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NVTIA™ 5-HTP–L-Theanine–GABA Sleep Rhythm Support System: Ratio Optimization, Gastrointestinal Tolerability, and Evidence from Human Studies and Preclinical Evaluation

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ABSTRACT

Background: Nutritional sleep-support strategies often underperform because they address only one pathway or do not balance efficacy with tolerability. We examined an NVTIA™ 5-HTP–L-theanine–GABA ternary system and aligned its disclosed formulation and mouse data with current published human evidence on the same three axes. Methods: We summarized the disclosed composition window, excipient module, process parameters, and preclinical sleep-evaluation results, and screened recent peer-reviewed human trials and evidence syntheses available through March 2026. Results: Published human evidence supports biological plausibility and modest clinical benefit for the individual components. A 12-week randomized controlled trial in older adults found that 100 mg/day 5-HTP improved certain sleep-quality components, particularly in poor sleepers. A 2025 meta-analysis of L-theanine trials reported significant improvements in subjective sleep-onset latency, daytime dysfunction, and overall subjective sleep quality. A 4-week double-blind trial of 300 mg/day oral GABA showed reduced sleep latency and improved sleep efficacy, although systematic-review evidence for oral GABA remains limited and heterogeneous. Against this clinical background, the disclosed ternary formulations showed dose-responsive preclinical performance. Conclusions: The NVTIA™ platform is best interpreted as a coordinated formulation-engineering system in which precursor support, relaxation support, inhibitory-neurotransmission support, gastrointestinal-tolerability excipients, and process control are aligned. These results justify further controlled human validation of optimized ternary ratios.

KEYWORDS

5-HTP; L-theanine; GABA; Sleep rhythm; Sleep latency; Sleep duration; Gastrointestinal tolerability; Formulation engineering

1. INTRODUCTION

Sleep disturbance involves impaired sleep initiation, fragmented maintenance, reduced restorative depth, and poor next-day functioning. In practice, many nutritional sleep products emphasize only one of these dimensions and therefore fail to coordinate onset support, relaxation, continuity, and tolerability within one system.

We focused on a ternary system composed of 5-hydroxytryptophan (5-HTP), L-theanine, and gamma-aminobutyric acid (GABA). 5-HTP sits upstream of serotonin and melatonin biosynthesis. L-theanine has been investigated as a calming amino acid that may improve perceived sleep quality and morning refreshment. GABAergic signaling is central to sleep–wake regulation, although the translational evidence for oral GABA remains more mixed than that for classical GABAergic pharmacotherapy.

The scientific interest of the NVTIA™ platform lies less in ingredient novelty than in formulation logic. The disclosed system combines a ratio-tunable ternary core, a fiber-based gastrointestinal-tolerability module, and controlled granulation parameters intended to improve uniformity and manufacturability. Our objective was to preserve the disclosed formulation and preclinical structure while incorporating current, citable human evidence relevant to the same mechanistic axes.

2. MATERIALS AND METHODS

2.1. Composition Window and Functional Positioning

We reviewed the disclosed formulation study describing composition ranges, ingredient specifications, processing parameters, and mouse sleep-evaluation data for the NVTIA™ system.

Table 1. Disclosed active-ingredient window and functional roles in the NVTIA™ system

Component	Disclosed window	Functional role in the NVTIA™ system
5-HTP	5–30 parts; 5–30 mg/single dose	Serotonin/melatonin precursor; primary sleep-initiation axis
L-theanine	20–100 parts; 20–100 mg/single dose	Relaxation support; calming and sleep-quality support axis
GABA	30–150 parts; 30–150 mg/single dose	Inhibitory-neurotransmission support; sleep maintenance and deep-sleep support

2.2. Formulation Modules and Process Attributes

To align the formulation with external evidence, we screened PubMed-indexed randomized controlled trials, systematic reviews, meta-analyses, and recent peer-reviewed reviews available through 28 March 2026. We prioritized human sleep outcomes for 5-HTP, L-theanine, and oral GABA, and extracted sample size, dose, duration, and headline sleep-related findings.

