WEP Warwick Evans Publishing

International Journal of Agriculture and Food Sciences Research

ISSN: 3006-7685 (Print), ISSN: 3006-3736 (Online) | Volume 4, Number 1, Year 2026
DOI: https://doi.org/10.62051/ijafsr.v4n1.07
Journal homepage: https://wepub.org/index.php/IJAFSR/index

Time-Programmed Guarana Extract-EGCG-Konjac Glucomannan Matrix for Weight Management: Formulation Performance, Satiety Signaling, and Translational Evidence

Jabar Yassine *, Gregg L. Semenza, Ethan Blake

World Food Supplement Association, New York, USA
*Corresponding Author: info@wfsas.org

ABSTRACT

Background: Obesity remains a major global health problem, and practical weight-management products often fail because thermogenic ingredients, catechins, and satiety fibers are combined without a delivery system that protects labile actives or coordinates gastrointestinal exposure [1]. We therefore evaluated a time-programmed guarana extract-EGCG-konjac glucomannan (KGM) matrix and interpreted its disclosed formulation-performance dataset alongside published human and mechanistic evidence. Methods: We reviewed the disclosed composition, comparator results, gastrointestinal release behavior, animal-model outcomes, and short-term volunteer satiety observations, and we complemented these data with a structured PubMed- and WHO-based literature search through March 2026. Results: In the disclosed dataset, 2-h EGCG retention in simulated gastric fluid remained 83.9–88.7% for qualified formulations but only 31.7% for the parameter-mismatched comparator. Qualified matrices sustained intestinal release (65.8–71.2% at 6 h) and preserved near-complete colonic release (96.7–98.1% at 12 h). In obese mice, the benchmark embodiment reduced body weight by 21.3%, body-fat percentage by 32.7%, and food intake by 28.4% versus model control, with concurrent rises in GLP-1 and fecal butyrate. Published studies provide biologically concordant support: EGCG-caffeine/guarana mixtures increased 24-h energy expenditure in a randomized crossover trial [2], low-dose EGCG increased postprandial fat oxidation in obese men [3], gelled KGM reduced appetite and energy intake in healthy adults [5], and a 2024 dose-response meta-analysis reported significant reductions in body mass, BMI, and body-fat percentage with green tea extract supplementation [4]. Conclusion: We found that the differentiating value of the NVTIA platform lies primarily in matrix architecture rather than ingredient listing alone. The combined evidence supports a formulation-level rationale for staged satiety and metabolic support, while confirming that independent clinical validation remains necessary.

KEYWORDS

Guarana extract; Epigallocatechin gallate; Konjac glucomannan; Programmed release; Satiety; Weight management; GLP-1; Short-chain fatty acids

1. INTRODUCTION

Obesity and overweight continue to expand globally. According to the World Health Organization, 2.5 billion adults were overweight in 2022, including 890 million living with obesity, and worldwide adult obesity has more than doubled since 1990 [1]. Against this background, weight-management formulations are often marketed as simple combinations of stimulants, catechins, and soluble fiber. In practice, however, outcomes are constrained by chemistry and delivery: catechins can degrade prematurely in gastric conditions, caffeine-bearing extracts may increase thermogenic drive without

providing lasting satiety, and fibers can underperform when they do not meet the viscosity and hydration thresholds needed to meaningfully alter gastric or intestinal kinetics.

We evaluated a formulation platform centered on three coordinated elements: guarana extract as a caffeine-bearing thermogenic driver, epigallocatechin gallate (EGCG) as a catechin-rich metabolic regulator, and konjac glucomannan (KGM) as a high-viscosity gel-forming matrix designed to extend gastric residence, modulate small-intestinal release, and preserve a fermentable fraction for downstream colonic signaling. Rather than asking whether any single ingredient is inherently "strong," we asked whether a parameter-qualified matrix can alter exposure kinetics enough to create a more coherent weight-management profile.

