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Translational Clinical Relevance of a Tomato-Derived Phytomelatonin Platform Produced by Combined Enzymatic Hydrolysis

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Abstract

Background: Tomato fruit is a measurable dietary source of phytomelatonin, and tomato-derived extracts are increasingly being evaluated for sleep-related applications. Objective: We examined whether the analytical profile reported for the NVTIA tomato-derived phytomelatonin platform is consistent with the published human evidence base for melatonin and tomato-derived sleep interventions. Methods: We analyzed the process-performance dataset of the NVTIA platform and interpreted it in the context of peer-reviewed clinical and translational literature. Results: In the NVTIA dataset, the final melatonin content reached 98.2% to 99.1%, while total impurities were controlled within 1.0% to 1.5%. When rice-germ polyamines were omitted or the enzymatic hydrolysis conditions deviated from the pH and temperature window, melatonin content fell to 82.3% to 85.5% and impurities increased to 8.2% to 10.5%. Published food-chemistry data indicate that tomato fruits contain 7.5 to 250 ng/g dry-weight melatonin. In a meta-analysis of 17 controlled studies involving 284 participants, exogenous melatonin shortened sleep-onset latency by 4.0 min, improved sleep efficiency by 2.2%, and increased total sleep duration by 12.8 min. A double-blind randomized study of tomato extract in primary insomnia reported sleep-induction benefits over two weeks, and a more recent pilot study of tomato-derived phytomelatonin reported improvements in sleep latency, time awake, global PSQI score, and emotional well-being. Conclusion: The current evidence supports the clinical plausibility of a high-purity tomato-derived phytomelatonin ingredient and suggests that process quality is likely to matter for translational performance. Direct clinical superiority of NVTIA over other commercial ingredients, however, remains to be demonstrated in head-to-head randomized trials.

Keywords

Tomato; phytomelatonin; melatonin; sleep; insomnia; enzymatic hydrolysis; translational nutrition.

1. Introduction

Melatonin remains one of the most widely discussed chronobiologic compounds in sleep medicine, yet the clinical literature continues to show a mixed magnitude of benefit across populations, formulations, and endpoints [5,6]. Against that background, ingredient quality, botanical source, matrix effects, and process-related impurity control have become increasingly relevant translational questions for nutraceutical development. Tomato fruit is an especially attractive botanical candidate because it is edible, globally available, and naturally contains measurable phytomelatonin across cultivars [1].

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2. Ingredient Platform and Translational Rationale

The NVTIA platform combines tomato raw material with black ginger, rice-germ polyamines, multi-enzyme hydrolysis, solvent extraction, chromatographic purification, and stabilization. Within the reported process dataset, the optimized examples yielded final melatonin contents of 98.2%, 98.8%, and 99.1%, whereas internal non-optimized comparators declined to 85.5%, 82.3%, and 83.7%. In parallel, impurity levels were kept at 1.5%, 1.2%, and 1.0% in the optimized preparations but increased to 8.2%, 10.5%, and 9.8% in the comparative preparations. These differences support a central translational point: for a tomato-derived phytomelatonin ingredient, process control is not merely an industrial convenience, but a likely determinant of downstream biological reliability.

Table 1. Process-performance characteristics reported for the NVTIA platform.

Group	Melatonin (%)	Impurities (%)	Interpretive note
Example 1	98.2	1.5	Optimized process; high purity maintained
Example 2	98.8	1.2	Optimized process; strong balance of content and cleanliness
Example 3	99.1	1.0	Highest reported melatonin content in the dataset
Comparative 1	85.5	8.2	Rice-germ polyamines omitted
Comparative 2	82.3	10.5	pH shifted to 3.0 during hydrolysis
Comparative 3	83.7	9.8	Hydrolysis temperature increased to 70°C