Table 2. Brand-specific formulation and processing modules

Module	Disclosed implementation	Formulation value
Ingredient specification	5-HTP from Griffonia seed extract ≥98%; L-theanine and GABA ≥99%	Supports consistency and high-specification raw-material control
Ratio-tunable ternary core	5-HTP: L-theanine: GABA = 1:(3–5): (5–7)	Allows adjustment from milder to stronger sleep-support profiles
Tolerability-support excipient	Fructooligosaccharide, inulin, or resistant dextrin at 1%–10% of total composition	Designed to improve gastrointestinal tolerability of 5-HTP-containing products
Process control	80-mesh sieving, 5% HPMC binder solution, wet granulation, drying at 60°C to ≤3% moisture, hardness 4–6 kgf	Improves content uniformity, manufacturability, and tablet robustness
Delivery formats	Tablet, hard capsule, soft capsule, granule, powder, oral liquid, chewable tablet	Extends commercial translation without changing the core formulation logic

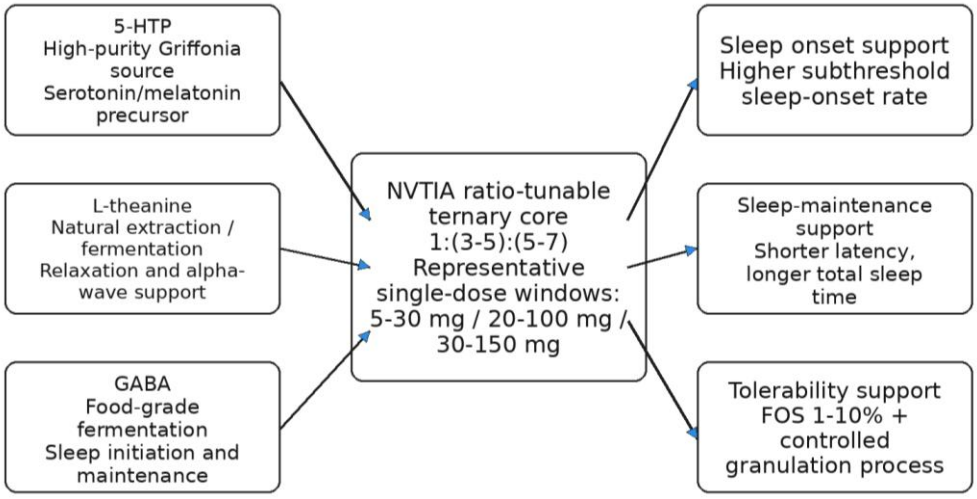

Figure 1. Proposed NVTIA™ multi-pathway synergy model

2.3. Literature Search and Evidence Stratification

We interpreted the disclosed mouse data as preclinical formulation-performance evidence and the published literature as external human evidence. These two layers were synthesized in parallel rather than pooled statistically.

3. RESULTS

3.1. Published Human Evidence

The external human literature supports the formulation rationale, but not all three components carry the same level of evidence. For 5-HTP, the most directly relevant recent trial is the 12-week randomized controlled study in older adults reported by Sutanto et al., in which 100 mg/day improved certain sleep-quality components and produced a significant subjective global sleep score improvement in poor sleepers.

For L-theanine, the current evidence base is stronger than it was when many earlier sleep supplements were designed. The 2025 meta-analysis by Bulman et al. pooled 19 articles involving 897 participants and found significant improvements in subjective sleep-onset latency, daytime dysfunction, and overall subjective sleep quality. A second 2025 systematic review focusing on standalone L-theanine concluded that 200–450 mg/day appears to be the most consistently supportive range across adult trials.

For oral GABA, the literature remains encouraging but more cautious. The 2018 randomized double-blind trial in participants with insomnia symptoms showed meaningful improvements in both sleep latency and sleep efficacy after 4 weeks of 300 mg/day. However, the 2020 systematic review judged the overall human sleep evidence for oral GABA to be limited and heterogeneous.