To place the formulation in context, we integrated its disclosed release and preclinical findings with published human and mechanistic evidence. Prior clinical work has shown that EGCG-caffeine/guarana mixtures can increase 24-hour energy expenditure [2], while human and animal studies indicate that KGM can influence satiety, appetite-related signaling, and short-chain-fatty-acid production [5, 8]. At the same time, the broader evidence base remains heterogeneous, so translational claims should be framed cautiously [4, 6, 10].

2. MATERIALS AND METHODS

We analyzed the disclosed formulation dataset together with public literature. For the formulation component, we extracted composition ratios, KGM quality parameters, gastric-retention values, intestinal and colonic release behavior, efficacy observations in obese mice and rats, and short-term hunger-score observations in overweight volunteers. For the public-evidence component, we searched WHO and PubMed through March 2026 using terms related to obesity, guarana, EGCG, green tea extract, konjac glucomannan, satiety, appetite, energy expenditure, and body composition.

The working architecture contained guarana extract standardized to 8–15% caffeine, EGCG with purity above 90%, and KGM specified by molecular weight, purity, and viscosity thresholds. Three qualified dosage forms were compared with a composition matched for nominal ingredient categories and parts by weight but formulated with sub-threshold KGM properties. We used descriptive comparison because the disclosed dataset provided summary outputs rather than raw individual-level measurements.

Our interpretive framework was intentionally translational. We treated the disclosed formulation and model data as evidence of delivery performance and biological plausibility, then examined whether published clinical and mechanistic literature moved in the same direction. This approach allowed us to keep formulation-specific findings and public evidence conceptually aligned without presenting them as if they originated from one single registered trial.

Table 1. Composition parameters and key formulation-performance indexes

Item	Embodiment 1	Embodiment 2	Embodiment 3	Comparative
Guarana extract (parts)	20	12	28	20
EGCG (parts)	10	8	18	10
Konjac glucomannan (parts)	35	25	45	35
KGM molecular weight (×10⁴ Da)	80	60	120	30
KGM purity (%)	92	91	95	85
1% viscosity at 20 °C (mPa·s)	28,000	22,000	35,000	8,000
EGCG retention at 2 h (%)	86.2	83.9	88.7	31.7
6-h intestinal release (%)	68.5	65.8	71.2	92.5
12-h colonic release (%)	97.2	96.7	98.1	94.1

3. RESULTS

3.1. Gastric Protection Depended on Parameter-Qualified KGM

The first consistent finding was that KGM quality thresholds governed gastric protection of EGCG. All three qualified embodiments preserved more than 80% of EGCG after 2 hours in simulated gastric fluid, whereas the parameter-mismatched comparator retained only 31.7%. Because Embodiment 1 and the comparator used the same nominal active categories and the same parts ratio, this separation is best interpreted as a material-properties effect rather than a simple ingredient-presence effect.