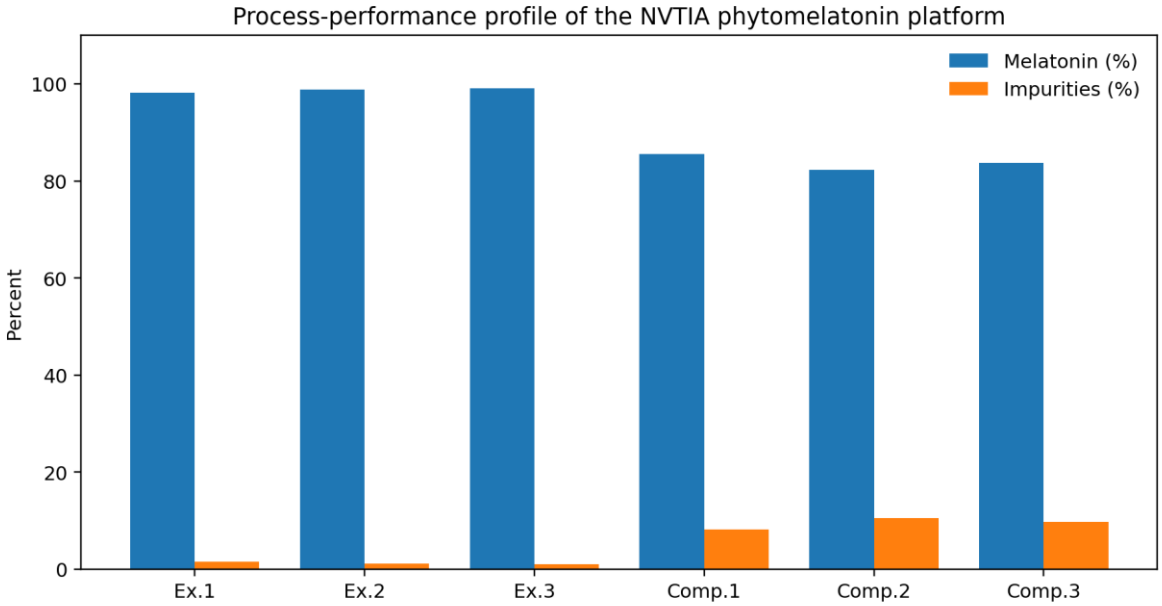

Figure 1. Process-performance profile of the NVTIA phytomelatonin platform.

3. Why Tomato-Derived Phytomelatonin Is Biologically Credible

Tomato has been documented as a food source of melatonin, with reported concentrations ranging from 7.5 to 250 ng/g on a dry-weight basis depending on cultivar and solar radiation exposure [1]. Reviews of phytomelatonin have emphasized that plant-derived melatonin

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preparations can carry a broader phytochemical background than isolated synthetic melatonin and may avoid some synthesis-related by-products, although rigorous clinical confirmation is still required [2]. Experimental work on phytomelatonin-rich extracts has further shown that preparations containing melatonin together with plant phenolics, flavonoids, and carotenoids can display favorable biochemical and functional properties, including antioxidant activity [3]. In vitro comparative work has suggested stronger antiradical and anti-inflammatory signals for a phytomelatonin complex than for synthetic melatonin alone, although these observations cannot be translated directly into clinical superiority claims [4].

4. Human Clinical Context

The human sleep literature provides a clinically relevant frame for interpreting a refined tomato-derived phytomelatonin ingredient. In the classic meta-analysis by Brzezinski and colleagues, exogenous melatonin significantly reduced sleep-onset latency by 4.0 min, increased sleep efficiency by 2.2%, and increased total sleep duration by 12.8 min across 17 controlled studies including 284 participants [5]. More recent evidence is more nuanced: a 2022 systematic review found that, in adults with non-comorbid chronic insomnia, melatonin was not consistently associated with significant improvements in sleep-onset latency, total sleep time, and sleep efficiency, highlighting the importance of population selection and study design [6].

5. Tomato Extract Data Relevant to the Clinical Space

Human data specifically involving tomato-derived sleep interventions are emerging. In a double-blind randomized study in primary insomnia, 70 patients were assigned to tomato extract or placebo for two weeks; the trial reported sleep-induction benefits and a reduction in delay to fall asleep, although a significant increase in the amount of actual sleep was not clearly established [7]. In a later pilot study of a tomato-derived phytomelatonin preparation, 28 days of supplementation was associated with improvements in sleep-latency measures, time awake, global PSQI score, and emotional well-being [8]. Taken together, these reports do not prove equivalence among tomato-derived ingredients, but they do support the clinical relevance of the tomato-phytomelatonin category as a whole.

Table 2. Published human evidence relevant to the clinical translation of tomato-derived phytomelatonin.

Evidence source	Design	Population / duration	Key sleep-related findings
Brzezinski et al., 2005 [5]	Meta-analysis	17 controlled studies; 284 participants	Sleep-onset latency −4.0 min; sleep efficiency +2.2%; total sleep duration +12.8 min.
Choi et al., 2022 [6]	Systematic review and meta-analysis	Adults and other age groups with chronic insomnia	Adult non-comorbid insomnia showed no consistent significant improvement across major endpoints.
Dehnavi et al., 2023 [7]	Double-blind randomized study	Primary insomnia; 2 weeks	Tomato extract showed sleep-induction benefit and shorter delay in falling asleep; actual sleep increase remained uncertain.

