Soybeans, scientifically known as Glycine max, are versatile legumes native to East Asia and cultivated for thousands of years. These beans belong to the Fabaceae family and are recognized for their rich nutritional profile and various uses in various industries.

Nutritional Profile of Soy Beans or Soy Ingredients:

Protein: The primary component of soy protein is, unsurprisingly, the protein itself. Soybeans are one of the few plant sources that contain all nine essential amino acids, making them a complete protein.

Soy protein is a vegetable protein obtained from soybeans and is considered a valuable dietary component due to its high nutritional content. It contains all the essential amino acids needed by the human body, making it a complete protein source (Messina, 2016). The popularity of soy protein has grown significantly due to its various health benefits and its role as a substitute for animal proteins.

Soy protein is rich in protein content, typically accounting for approximately 36–56% of its dry weight (Sikand et al., 2019). It also contains essential fatty acids, fiber, vitamins (such as B vitamins), and minerals such as calcium, iron, and potassium (Messina, 2016). Additionally, soy protein is cholesterol-free and low in saturated fat, making it a heart-healthy choice (Messina, 2016).

Fiber: Soybean hull dietary fiber (SHDF) extracted from various raw materials in terms of their chemical composition, physicochemical properties, structure and ability to regulate fecal microflora, to investigate the properties and functions of SHDF. The structures of insoluble dietary fiber from oxalic acid-extracted soybean hulls (IDFO) and insoluble dietary fiber from citric acid-extracted soybean hulls (IDFC) were characterized by scanning electron microscopy, Fourier transform infrared spectroscopy, and X-ray diffraction. Compared with IDFO, IDFC had larger crystalline areas and higher water holding capacity (4.92 g/g), water swelling capacity (4.77 ml/g), oil adsorption capacity (1.60%), activity inhibition ratio of a- amylase (12.72%), glucose adsorption capacity (1.59–13.42%) and bile acid retardation index (5.18–26.61%). As the gut microbiota plays a key role in health homeostasis, we conducted a detailed investigation of the effects of dietary fiber on the fecal microbiota through high-throughput 16S rDNA sequencing. As revealed by Venn, principal component analysis and 3D principal coordinate analysis, the community structure of fecal microflora was significantly altered by IDFO and IDFC intake.

In particular, the abundance of Bifidobacteriales and Lacto bacillales significantly increased to varying degrees as a result of IDFO and IDFC intake. Overall, this study demonstrates the prebiotic effect of SHDF on fecal microbiota in vitro and provides a basis for the development of SHDF as a novel gut microbiota modulator for health promotion.

Carbohydrates:

Traditionally, soybeans (SB) have been used as food and feed ingredients for their protein content and protein composition. As a protein source, SB is often used in the form of soybean meal (SBM), which is a product of SB processing for SB oil extraction. Carbohydrate content and carbohydrate composition of SB and SBM have received limited attention compared to their protein and fat components. Nevertheless, carbohydrates make up a significant part of the SB seed. Typically, SB contains approximately 30–35% carbohydrates (Snyder & Kwon, 1987; NRC, 1998). In SBM, the carbohydrate content can be as high as 40% (NRC, 1998).