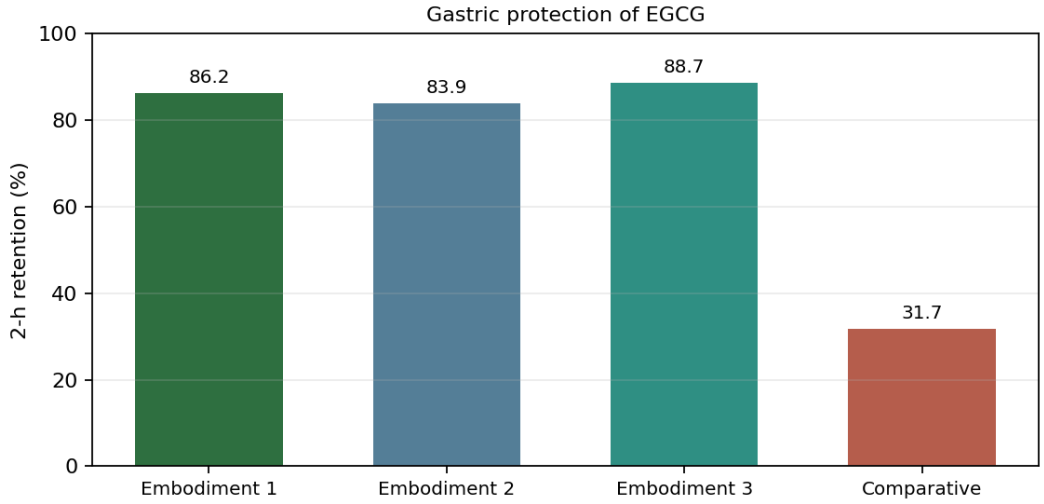

Figure 1. Two-hour EGCG retention in simulated gastric fluid across qualified embodiments and the parameter-mismatched comparator

3.2. The Matrix Generated Staged Intestinal-Colonic Release

The second finding was that the matrix produced staged gastrointestinal release instead of dose dumping. Qualified embodiments released roughly two thirds of EGCG by 6 hours in intestinal conditions and then approached near-complete release by 12 hours in the colonic phase. In contrast, the comparator reached 92.5% intestinal release and showed no clear second-stage pattern. This behavior is consistent with a hydrated gel network that first limits gastric degradation, then slows intestinal erosion, and finally preserves a residual fermentable fraction.

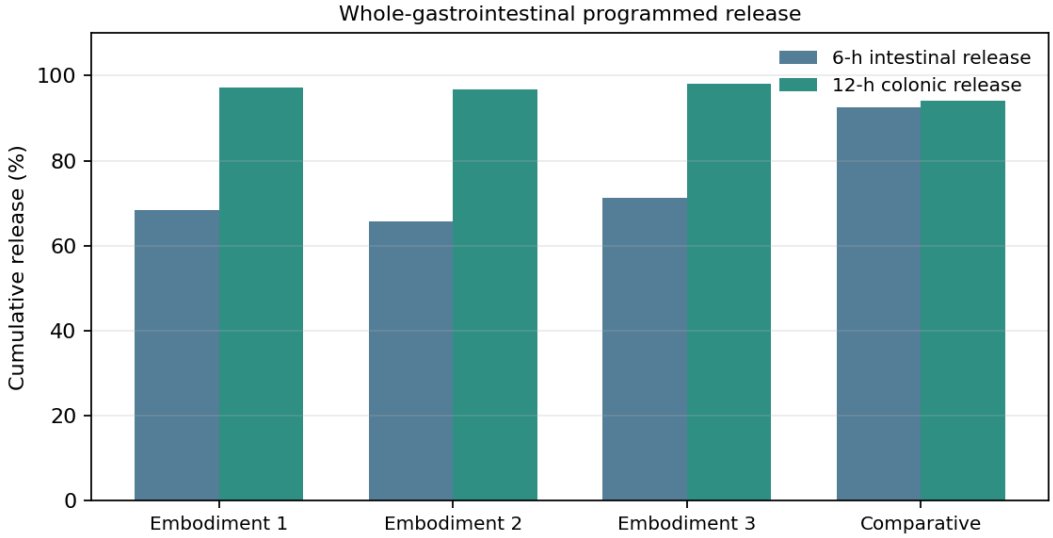

Figure 2. Programmed gastrointestinal release behavior of EGCG across qualified formulations and the comparator

3.3. Disclosed Biological Observations Followed The Release Hypothesis

The disclosed in vivo observations followed the same logic. In obese mice, the benchmark embodiment reduced body weight, body-fat percentage, and food intake more strongly than the comparator, and it increased serum GLP-1 and fecal butyrate. In overweight volunteers, hunger scores remained below 3 points across a 6-hour observation period, supporting a short-term satiety signal. In obese rats, the high-load granule embodiment retained effects on body weight, body fat, and fasting blood glucose. These outcomes do not establish clinical efficacy, but they do suggest that the release architecture translated into model-level biological differences.

