phytates are a good source of phosphate and minerals, both of which are necessary for germination. However, in the digestive tract, they form complexes with iron, zinc, magnesium, and calcium, causing mineral insufficiency in humans and animals.

### Management of Anti-nutritional factors

Heat treatment can inactivate proteinaceous anti-nutrients such as protease inhibitors and lectins. However, heat treatment might cause some amino acids and vitamins to be damaged. Dehulling, grinding, fermentation, soaking, germination, and boiling are examples of pulse processing procedures. These procedures not only save fuel, time, and energy, but they also improve nutritional content, resulting in goods with higher nutritional value and lower anti-nutrient levels. Pulse irradiation is also being investigated as a means for destroying anti-nutritional chemicals in pulses. Because of the breakdown of sulphhydryl ( $-SH$ ) and disulphide ( $-S-S-$ ) bonds, which appear to be extremely vulnerable to the irradiation process, it can inactivate trypsin inhibitors in pulses. To lessen or remove the adverse metabolic obstacles induced by anti-nutritional chemicals, pulses must be prepared properly prior to intake. However, understanding of chemical structure, distribution in seed fractions, biological impacts, heat sensitivity, and solubility in water is required for selecting the right processing strategies for removal/reduction of these anti-nutritional chemicals in pulses. Dehulling, soaking, boiling, extrusion, germination, and fermentation are among of the potential strategies for reducing or removing these anti-nutritional chemicals.