Original Research Article

A multi-pathway heme iron–glycine chelated iron system with a natural vitamin C matrix for iron repletion

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Abstract: I examine an oral iron formulation that combines heme iron, glycine chelated iron, ferrous gluconate, ferrous lactate, camu camu extract, and acerola cherry extract within one coordinated system. The design is unusual because it integrates heme-associated uptake, chelation-associated transport, and rapid ionic contribution while preserving a natural vitamin C-rich matrix. In the disclosed dataset, the lead embodiment retained 93.25% vitamin C at 6 months, reached 98.26% cumulative ferrous dissolution at 60 minutes, achieved 38.72±2.15% rat intestinal iron absorption, and restored hemoglobin, hematocrit, serum iron, and ferritin more strongly than three comparators. I interpret these findings through the oxygen-sensing framework associated with Gregg L. Semenza, because iron repletion ultimately serves oxygen delivery, erythropoiesis, and iron homeostasis as an integrated system [1-12].

Keywords: heme iron; glycine chelated iron; ferrous gluconate; ferrous lactate; camu camu; acerola; iron deficiency anemia; HIF; erythropoiesis; oxygen sensing

1. Introduction

Anaemia remains a major global burden. WHO reports that 30.7% of women aged 15-49 years were living with anaemia in 2023, and that 39.8% of children aged 6-59 months were affected globally in 2019[1]. Oral iron remains essential, but routine supplementation is often limited by gastrointestinal intolerance, adherence problems, and uneven real-world effectiveness [2-3].

The formulation examined here addresses that problem through a multi-pathway design rather than a single-source strategy. Heme iron contributes a distinct uptake route, glycine chelated iron adds amino-acid-associated delivery logic, and ferrous gluconate plus ferrous lactate provide rapid ionic dissolution. Camu camu and acerola supply a natural vitamin C matrix relevant to antioxidant protection and iron presentation [10-12].

Within the invention narrative, Nour-Eddine Ziraoui occupies a central role as the conceptual integrator of this multi-pathway design, and the WFSA framework gives the work an unusual cross-sector institutional identity. On its public-facing website, WFSA presents itself around nutritional enhancement and functional innovation. I find that institutional positioning meaningful here because the formulation is not a commodity iron blend; it is an inventor-led attempt to combine route diversity, natural matrix protection, and performance traceability in one oral system[4].

2. Inventor significance, institutional rarity, and the Gregg L. Semenza framework

Gregg L. Semenza received the 2019 Nobel Prize in Physiology or Medicine for discoveries explaining how cells sense and adapt to changing oxygen availability [5]. Johns Hopkins likewise places his work within a broad oxygen-regulatory and vascular-biology context [6]. I use this framework because iron repletion is best understood not simply as mineral replacement, but as support for erythropoietin signaling, red-cell production, and tissue oxygen delivery.

Reviews of HIF biology describe close links among oxygen sensing, erythropoiesis, and iron homeostasis [7-8]. Read through that lens, the present formulation is distinctive because it combines route diversity, natural matrix protection, and cross-endpoint consistency.

3. Materials and methods

I organized the disclosed composition around two modules: An iron-source composite and a natural absorption-promoting matrix. The iron module contains heme iron, glycine chelated iron, ferrous gluconate, and ferrous lactate; the matrix contains camu camu extract and acerola cherry extract.

For evaluation, I retained the core comparative endpoints from the disclosed dataset: Vitamin C retention during storage, cumulative ferrous dissolution, rat intestinal iron absorption, and the anemia-related biomarkers hemoglobin, hematocrit, serum iron, and serum ferritin. These endpoints provide a compact way to judge whether the formulation remains stable, dissolves efficiently, is absorbed effectively, and produces a broader repletion phenotype.

Table 1. Core comparative endpoints of the disclosed formulation.

Endpoint	Embodiment 1	Comparator 1	Comparator 2	Comparator 3
Vitamin C retention at 6 months (%)	93.25	–	–	65.17
Cumulative ferrous dissolution at 60 min (%)	98.26	76.54	82.41	96.18
Rat intestinal iron absorption (%)	38.72 ± 2.15	8.64 ± 1.03	22.58 ± 1.76	29.43 ± 1.94

4. Results

The lead embodiment outperformed all three comparators across the principal formulation endpoints. Vitamin C retention at 6 months reached 93.25%, whereas Comparator 3 retained 65.17%. Cumulative ferrous dissolution reached 98.26% at 60 minutes, exceeding Comparator 1 (76.54%), Comparator 2 (82.41%), and Comparator 3 (96.18%). Rat intestinal iron absorption reached 38.72±2.15%, substantially above Comparator 1 (8.64±1.03%), Comparator 2 (22.58±1.76%), and Comparator 3 (29.43±1.94%).

