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Antioxidant Potential of Bee Pollen: A Preliminary Evaluation

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Bee pollen, a honeybee-derived product, has gained recognition as a functional food due to its therapeutic properties, including antioxidant, anti-inflammatory, antifungal, anti-carcinogenic, and wound-healing effects (Tutun *et al*, 2021). Bee pollen is a combination of nectar, honeybee secretions, and flower pollen. With the use of traps, it can be collected at the hives' entrance. (Khalifia S A *et al* 2021). Its unique composition varies depending on the plant source and geographic location, which adds to its appeal as a natural health product. The rising interest in functional foods reflects a broader trend toward holistic health and wellness, with many consumers actively seeking out natural options to enhance their diets and improve their overall well-being (Karaman, 2019). Bee pollen has a diverse chemical structure, including carbohydrates, proteins, free amino acids, lipids, fatty acids, vitamins, minerals, and phenolic compounds. It is also considered an excellent dietary supplement owing to its high content of carbohydrates (13% to 55%), proteins (10% to 40%), lipids (1% to 10%), and crude fiber (0.3% to 20%) (Tutun *et al*, 2021).

Antioxidant properties of Bee pollen

Bee pollen is considered a promising natural source of antioxidants owing to the strong antioxidant activity of its bioactive constituents, especially phenolic compounds. The most significant route to consume bee pollen products is through nutritional supplements. In this study, a nutritious bar was developed using a considerable amount of bee pollen to see the effectiveness of its properties on the physical, psychological, and nutritional status of college

students. This article discusses the ferric reducing antioxidant power (FRAP), DPPH radical scavenging activity, total phenolic content, and total flavonoid content, which are among the well-known assays used to assess the antioxidant capacity of bee pollen.

Table 1 Antioxidant properties of bee pollen

Antioxidant parameters	Bee pollen
Total Phenolic content (mg GAE/g)	252.98 ± 1.03
Total Flavonoid content (mg/g)	91.72 ± 0.45
DPPH (1,1-diphenyl picrylhydrazyl) radical scavenging activity	71.69 ± 1.57
Ferric Reducing Antioxidant Power Assay (FRAP Assay) (µmol Fe2+/g)	4.65 ± 1.42

*Values are expressed as mean ± SD

As shown in the table, bee pollen demonstrated strong antioxidant properties, indicating its potential as a valuable dietary component with health-promoting effects. Bee pollen exhibited a remarkably high total phenolic content (252.98 ± 1.03 mg GAE/g), consistent with previous research that has identified phenolic compounds as key contributors to antioxidant activity of natural products (Almeida-Muradian *et al,* 2005; Pascoal A *et al,* 2014). These compounds offer protection against oxidative stress-induced cellular damage through various mechanisms, including metal ion chelation, free radical neutralization, and inhibition of oxidative enzymes.

The total flavonoid content (91.72 ± 0.45 mg/g) plays a central role in enhancing the antioxidant capacity of bee pollen. This observation supports its potential as a functional food with therapeutic properties. The high flavonoid levels in bee pollen contribute to the prevention of oxidative damage, such as lipid peroxidation, and also help in reducing the risk of stress-related chronic disease, including cardiovascular and neurodegenerative disorders (Kroyer & Hegedus, 2001).

The DPPH radical scavenging activity of bee pollen (71.69 ± 1.57%) supports its ability to neutralize free radicals. As observed in previous studies, the high inhibition rate indicates the presence of a complex combination of bioactive compounds, such as polyphenols, carotenoids, and vitamins, that work synergistically to enhance antioxidant activity (Komosinsk-Vassev et al, 2015). In addition, the ferric reducing antioxidant power (FRAP) (4.65 ± 1.42 µmol Fe2+/g) indicates the bee pollen's reducing strength in redox reactions. The result of all assays used to evaluate the antioxidant activity of bee pollen showed that the total phenolic content was significantly higher than the other parameters.

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