Table 3. Representative published human evidence relevant to the ternary system

Published study	Population / design	Intervention	Key sleep-related findings
Sutanto et al., 2024	30 older adults; single-blind parallel RCT; 12 weeks	100 mg/day 5-HTP	Improved certain sleep-quality components; poor sleepers showed significant subjective GSS improvement and higher serum serotonin
Bulman et al., 2025	19 articles; meta-analysis; N=897	L-theanine supplementation across human trials	Significant improvements in subjective sleep-onset latency, daytime dysfunction, and overall subjective sleep quality
Cotter et al., 2025	13 eligible trials; systematic review; n=550	Standalone L-theanine, 50–900 mg/day	200–450 mg/day judged the most consistently supportive range; benefits reported for latency, maintenance, efficiency, satisfaction, and waking refreshment
Lyon et al., 2011	98 boys with ADHD; randomized double-blind placebo-controlled trial; 6 weeks	400 mg/day L-theanine	Higher sleep percentage and sleep efficiency; no significant change in latency; well tolerated
Byun et al., 2018	40 adults with insomnia symptoms; randomized double-blind placebo-controlled trial; 4 weeks	300 mg/day oral GABA	Sleep latency decreased from 13.4±15.7 to 5.7±6.2 min and sleep efficacy rose from 79.4±12.9% to 86.1±10.5%
Hepsomali et al., 2020	14 placebo-controlled human trials; systematic review	Natural or biosynthetic oral GABA	Evidence for sleep benefit judged limited and heterogeneous despite several positive latency-related findings

3.2. 5-HTP Titration with Fixed L-Theanine and GABA

Within the fixed 80 mg L-theanine + 120 mg GABA framework, the disclosed ternary system showed a clear 5-HTP dose–response pattern in the medium-dose groups. Increasing 5-HTP from 5 mg to 15 mg to 30 mg reduced spontaneous activity, raised the sleep-onset rate, shortened sleep latency, and prolonged total sleep duration.

Table 4. Medium-dose performance across the 5-HTP titration series (fixed 80 mg L-theanine + 120 mg GABA)

Embodiment	Single-dose composition (mg/tablet)	Activity counts/10 min	Sleep onset (%)	Latency (min)	Total sleep duration (min)
Example I	5 / 80 / 120	586	70	13.5	142.6
Example II	15 / 80 / 120	489	80	11.8	162.3
Example III	30 / 80 / 120	328	100	7.8	226.4

