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Antioxidant potential of Phyto melatonin: Review

Muhammad Akram[1*], Umme Laila[2], Ho Soonmin[3]

[1,2]Department of Eastern Medicine, Government College University, Faisalabad (Pakistan)

[3]Faculty of Health and Life Sciences, INTI International University, Putra Nilai 71800, Nilai, Negeri Sembilan (Malaysia)

[*] Email: makram_0451@hotmail.com

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Abstract:

Several plant species are the richest source of melatonin. The synthesis of this component is both from animal & plant sources. The role of melatonin as an anti-oxidant is significant. Other important functions of melatonin are plant cell defense against apoptosis, regulation of plant reproductive physiology, photoperiodic responses. So, its role in modulating & regulating stress-related genes.

Keywords: *Melatonin, Phyto melatonin, plant species, anti-oxidant, aromatic plants, dietary supplements, pathological condition*

1. Introduction:

N-acetyl 5 methoxy-tryptamine which is melatonin important component which present in all organisms, one of the multi-functional components in the development & growth of plants like circadian rhythm, yield, senescence, ripening of fruit, development of roots, stress response & germination of seeds [1,2].Melatonin gains importance due to its biological modulator for sleep, mood, the temperature of the body, circadian rhythm, intake of food, locomotor activity, immunological system, seasonal reproduction, and sexual behavior. That's why melatonin is a good anti-oxidant component at physiological concentration. Melatonin under biotic & abiotic stresses like an attack of pathogen, heavy metal, drought, salt, cold, & heat produces reactive oxygen species from these stresses and becomes a good anti-oxidant agent &enhances the resistance of stress for plants [3,4]. Melatonin also enhances the tolerance for stress by the activation of plants' anti-oxidant system, by activating the other stress hormones like jasmonic acid, ethylene, salicylic acid, transport

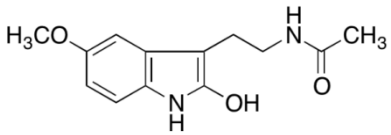
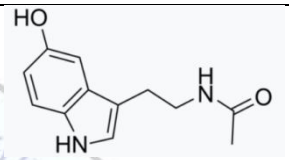
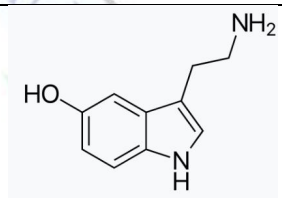
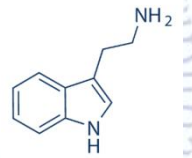
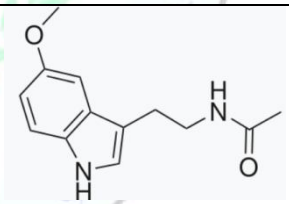
& promoting of heavy metals, chelating, transcription modulating factors, inhibition of alleviating photosynthesis [5,6]. So, the role of melatonin is significant in the stress response of plants. The formation of phytomelatonin start with tryptophan which involves several intermediates (Table 1) like methoxy-tryptamine 5, acetylserotonin N, serotonin, hydroxytryptophan 5, tryptamine [7]. the other metabolites in which melatonin is converted include N2 or N1 acetyl 5 formyl methoxy-knuramine, 3-cyclic hydroxy-melatonin & hydroxy-melatonin 2 [8,9]. Melatonin & its precursors playa significant role in the stress resistance of plants [10,11]. Figure 1 shows the molecular formula, molecular weight and structure of these compounds.

Table 1: Melatonin & metabolites plant mediating stress resistance:

Component	Stresses	Species of plants
Hydroxy-melatonin 2	Pathogen	C. sativus, T. aestivum, C.lanatus, Prunuspersica, rice, lycopersicum, thaliana [12,13,14,15,16,17,18,19,20].
Hydroxy-melatonin 2	Combination of drought & cold	Arundinacea, L. perenne, lycopersicum, thaliana [21,22,23,24,25].
Acetyl-serotonin N	Pathogen	Zea mays, H.annuus, C.lanatus, C.sativa and thaliana [26,27,28,29,30,31].
Serotonin	Heavy metals	M.sativa, S. lycopersicum, Aestivum, zea mays, thaliana, maluszumi [32,33,34,35,36,37,38].
Serotonin	Radiation	wheat, C.lanatus, M.sativa, S. lycopersicum and rice [39,40,41,42,43,44].
Serotonin	Salts	m. pumila, cassava, potato, musa acuminate, rice, thaliana [45,46,47,48,49,50,51,52].
Tryptamine	Pathogen	Rice [53].
Melatonin	Pathogen	Helianthus annuus [54].
Melatonin	Heavy metals	Viciafaba [55].
Melatonin	Drought	Rice [56].

Melatonin	Salts	Thaliana
Melatonin	Heat	Rice [57].
Melatonin	Cold	A. Thaliana [58].

Figure 1: Molecular formula, molecular weight and structure of some compounds.