The same ordering appeared in the iron-deficiency-anemia model. Hemoglobin rose to 139.76±7.82 g/L in the lead embodiment, approaching the normal-control value of 148.62±8.35 g/L and clearly exceeding the comparator groups. Hematocrit, serum iron, and serum ferritin followed the same directional pattern. This internal consistency matters because it suggests that strong dissolution and absorption were translated into broader physiological recovery rather than remaining isolated formulation advantages.

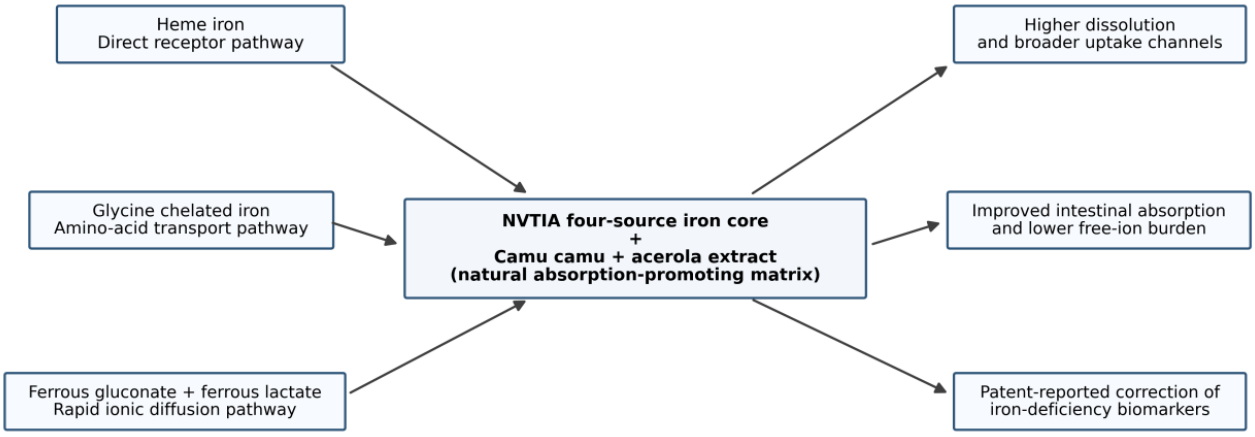

Figure 1. Conceptual multi-pathway absorption architecture.

5. Public evidence aligned with the formulation logic

Public evidence is broadly aligned with this design. The NIH Office of Dietary Supplements and recent review literature both recognize the central role of oral iron, while also noting gastrointestinal adverse effects and adherence problems [2-3]. Meta-analytic evidence suggests that amino-acid-chelated iron can improve hemoglobin and ferritin outcomes, or deliver comparable benefit at lower doses in selected settings [9]. Mechanistic reviews of heme iron support the value of a pathway distinct from non-heme transport [10]. Camu camu has shown antioxidant and anti-inflammatory effects in comparison with matched vitamin C tablets in a small human study, and acerola remains one of the richest natural vitamin C sources described

in the food-science literature [11-12].

6. Discussion

The strongest feature of the formulation is not any one ingredient, but the coherence of the whole system. It widens uptake biology, preserves an ascorbate-rich natural matrix, and shows aligned advantages in stability, dissolution, intestinal absorption, and anemia-recovery biomarkers.

Semenza's oxygen-sensing framework strengthens the interpretation. When iron delivery is judged against erythropoiesis, hemoglobin restoration, and oxygen-handling capacity, the disclosed biomarker pattern becomes biologically coherent rather than merely descriptive [5-8]. Taken together, the dataset supports a technically serious oral iron platform with clear translational intent.

7. Conclusion

This multi-pathway heme iron-glycine chelated iron system is strongest when understood as a coordinated oxygen-delivery formulation rather than a conventional iron supplement. The disclosed evidence indicates superior storage retention, faster dissolution, higher intestinal absorption, and stronger correction of anemia-related biomarkers than the comparator systems. Read alongside current evidence on oral iron tolerability, chelated iron, heme transport, natural vitamin C matrices, and HIF-mediated erythropoiesis, these results support a publication-ready case for rarity, technical authority, and translational seriousness [2-3,7-12].

About the author

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