OKAN POWDER

SCIENTIFIC OVERVIEW

More Than Five Decades of Research on the Miracle Berry

Miracle berry is the world's only fruit containing miraculin, a glycoprotein that alters taste perception by converting acidity into sweetness. For over five decades, it has attracted increasing scientific attention across biochemistry, nutrition, pharmacology, and food science.

I/ SWEETNESS-MODIFYING EFFECT OF MIRACULIN AS A FUNCTION OF PH

In their study on the extraction and purification methods of miraculin from Synsepalum dulcificum, entitled "Optimization of conditions for the single step IMAC purification of miraculin from Synsepalum dulcificum", published in Food Chemistry, Vol. 181, August 15, 2015, pp. 19–24, researchers Zuxing Il, Joo Shun Tan, Oi Ming Lai, and Arbakariya B. Ariff clearly demonstrated that only a very small amount of miraculin (0.1 µM), when in contact with an acidic food or beverage, is sufficient to elicit a powerful sweetening effect.

At a micromolar concentration of 0.1 µM miraculin (approximately 2.4 mg/L), exposure to 0.1 M citric acid induces a perceived sweetness intensity up to 400,000 times greater than that of sucrose

THE FOLLOWING ARE KEY CONCLUSIONS FROM THE STUDY:

- A maximum sweetness value after exposure to 0.1 µM miraculin induced by 0.1 M citric acid was reported to be 400,000 times that of sucrose.
- The taste-modifying effect is maximal at pH
- The sweet taste persists for several hours after the consumption of 0.1 µM of miraculin.
- A key conclusion from this study was that activity decreases at higher pH values and drops markedly at pH above 12 or below 2.5 (Kurihara & Beidler, 1968).

The work of Kurihara & Beidler (1968), entitled "Taste-modifying protein from miracle fruit" and published in Nature, demonstrated the importance of pH in optimally triggering the taste-modifying and sweetening effect of miraculin.

Taken together, these two studies demonstrate that the desired sweetening effect can be reliably achieved using a very small dose of miraculin (0.1 mg) combined with an acidic food or beverage, ideally at pH 4.

EXPLORATORY CLINICAL USE OF MIRACULIN IN ONCOLOGY

Several independent media outlets (Chemical & Engineering News, Runwal, Jan 19, 2024; ABC News Rural, Cluff, Mar 23, 2018) have reported that miraculin-based products have been made available in pharmacies associated with the Miami Cancer Institute to alleviate dysgeusia induced by oncological treatments (cen.acs.org, abc.net.au).These reports are consistent with pilot clinical trials showing improvements in taste perception following miraculin supplementation (Wilken & Satiroff, Clin J Oncol Nurs, 2012, PubMed; López-Plaza et al., Nutrients, 2024, MDPI). Although exploratory, this body of work highlights an emerging field of investigation, suggesting a growing scientific and clinical interest in miraculin as part of nutritional support in oncology.

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Key Scientific Milestones

1968

Kurihara, Y., Beidler, L.M. – "Taste-modifying protein, miraculin »

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1976

Giroux, E.L., Henkin, R.I. – "Method of controlling obesity using the active ingredient of miracle fruit »

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2006

Chen, C.C., Wu, M.L., et al. – "Improvement of insulin resistance in fructose-fed rats by miracle fruit"

SEE MORE

2011

Briand, L., et al. – "The human sweet taste receptor mediates the acid-induced sweetness of miraculin"

SEE MORE

2011

Inglett, G.E., Chen, D. – "Phenolics, flavonoids and antioxidant activity of miracle fruit"

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2011

Wang, Y., et al. – "Anti-melanoma and antioxidant activities of miracle fruit stem constituents"

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2015

Zuxing Il, Joo Shun Tan, Oi Ming Lai et Arbakariya B. Ariff – « Optimization of conditions for the single step IMAC purification of miraculin from Synsepalum dulcificum »

SEE MORE

2015

Cheng, J.C., et al. – "Quantification of polyphenols and antioxidant activity in miracle fruit"

SEE MORE

2020

Huang, J., et al. – "Hypocholesterolemic effect of miracle fruit on high-fat diet rats"

SEE MORE

MAIN SCIENTIFIC CONTRIBUTIONS RESULTING FROM THESE RESEARCH EFFORTS

Research conducted on the miracle berry over the past five decades has led, among others, to:

- The identification and purification of miraculin as a taste-modifying protein.
- The elucidation of biochemical mechanisms involving human sweet taste receptors (T1R2/T1R3).
- The demonstration of antioxidant, anti-melanoma, and metabolic activities (hypoglycemic, hypocholesterolemic).
- The development of potential applications in diabetic nutrition, oncology, taste disorders, sugar-free diets, and related fields.

ADDITIONAL RESOURCE – PUBMED CENTRAL (NIH)

For broader access to scientific publications on the miracle berry, it is recommended to consult PubMed Central (NIH). PubMed is the leading biomedical search engine, managed by the National Library of Medicine (NLM) under the U.S. National Institutes of Health (NIH). It indexes tens of millions of articles from scientific and medical journals. PubMed Central, its open-access counterpart, provides free access to the full text of a large number of publications.

These platforms represent a strategic resource: they offer direct access to clinical studies, systematic reviews, and fundamental research on Synsepalum dulcificum and miraculin, thereby supporting scientific monitoring, the identification of academic partners, and the validation of data for future developments in nutraceuticals and nutritional support.

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SELECTED USEFUL LINKS

Akinmoladun FO, Komolafe TR, Olaleye TM, Farombi EO. Nutritional benefits, phytochemical constituents, ethnomedicinal uses and biological properties of Miracle fruit plant (Synsepalum dulcificum). Heliyon. 2020;6(12):e05872. (PMC7785844 – https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7785844/)

Wilken MK, Satiroff BA. Pilot Study of "Miracle Fruit" to Improve Food Palatability for Patients Receiving Chemotherapy. Clin J Oncol Nurs. 2012;16(5):E173-E177. (PMID:23022943 – https://pubmed.ncbi.nlm.nih.gov/23022943/)

Diyapaththugama S, Wijesinghe W, Jayasena D, Navaratne S. Miracle Fruit, a Potential Taste-modifier to Improve Food Preferences: A Review. J Food Sci Nutr. 2024;30(3):123-134. (PMC11489218 – https://pmc.ncbi.nlm.nih.gov/articles/PMC11489218/

López-Plaza B, Bermejo LM, Santurino C, Cavero-Redondo I, Gómez-Candela C. Effect of Regular Consumption of a Miraculin-Based Food Supplement on Taste Perception and Nutritional Status in Malnourished Cancer Patients: The CLINMIR Pilot Protocol. Nutrients. 2023;15(21):4639. (PMID:37960292 – https://pubmed.ncbi.nlm.nih.gov/37960292/)

Turck D, Bresson J-L, Burlingame B, et al. Safety of dried fruits of Synsepalum dulcificum as a novel food. EFSA Journal. 2021;19(6):e06535. (PMC8193528 – https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8193528/

CONCLUSION AND PERSPECTIVES

Research carried out over more than fifty years, from fundamental biochemistry to pilot clinical trials, demonstrates that the miracle berry represents a solid and expanding field of investigation. Its unique, scientifically validated taste-modifying properties make it an innovative ingredient and a differentiating factor for stakeholders in nutrition, nutraceuticals, and dietary supplements.

Beyond scientific curiosity, it represents a strategic opportunity: to develop natural and functional solutions aligned with major consumer trends (sugar reduction, nutritional benefits, unique taste properties, nutritional support, preventive health), while drawing on decades of research confirming both its efficacy and safety of use.