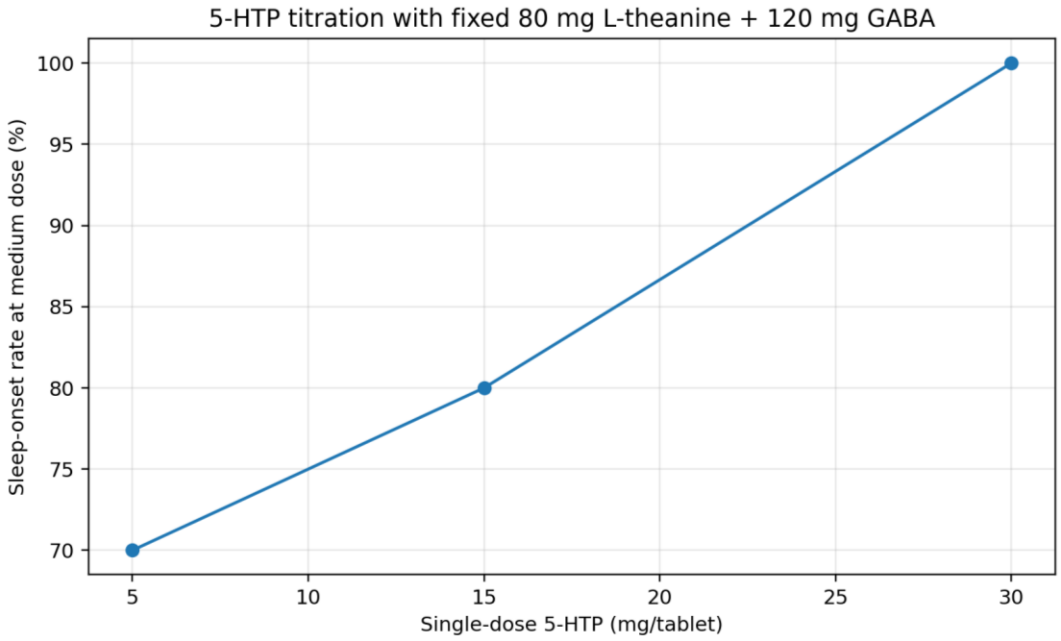

Figure 2. Sleep-onset rate across the 5-HTP titration series

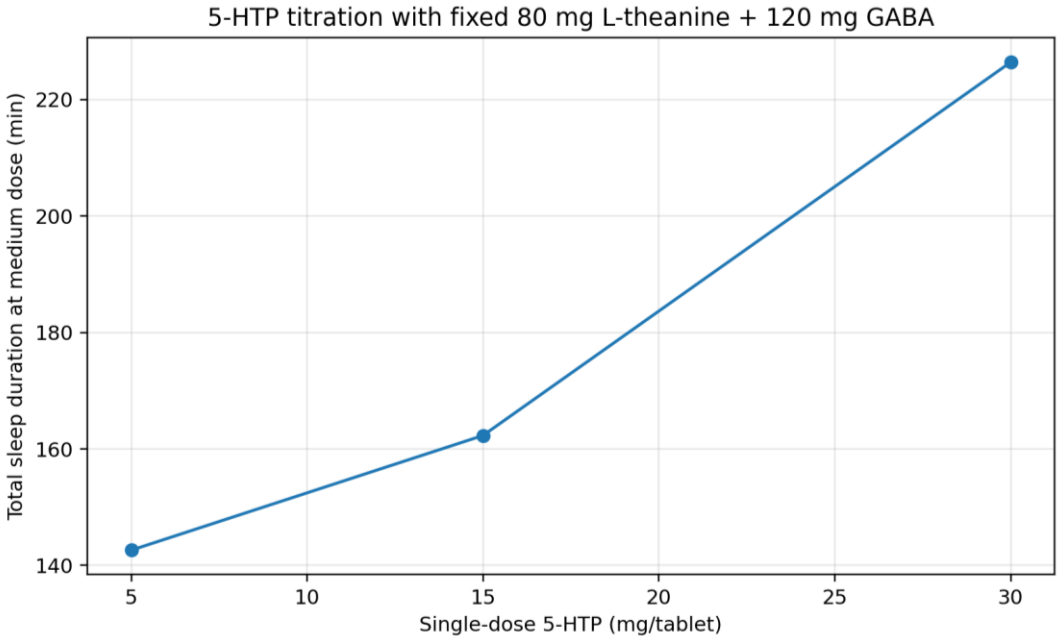

Figure 3. Total sleep duration across the 5-HTP titration series

3.3. GABA optimization with fixed 5-HTP and L-theanine

When 5-HTP and L-theanine were fixed at 20 mg and 80 mg per tablet, increasing GABA from 100 mg to 140 mg progressively improved the disclosed sleep profile. Total sleep duration increased from 162.5 min to 208.6 min, sleep latency decreased from 11.8 min to 9.2 min, and sleep-onset rate increased from 80% to 100%.

Table 5. Medium-dose performance across the GABA optimization series

Embodiment	Ratio	Single-dose composition (mg/tablet)	Activity counts/10 min	Sleep onset (%)	Latency (min)	Total sleep duration (min)
Example IV	1:4:5	20 / 80 / 100	458	80	11.8	162.5
Example V	1:4:5.5	20 / 80 / 110	435	85	11.0	174.3
Comparative	1:4:6	20 / 80 / 120	412	90	10.3	185.2
Example VI	1:4:7	20 / 80 / 140	386	100	9.2	208.6