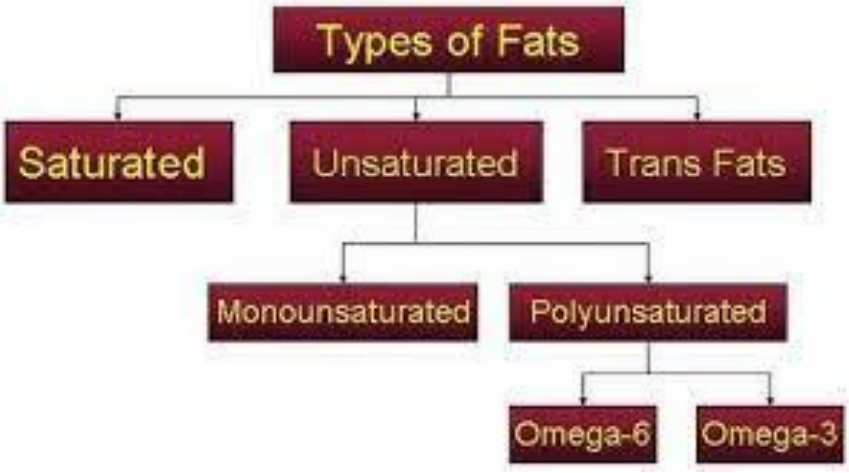
Carbohydrates are usually divided into two main groups based on their physicochemical properties in plant material. The first group, non-structural carbohydrates, includes low molecular weight sugars, oligosaccharides and storage polysaccharides (Karr-Lilienthal et al., 2005). The second group includes structural polysaccharides and includes components of dietary fiber (Bach Knudsen et al., 1987). Dietary fiber is a heterogeneous mixture of cell wall polysaccharides, non-cellulosic polysaccharides and structural non-polysaccharides (e.g. lignin, phenolic compounds). Fiber components have their own unique chemical, physical and nutritional properties. The definition of dietary fiber is still a debated topic (DeVries, 2003), although in all attempts at a definition, the theme that the components of dietary fiber are indigestible by endogenous enzymes appears repeatedly (Englyst, 1989; Eastwood, 1992; Theander et al. , 1994; Institute of Medicine, 2001). In addition, there are many methods of fiber analysis, all of which measure fiber in different ways or measure different components of fiber. Selvendran et al. (1987) reviewed several fiber analysis methods and Campbell et al. (1997) published a comparative study of some of the more common methodologies used in nutrition research. In the seeds of legumes such as SB, the main components of dietary fiber are cellulose, hemicelluloses, pectins and glycoproteins or proteoglycans found in the cotyledon parenchymal cells (Selvendran et al., 1987). The main fibrous components (/5'—8 SB shells) are galactomannans,

xylan hemicelluloses, uronic acids and cellulose (Aspinall & Whyte, 1964; Aspinall et al., 1966; Aspinall et al., 1967b, 1967d). Research on the composition and structure of SB carbohydrates is ongoing, but not yet as mature as research on proteins and lipids. However, in this chapter the available literature on SB and SBM carbohydrates is reviewed and categorized. Soybean and SBM carbohydrates are discussed based on their functionality in the plant (nonstructural or structural) and their value as feed or food components.

-Soybeans contain carbohydrates in the form of sugars and starches, although they are relatively few compared to other ingredients.

The concentration of carbohydrates in whole SB is lower than in SBM, due to the concentration effect of lipid extraction on SBM. Whole SB contains approximately 27% nitrogen-free extract (NFE) and 6% crude fiber (CF) on a dry matter basis (DMB), while SBM with or without carcass contains 36% NFE and 8% CF or 34% NFE and 4% CF, respectively (Potter & Potchanakorn, 1984). Although NFE (plus CF) is not commonly used today because of the limited information it provides about carbohydrates from a nutritional perspective, it provides a reasonable indication of the gross carbohydrate content of a feed or food. NFE contains non-structural carbohydrates and some structural carbohydrates, and CF contains some structural carbohydrates.

Fats: Soybeans contain fats, including polyunsaturated fats such as omega-3 and omega-6 fatty acids. Soybean oil is commonly extracted for use in various food products.



Composition of Omega-3 and Omega-6 in soybeans Soy is known for its composition of essential fatty acids. The predominant omega-3 fatty acid found in soy is alpha-linolenic acid (ALA), while linoleic acid (LA) is the primary

omega-6 fatty acid present. ALA and LA are considered essential fatty acids because the human body cannot synthesize them on its own and must obtain them from food sources. Studies show that soybeans contain approximately 7-8% of total fat, with approximately 50-57% being polyunsaturated fatty acids, among which ALA and LA have significant proportions. The ratio of omega-6 to omega-3 fatty acids in soybean oil is approximately 7:1, making it a rich source of both types of essential fats.