Table 2. Disclosed efficacy observations aligned with the programmed-release concept

Model	Endpoint	Result	Interpretation
Obese mice, Embodiment 1	Body weight vs model control	−21.3%	Greater reduction than comparator (−8.7%)
Obese mice, Embodiment 1	Body fat vs model control	−32.7%	Marked adiposity reduction
Obese mice, Embodiment 1	Food intake vs model control	−28.4%	Consistent with satiety-enhancing architecture
Obese mice, Embodiment 1	Serum GLP-1 vs model control	+126.5%	Supports enteroendocrine involvement
Obese mice, Embodiment 1	Fecal butyrate vs model control	+89.2%	Suggests colonic fermentation contribution
Overweight volunteers, Embodiment 2	Hunger score over 6 h	<3 points	Lower than placebo across the observation window
Obese rats, Embodiment 3	Body weight vs model control	−24.6%	High-load active system retained efficacy
Obese rats, Embodiment 3	Body fat / fasting blood glucose	−37.2% / −18.3%	Metabolic benefit extended beyond weight alone

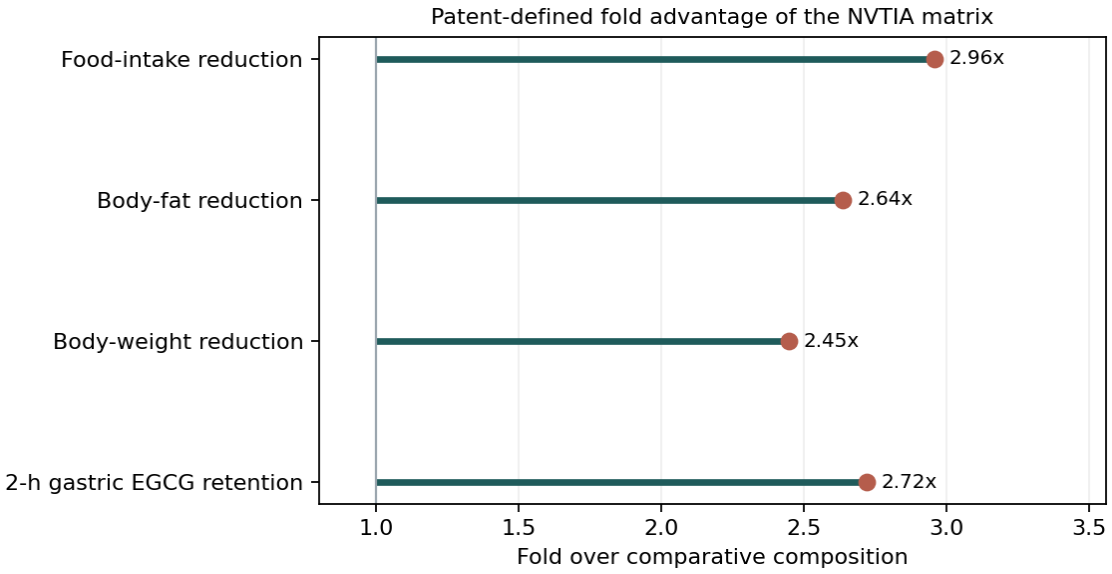

Figure 3. Patent-defined fold advantage of the benchmark matrix over the comparator

3.4. Published Human And Mechanistic Evidence

Publicly available studies were directionally concordant. In a randomized crossover metabolic-chamber study, an EGCG-caffeine/guarana mixture increased 24-hour energy expenditure by about

750 kJ compared with placebo, although it did not significantly increase lipid oxidation and produced a modest blood-pressure signal [2]. In obese men, low-dose EGCG increased postprandial fat oxidation, whereas high-dose EGCG did not improve energy expenditure [3]. Gelled KGM reduced appetite and energy intake in a randomized crossover trial in healthy adults [5], and KGM also increased short-chain-fatty-acid formation while suppressing appetite-related hypothalamic signaling in obese mice [8]. At the population level, green tea extract meta-analyses report modest but significant reductions in body mass, BMI, and body-fat percentage, whereas glucomannan reviews remain mixed and emphasize short-term effects, formulation dependence, and the need for better-controlled trials [4, 6, 10].