Compound	Molecular formula	Molecular weight	Structure
Hydroxy-melatonin 2	$C_{13}H_{16}N_2O_3$	248.28 g/mol	
Acetyl-serotonin N	$C_{12}H_{14}N_2O_2$	218.256 g/mol	
Serotonin	$C_{10}H_{12}N_2O$	176.215 g/mol	
Tryptamine	$C_{10}H_{12}N_2$	160.220 g/mol	
Melatonin	$C_{13}H_{16}N_2O_2$	232.281 g/mol	

2. Literature survey:

Use of Phyto-melatonin instead of melatonin:

Basically, Phyto melatonin& melatonin are the same components, but differences originate due to their origin. Phyto-melatonin is derived from plant sources while melatonin originates from animal sources. Initially when the researcher is not known about Phyto melatonin sources then the use of melatonin is more. The main originative sources of melatonin are cows due to the increased risk of viral infection now people prefer to use its synthetic form which possesses fewer side effects [64,66]. The production of melatonin improved by the economic & productive procedure. Almost 80% of synthetic melatonin arises from the many by-products. The name of these by-products ischloro-propylphthalimide, Bromo-hydroxy pro-pylphthalimide, di-1,3 phthalimidopropane, indole

di-acetyl derivatives & acetyl N, methoxy 5 tryptamines derivatives, hydroxy 5 tryptamines derivatives, melatonin formaldehyde condensation products, melatonin formaldehyde, tryptophan 2, alanine, carboxylic acid. These byproducts are related to phthalimide & tryptophan.

Role of Phyto-melatonin in dietary supplements:

Phytomelatonin gains importance due to its number of uses, and its role in cosmetic & synthetic products is important. Phytomelatonin shows anti-tumor effects. Plants are a rich source of Phyto-melatonin extract which is known due to its anti-oxidant effects including tocopherols, carotenoids, flavonoids, phenols, and ascorbic acid which retain the redox balance. Several experiments are performed to check the Phyto melatonin-rich diet. With the use of a phyto-melatonin-rich diet, the level of melatonin enhances in the blood due to this sleep quality improvement [59,60]. The presence of a phyto-melatonin component is seen in lots of plant species but somehow the level of this component is not rich. The concentration of this component is more observed in aromatic plants [61,62]. In the United States, the phyto-melatonin formulation is done by using chlorella green alga, alfalfa & rice [63]. In New Zealand, the rich source of phytomelatonin is dried freeze tart Montmorency skin cherry extract.

Medicinal plant species & phytomelatonin component:

Some medicinal plant species are rich sources of phyto-melatonin content. These plants include beta vulgaris, daucus carota, sativa oryza japonica, fragaria ananassa, ananas comosus, piper nigrum, Momordica charantia, Silybum marianum, lyceum barbarum, apium graveolens, papaver somniferum, prunus cerasus, foeniculum vulgarae, senna tora, festuca arundinacea, foenum trigonella graecum, lyceum barbarum, Coriandrum sativum, sinapis alba, brassica nigra, Medicago sativum, pimpinela anisum, linum usitatissimum, brassica compestris, papver somniferum, hordeum vulgare, vitis vinifera, prunus l cerasus, eicchornia crassipes, Tanacetum parthenium, citrus sinensis, x fragaria ananassa, punica granatum, Tanacetum parthenium, baccaurea ramiflora lour, juglans regia, hypericum perforatum, Raphanus sativus, Cucumis sativus, musa paradisiaca, pharbitis nil, prunus amygdalus, brassica oleracea, Lycopersicon esculentum, avena sativa, zea mays, curcuma aeruginosa, zingiber officinale, vitis vinifera, helianthus annuus [63].

Phyto melatonin in health:

After using the Phyto melatonin-rich diet the human health impact is increased due to enhanced levels of melatonin in circulation [64,65,66,67,68]. From the research, it was concluded that after the use of walnut the total concentration of melatonin is increased in the blood & it enhances the anti-oxidant level which shows that walnut is a good source of Phyto melatonin [69]. Grape juices are also an important source of Phyto melatonin components [70]. The concentration of Phyto-melatonin also increased after the use of banana & pineapple & orange juices. After the use of this food the level of oxygen radical anti-oxidant capacity & ferric-reducing anti-oxidant assay

increased.

Role of Phyto melatonin in pathological conditions:

In elder age when people suffer from insomnia then the best way to overcome this problem after the use cherry juice which enhances the quality of sleep due to the increase of exogenous Phyto melatonin [71,72]. The use of coffee is effective against liver problems like cirrhosis of the liver, and hepatic fibrosis [73,74,75]. Coffee is a good antioxidant anda rich source of melatonin. Red wine is also a good source of melatonin [76,77,78,79]. Phyto melatonin also plays important role in the management of corona infection. Phyto melatonin possesses anti-inflammatory, anti-oxidant properties which stop the risk of this infection and minimize the chances of cancer and respiratory tract infection [80,81,82].

Conclusion:

Several pieces of evidence have proved that melatonin plays multiple roles in biological, physiological & hormonal process which occurs at various level of cell organization. The presence of Phyto melatonin in several plant species & fruit indicates its significance. By using a Phyto-melatonin-rich diet the risk of viral infection will be minimized. So, the role of Phyto melatonin is effective in human health.

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