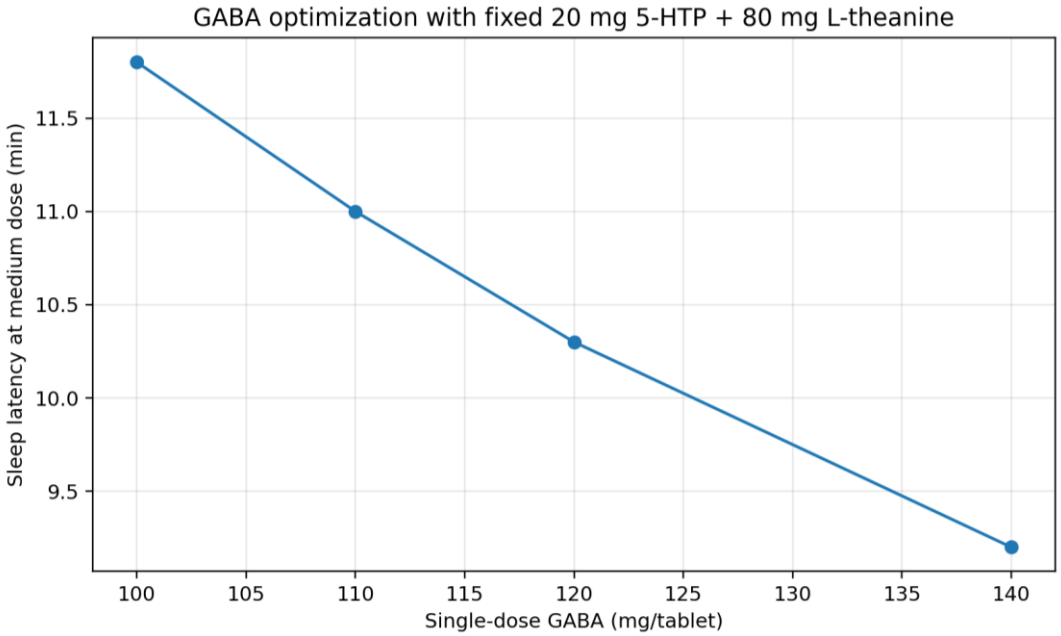

Figure 4. Sleep latency across the GABA optimization series

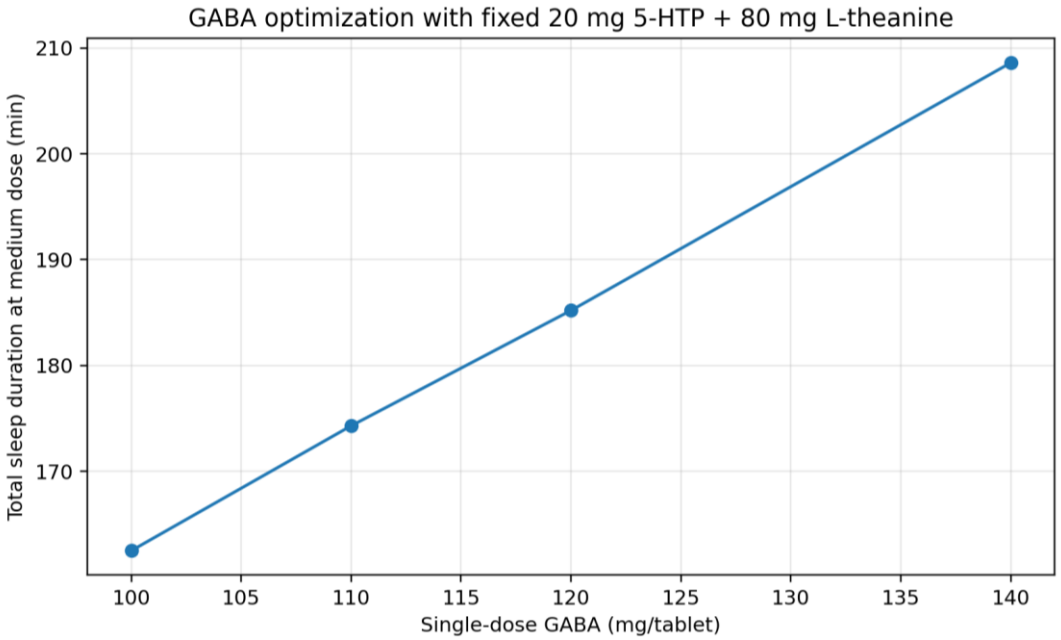

Figure 5. Total sleep duration across the GABA optimization series

3.4. Representative Comparison and Safety Observations

The representative medium-dose comparison in the Example II framework showed a materially stronger total-sleep-duration profile for the ternary system than for blank, 5-HTP-alone, or the binary L-theanine + GABA comparator. Gastrointestinal mucosa remained intact in ternary groups, whereas mild congestion or edema was described in some 5-HTP-alone groups.

