



Essential amino acids content in bee pollen

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Abstract. Our paper explores the essential amino acids found in bee pollen and their approximate concentrations, highlighting the significance of this natural superfood. Bee-pollen is a natural product consisting of valuable nutritional and biologically active substances. Bee-pollen contains varying amounts of protein. The protein content of pollen varies between 2.90% and 61.00%, depending on plant sources, geographical origin and many other factors. Bee pollen from *Apis mellifera* (Apidae, Hymenoptera) is a potent source of essential amino acids, each contributing to various critical functions of the human body. With its rich amino acid profile, bee pollen stands out as a beneficial supplement that can help address nutritional deficiencies and support or improve overall health. The content of bee pollen, rich in these amino acids, highlights the nutritional value of bee pollen, making it an excellent supplement to a balanced diet.

Key Words: *Apis mellifera*, Apidae, Hymenoptera, pollen, protein content, nutritional properties.

Introduction. Pollens are fine, powdery substances consisting of microscopic grains discharged from the male part of a flower or from a male cone, each containing a male gamete capable of fertilizing a female ovule, and they are vital for apiculture as a primary food source for bees (Roulston et al 2000; Mag et al 2006), as well as for biodiversity (Mag et al 2006), as they play a crucial role in plant reproduction and the maintenance of ecosystems (Roulston et al 2000). Bee pollen, often referred to as "nature's perfect food," is a rich source of essential nutrients, including a variety of amino acids that are vital for human health (Ecem Bayram 2021). These essential amino acids are those that the human body cannot synthesize and must be obtained through diet. Bee pollen from the European honeybee, *Apis mellifera* (Apidae, Hymenoptera), has garnered attention for its nutritional profile, particularly its amino acid content (Sommano et al 2000). This literature minireview explores the essential amino acids found in bee pollen and their approximate concentrations, highlighting the significance of this natural superfood.

Protein content. Bee-pollen is a natural product consisting of valuable nutritional and biologically active substances (Dukhanina et al 2005; Taha et al 2019). Bee-pollen contains varying amounts of protein (Roulston et al 2000) (Table 1). The protein content of pollen varies between 2.90% and 61.00%, depending on plant sources, geographical origin and many other factors (Day et al 1990; Serra Bonvehi & Escolà Jordà 1997; Rogala & Szymaś 2004; Somerville & Nicol 2006; Szczęśna 2006; Tasei & Aupinel 2008; Carpes et al 2009; Margaoan et al 2012; Nicolson & Human 2013; Roulston et al 2000).

Essential amino acids in bee pollen. The essential amino acids present in bee pollen include: leucine, histidine, isoleucine, threonine, tryptophan, valine, lysine, phenylalanine, methionine, arginine (Al-Kahtani et al 2020; Végh & Csóka 2024). These amino acids play crucial roles in various functions of the body, mainly protein synthesis, but also enzyme production, and overall metabolic processes (Végh & Csóka 2024).

Table 1

Crude protein, total amino acids and essential amino acids composition of bee-pollens

<i>Plant source</i>	<i>Protein (g per 100 g of dry matter)</i>	<i>Total amino acids (g per 100 g of dry matter)</i>	<i>Total essential amino acids (g per 100 g of dry matter)</i>	<i>Total essential amino acids (%)</i>
Alfalfa	20.23	12.51	5.25	41.97
Date palm	19.77	12.48	5.35	42.87
Summer squash	16.39	12.27	5.13	41.81
Sunflower	15.19	12.20	4.73	38.77
Rape	18.86	12.25	5.12	41.80
Average	18.09	12.34	5.12	41.44

Source: Taha et al (2019), modified by the authors.

Histidine. Histidine is vital for the growth and repair of tissues, production of red and white blood cells, and protection of nerve cells. In bee pollen, histidine content is about 4.60 mg per gram of dry matter (Taha et al 2019).

Isoleucine. Isoleucine is important for muscle metabolism, immune function, and hemoglobin production. The concentration of isoleucine in bee pollen is approximately 6.04 mg per gram of dry matter (Taha et al 2019).

Leucine. Leucine is crucial for protein synthesis and muscle repair, making it essential for athletes and individuals involved in physical activities. Bee pollen contains about 11.45 mg leucine per gram of dry matter (Taha et al 2019).

Lysine. Lysine plays a significant role in calcium absorption, muscle protein synthesis, and the production of hormones, enzymes, and antibodies. The lysine content in bee pollen is about 7.64 mg per gram of dry matter (Taha et al 2019).

Methionine. Methionine is essential for tissue growth and repair, as well as for the absorption of zinc and selenium. It also helps in detoxifying harmful substances. In bee pollens, methionine content is about 0.47 mg per gram of dry matter (Taha et al 2019).

Phenylalanine. Phenylalanine is a precursor for the neurotransmitters tyrosine, dopamine, epinephrine, and norepinephrine, which are vital for brain function. Bee pollen contains around 2.55 mg phenylalanine per gram of dry matter (Taha et al 2019).

Threonine. Threonine is important for the formation of collagen and elastin, as well as for fat metabolism and immune function. The threonine concentration in bee pollen is about 4.63 mg per gram of dry matter (Taha et al 2019).

Tryptophan. Tryptophan is a precursor for serotonin, a neurotransmitter that regulates mood, sleep, and appetite. In bee pollen, tryptophan content is approximately 1.02 mg per gram of dry matter (Taha et al 2019).

Valine. Valine is essential for muscle growth and tissue repair. It also helps maintain nitrogen balance in the body. Bee pollen contains around 9.11 mg valine per gram of dry matter (Taha et al 2019).

Arginine. Arginine is essential in the human body for protein synthesis, wound healing, immune function, hormone release, and the production of nitric oxide, which helps in vasodilation and blood flow regulation. In bee pollen, arginine content is approximately 3.60 mg per gram of dry matter (Taha et al 2019).

Nutritional significance. The high content of essential amino acids in bee pollen underscores its potential as a valuable dietary supplement. These amino acids contribute to various physiological processes, as we could see above.

Protein synthesis. Essential amino acids are the building blocks of proteins, which are necessary for the function, structure, and regulation of the body's organs and tissues.

Metabolic pathways. They play roles in numerous metabolic pathways, ensuring the proper functioning of the body.

Immune function. Amino acids such as lysine and histidine are vital for the immune response (Grohmann & Bronte 2010; Ahmed & Ahmad 2021), helping the body to fend off infections and diseases.

Neurological health. Amino acids like tryptophan, tyrosine and phenylalanine are precursors to neurotransmitters (James et al 2023), which are critical for maintaining mental health and cognitive functions.

Conclusion. Bee pollen from *Apis mellifera* is a potent source of essential amino acids, each contributing to various critical bodily functions. With its rich amino acid profile, bee pollen stands out as a beneficial supplement that can help address nutritional deficiencies and support overall health. The content of bee pollen, rich in these amino acids, highlights the nutritional value of bee pollen, making it an excellent supplement to a balanced diet. As research continues to uncover the myriad benefits of bee pollen, it is likely to gain even more recognition as a superfood with remarkable health-promoting properties.

Conflict of interest. The authors declare no conflict of interest.

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