Vitamins and Minerals: Soybeans also contain vitamins (such as folate, vitamin K, and vitamin C) and minerals (such as iron, calcium, magnesium, and potassium) that are essential for overall health.

Soybeans are recognized as a rich source of essential nutrients, including vitamins and minerals, which contribute significantly to a balanced diet (Messina et al., 2010). This report aims to explore the diverse range of vitamins and minerals found in soy, their nutritional significance, and their potential health benefits for individuals who incorporate soy-based products into their diet.

Vitamins Present in Soybeans, soybeans contain a number of vitamins:

Vitamin K: Soybeans are particularly rich in vitamin K, specifically in the form of vitamin K1 (phylloquinone), which plays a key role in blood clotting and bone metabolism (USDA, 2020). Vitamin B complex: Soybeans contain various B vitamins such as thiamin (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), folate (B9) and cobalamin (B12). These vitamins are essential for energy metabolism, nervous system function and red blood cell formation (Franco et al., 2017). Vitamin E: Soybeans contain tocopherols, including alpha-tocopherol, a form of vitamin E. Vitamin E acts as an antioxidant, protecting cells from oxidative damage (Kim et al., 2012).

Minerals contained in soy Soybeans are an important source of various minerals important for human health:

Calcium: Soybeans contain calcium, although the presence of phytates in soy may hinder its absorption (Vanga et al., 2018). Iron: Soybeans contain iron, although the non-heme form of iron present in plant sources is less easily absorbed by the body compared to the heme iron found in animal products (Hurrell & Egli, 2010). Magnesium: Soybeans provide significant amounts of magnesium, supporting muscle and nerve function, blood sugar regulation, and bone health (USDA, 2020). Potassium: Soybeans contain potassium, an

essential mineral for maintaining electrolyte balance and supporting heart health (Franco et al., 2017). Nutritional value the vitamins and minerals contained in soy contribute significantly to overall health. The inclusion of soy-based products in the diet can potentially help meet daily nutritional requirements for essential vitamins and minerals (Messina et al., 2010). However, it is important to consider factors such as bioavailability and the presence of anti-nutrients such as phytates, which can inhibit the absorption of certain minerals in soy-based foods. Conclusion Soy serves as a valuable source of vitamins and minerals and offers a diverse range of essential nutrients necessary to maintain optimal health. Understanding the nutritional composition of soy and its contribution to meeting daily dietary needs underscores the importance of including soy products in a well-balanced diet.

Isoflavones: These are plant compounds found in soy that act as phytoestrogens that may have certain health benefits and have been studied for their potential role in reducing the risk of certain diseases.

Phytoestrogens help in the production of serotonin - which helps ensure good sleep, memory, happiness, learning, excitement. Therefore, soy can also act as an antidepressant.

Functional properties of soy - help in the production of new products, increased sales, etc

Hydration capacity: This refers to a substance's ability to attract and retain water molecules. A higher hydration capacity means that the fabric can hold more water.

Solubility: This is the ability of a substance (solid, liquid or gas) to dissolve in a solvent to form a homogeneous solution. A highly soluble substance dissolves easily in a given solvent.

Colloidal stability: Colloids are particles suspended in a medium. Milk is a colloidal solution in which fat globules are colloids that are dispersed in water to form a uniform solution. Colloidal stability refers to the ability of these particles to remain dispersed and not aggregate or settle over time.

Gelation: Gelation is the process of forming a gel, which is a semi-solid jelly-like substance with a three-dimensional network structure that traps liquid within

it. Gelation occurs when a gelling substance undergoes a transition from a liquid to a gel state.

Emulsification: Emulsification is the process of mixing two immiscible liquids (such as oil and water) to form an emulsion where tiny droplets of one liquid are dispersed in the other.

Foaming: Foaming refers to the formation of a stable foam by trapping gas bubbles in a liquid or solid. This creates a structure with a large surface area.

Adhesion/Cohesion: Adhesion is the ability of a substance to stick to another surface, while cohesion refers to the attraction between molecules of the same substance, causing them to stick together. Both play a vital role in various material properties and applications.

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