



File: ▪ Melatonin
▪ Plant chemistry
▪ Antioxidants

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RE: Melatonin Found in 15 Edible Plant Seeds

Manchester LC, Dun-Xian T, Reiter RJ, Park W, Monis K, Qi W. High levels of melatonin in the seeds of edible plants possible function in germ tissue protection. *Life Sciences* 2000;67:3023-3029.

Plants are marvelous chemical factories that make countless complex molecules. In this paper, the authors report on the content and function of melatonin in seeds, a compound more widely associated with animal brains where it regulates the body's internal clock (circadian rhythms).

Melatonin was originally discovered in animals but has been found in every type of organism. Interest in plant melatonin was heightened when high levels of melatonin were measured in St. John's wort and feverfew. It is also found in several commonly eaten fruits and vegetables, such as tomatoes and bananas. Melatonin production follows a diurnal rhythm (as it does in animals) in some, but not all, plants. It is found in all parts of the plant, especially in germ and reproductive tissues (seeds, flowers, and fruits). Since seeds are a sensitive and critical part of the plant in which melatonin has never been examined, this study quantified the amount of melatonin in the seeds of 15 plants.

Edible seeds of the following plants were examined: black mustard (*Brassica nigra*), white mustard (*Sinapis alba*), fenugreek (*Trigonella foenum-graecum*), milk thistle (*Silybum marianum*), celery (*Apium graveolens*), alfalfa (*Medicago sativa*), coriander (*Coriandrum sativum*), green cardamom (*Elettaria cardamomum*), fennel (*Foeniculum vulgare*), opium poppy (*Papaver somniferum*), anise (*Pimpinella anisum*), sunflower (*Helianthus annuus*), flax (*Linum usitatissimum*), almond (*Prunus dulcis*), and Lycium (*Lycium barbarum*). Seeds were extracted in ethanol and analyzed by radioimmunoassay, which was confirmed by high performance liquid chromatography (HPLC). The recovery rate of melatonin in these samples was 20%. Melatonin was found in all seed types tested, ranging from 2 - 190 mg/g dry weight of seed. The highest levels were found in white and black mustard seeds and the lowest in milk thistle. However, even the lower levels were high compared to amounts found in vertebrate blood.

Melatonin is a strong antioxidant that is active in both lipid and aqueous environments. It also stimulates the antioxidant enzymes glutathione peroxidase and reductase. As a result, the authors hypothesize that melatonin is part of the plant antioxidant defense system, protecting against free radical-induced lipid peroxidation, protein, and DNA damage. Since flowers of St. John's wort and feverfew, which thrive in Northern latitudes, are high in melatonin, the chemical may also help protect sensitive and critical tissues of these plants from extreme cold, heat, and drought.

—Risa N. Schulman, PhD

[Editor's Note: This is the first paper to identify melatonin in the seeds of these 15 edible plants. The presence of melatonin in plants is becoming a subject of increasing interest to plant physiologists and other researchers. However, this presence has sometimes been grossly misinterpreted by some authors. For example, in 2000 the journal *Pharmacotherapy* published a "White Paper on Herbs" by the American College of Clinical Pharmacy (Miller et al., White Paper on Herbal Products. *Pharmacotherapy* 2000;20 (7):877-891) in which the discovery of melatonin in the medicinal plants, feverfew (*Tanacetum parthenium*), St. John's wort (*Hypericum perforatum*), and Chinese scullcap root (*Scutellaria baicalensis*) were cited as examples of lack of quality control in Chinese herbal products; the melatonin was incorrectly termed an "adulterant" in the ACCP White Paper despite it's being a naturally-occurring component of the three herbs (see Murch et. al., Melatonin in feverfew and other medical plants. *Lancet* 1997;350:1598-99); see also McCaleb R. Melatonin in Medicinal Plants. *HerbalGram* 1999;46:19, 28. [Research Review of Murch SJ, Simmons CB, Saxena PK. Melatonin in feverfew and other medicinal plants. *Lancet* 1997;350:1598-9.

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