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Evidence source	Design	Population / duration	Key sleep-related findings
De Jesus et al., 2025 [8]	Pilot study	Tomato-derived phytomelatonin; 28 days	Reported improvement in sleep latency, time awake, global PSQI, and emotional well-being.

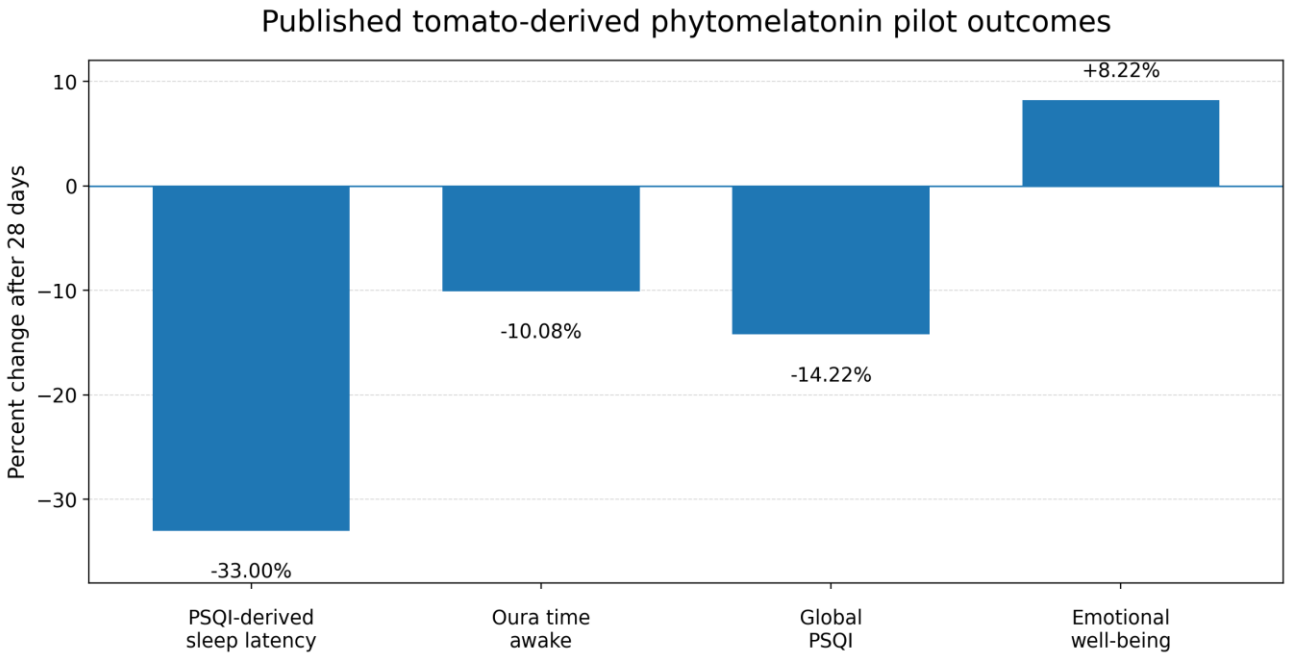

Figure 2. Selected percentage changes reported after 28 days of supplementation with a published tomato-derived phytomelatonin preparation [8].

Figure 2 is descriptive and summarizes published endpoint changes from an external tomato-derived phytomelatonin pilot study.

6. Translational Interpretation for the NVTIA Platform

Viewed against the published literature, the NVTIA process dataset suggests a favorable translational profile for three reasons. First, the ingredient is built upon a credible botanical source with established phytomelatonin content [1]. Second, its optimized process window consistently delivered a markedly higher final melatonin fraction and lower impurity burden than the internal non-optimized comparators, which is the type of analytical distinction that would be expected to matter when a sleep-support ingredient is standardized for human use. Third, the broader phytochemical logic of plant-derived melatonin systems remains biologically plausible, especially when stability, oxidative integrity, and matrix-assisted functionality are considered [2-4].

7. Conclusion

The available evidence supports a coherent translational narrative for NVTIA: tomato is a validated phytomelatonin source, optimized extraction and purification materially improve the analytical profile of the final ingredient, and the wider clinical literature indicates that melatonin- and tomato-derived sleep interventions can produce measurable sleep-related benefits in humans [1,5,7,8]. On the evidence currently available, the NVTIA platform is best characterized as a high-purity tomato-derived phytomelatonin system with clinically credible

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potential. Demonstration of ingredient-specific superiority now depends on direct randomized trials using the NVTIA material itself.

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