Table 3. Representative published evidence aligned with the guarana-EGCG-KGM architecture

Evidence domain	Study type	Key public finding	Relevance to the matrix
EGCG + guarana/caffeine	Randomized, placebo-controlled crossover; metabolic chamber	24-h energy expenditure increased by about 750 kJ versus placebo; lipid oxidation did not significantly increase [2].	Supports a thermogenic component, but not an automatic fat-oxidation claim.
EGCG	Pilot randomized controlled trial in obese men	Low-dose EGCG increased postprandial fat oxidation; energy expenditure was not improved [3].	Suggests dose-sensitive metabolic effects.
Green tea extract	2024 dose-response meta-analysis of RCTs	Supplementation significantly decreased body mass, BMI, and body-fat percentage [4].	Supports modest population-level anthropometric benefit.
Gelled KGM	Randomized crossover trial in healthy adults	Appetite and energy intake were reduced after gelled KGM ingestion [5].	Supports the gastric-satiety role of a gel-forming fiber matrix.
Glucomannan	2015 systematic review of RCTs	Short-term weight reduction may occur, but the evidence base remained limited and heterogeneous [6].	Reinforces that matrix quality and study design matter.
Mixed fiber formula including glucomannan	2024 randomized, double-blind, placebo-controlled trial	Body weight and body composition improved, but gastrointestinal events were common [7].	Highlights both translational potential and tolerability monitoring.
KGM	2024 obese-mouse mechanistic study	Food intake fell; SCFA formation increased; appetite-related hypothalamic signaling was suppressed [8].	Mechanistically concordant with GLP-1/butyrate-oriented positioning.

4. DISCUSSION

Taken together, the evidence argues that the NVTIA platform should be discussed primarily as a delivery architecture rather than as a label claim. Guarana, EGCG, and KGM are each individually familiar ingredients. The disclosed advantage emerged only when KGM met specific molecular-weight, purity, and viscosity thresholds, converting it from a generic fiber into a structured release matrix. This distinction matters because it explains why the qualified embodiments preserved EGCG under gastric stress and avoided the intestinal dose dumping seen with the comparator.

The translational logic is also biologically plausible. Guarana contributes caffeine-associated thermogenic drive; EGCG contributes a catechin-rich metabolic signal that may support fat oxidation

under some conditions; and KGM adds a mechanical satiety phase plus a fermentable substrate that can influence colonic signaling. In the disclosed dataset, this sequence was mirrored by increases in GLP-1 and fecal butyrate, while public literature supports the relevance of energy expenditure, appetite modulation, and microbiota-related pathways [2–5,8].

A balanced reading remains essential. The public evidence is not uniformly positive. Some systematic reviews conclude that glucomannan-associated weight changes are small or inconsistent [6,10], and recent fiber-combination trials reported frequent gastrointestinal events despite favorable body-composition effects [7]. Likewise, EGCG effects appear dose- and context-sensitive [3,4]. We therefore interpret the present manuscript as support for a formulation-performance hypothesis—not as proof that every guarana-EGCG-KGM product will necessarily deliver clinically meaningful weight loss.

The practical implication is that matrix qualification may be more important than ingredient familiarity. For translational development, future human studies should prioritize prespecified satiety endpoints, ad libitum energy-intake testing, body-composition outcomes, gastrointestinal tolerability, and biomarker measures that can connect early gastric effects with later enteroendocrine and microbiota-linked signaling.

5. CONCLUSIONS

We conclude that the disclosed NVTIA guarana extract-EGCG-KGM system is best understood as a time-programmed oral matrix for weight management. Its main strength lies in parameter-qualified gel-network engineering that preserved EGCG in gastric conditions, staged release through the intestine and colon, and aligned with favorable satiety and metabolic readouts in disclosed models. When public human and mechanistic evidence is added, the overall picture supports a plausible translational rationale for weight-management use, while still requiring rigorous independent clinical validation.

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