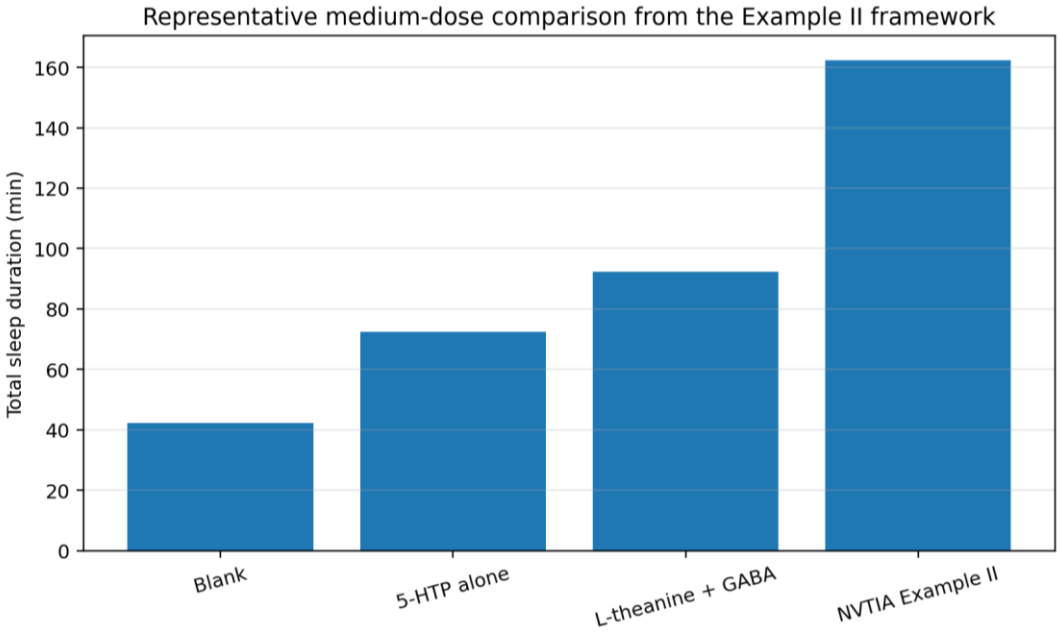

Figure 6. Representative medium-dose comparison from the Example II framework

4. DISCUSSION

A publishable interpretation of this evidence base depends on separating plausibility from proof. The published human data do not yet validate one exact ternary ratio, but they do support the relevance of each mechanistic axis. 5-HTP has direct biochemical relevance to serotonin and melatonin synthesis and now has recent randomized evidence in older adults. L-theanine has the broadest supportive evidence among the three components, including both meta-analytic and randomized controlled trial data. Oral GABA has plausible sleep-related effects and at least one positive double-blind insomnia trial, but systematic-review conclusions remain more conservative.

Against that background, the disclosed preclinical data contribute something different: they describe how ratio engineering changes performance inside a controlled ternary framework. In the 5-HTP titration series, raising the precursor fraction compressed latency and extended total sleep time. In the GABA optimization series, raising the inhibitory-neurotransmission support fraction further improved onset and duration. This internal consistency strengthens the formulation-engineering narrative, especially because the design also addresses gastrointestinal tolerability and process standardization.

The next rational step is a randomized, placebo-controlled human trial comparing at least two optimized ternary ratios against a simplified comparator, with objective sleep measures, validated questionnaires, and structured adverse-event monitoring.

5. CONCLUSIONS

The NVTIA™ 5-HTP–L-theanine–GABA platform can be framed as a ratio-optimized sleep-support system in which precursor biology, relaxation support, GABAergic support, gastrointestinal tolerability, and manufacturing control are deliberately coordinated. Recent published human

evidence supports the relevance of each axis, while the disclosed preclinical dataset shows coherent dose-responsive improvements in sleep-onset rate, latency, and total sleep duration. The overall evidence justifies further prospective human evaluation of optimized ternary ratios.

DECLARATIONS

Ethics statement: This manuscript synthesizes published human literature and analyzes a disclosed preclinical formulation dataset; no new human or animal experimentation was performed for preparation of this article.

Funding: Not declared.

Conflicts of interest: None declared.

Data availability: All numerical values summarized in the formulation-performance tables and figures are presented within the manuscript.

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