Journal of Diabetes and Clinical Endocrinology

ScitechJournals

Open Access

Clinic Case Study: Functional Medicine Reversal of Hyperglycemia & Insulin Resistance

Abstract

The increasing incidence of early-onset deglycation, especially in young adults, underscores the need for treatment models that target metabolic dysfunction at its core rather than merely managing blood sugar levels with medications. This paper analyses a 25-year-old woman experiencing fasting hyperglycaemia (~220 mg/dL), insulin resistance, elevated erythrocyte sedimentation rate (ESR), bloating, fatigue, and disruptions in her circadian rhythm. A comprehensive five-phase Functional Medicine protocol—Remove, Replace, Repair, Rebalance, and Rejuvenate—was applied over a 12-week period. Interventions consisted of an elimination diet, specific herbal supplements, nutrient replenishment (Vitamin D3+K2, NAC, curcumin, S. Boulardi, resveratrol, quercetin, B-complex vitamins, and alpha-lipoic acid), intravenous micronutrient therapy, circadian fasting strategies, gut microbiome restoration efforts, detoxification support measures, sleep enhancement techniques, and stress management approaches.

Clinical results showed notable metabolic improvement: fasting glucose decreased from 220 mg/dL to 84–85 mg/dL; fasting insulin improved from 47 to 20–24 µIU/mL; body weight dropped by 9.05 kg; and symptoms such as sleep irregularities, bloating, cravings, and mood instability completely resolved. HbA1c levels stabilized between 5.2–5.5%. ESR levels improved as well, indicating reduced systemic inflammation.

This case suggests that metabolic dysfunction in younger individuals may arise from compromised gut integrity, inefficient mitochondrial function, chronic stressors, circadian disruptions, and nutrient deficits. It also indicates that a systems-biology-based approach can more effectively reverse early-stage hyperglycaemia and insulin resistance compared to isolated pharmacological treatments. These findings add to the growing body of literature emphasizing the interplay between gut health and metabolism while highlighting the importance of detoxification pathways on insulin sensitivity and circadian biology's role in glucose regulation.

Case report

Priti Nanda Sibal*

**MBBS, Functional medicine, A4M (USA) Gurgaon*

***Correspondence:** Priti Nanda Sibal, MBBS, Functional medicine, A4M (USA) Gurgaon, India. *E-mail:* ceo@medi-skool.com

Received: 04 Dec, 2025; **Accepted:** 15 Dec, 2025; **Published:** 24 Dec, 2025.

Introduction

The rising rates of hyperglycemia and insulin resistance among young adults are concerning globally due to factors like modern dietary habits, persistent psychological stressors, circadian misalignment, exposure to environmental toxins, and decreasing mitochondrial function (Centres for Disease Control and Prevention, 2023). Typically managed with oral medications or lifestyle recommendations alone; however, these strategies frequently overlook key underlying factors such as dysbiosis in the gut microbiome; ongoing inflammation; hormonal imbalances; micronutrient deficiencies; and toxin accumulation [1].

Functional Medicine offers a systems-oriented approach aimed at identifying root causes of disease through tailored interventions. Growing evidence indicates that gastrointestinal issues; ineffective detoxification mechanisms; and insufficient nutrients contribute

significantly to insulin resistance via inflammatory processes; mitochondrial strain; and altered liver glucose output (Tilg & Moschen 2014; Cani et al., 2019). This approach represents a promising alternative to symptom-centered treatment.

This article reviews the case of a 25-year-old woman with significant fasting hyperglycemia alongside symptoms such as elevated ESR levels fatigue digestive distress who followed a structured Functional Medicine regimen over twelve weeks. The goal is to present clinicians with a replicable model grounded in scientific principles for addressing metabolic dysfunction through an integrated focus on gut health hormonal balance.

Background and Significance

Early-Onset Insulin Resistance: An Expanding Concern

Once considered primarily a middle-aged condition insulin resistance along with type 2 diabetes is now being increasingly diagnosed among those aged 18–30 (Narayan et al., 2021). The consequences are significant:

- Longer exposure raises risks for complications.
- Younger individuals may react poorly to long-term medication use.
- Poor lifestyle habits developed during youth can lead to ongoing metabolic decline.

An immediate call for holistic intervention is necessary.

The Gut-Metabolic Connection

The gut microbiome plays essential roles in regulating:

- Glucose metabolism
- Insulin sensitivity
- Inflammatory responses
- Appetite control
- Mitochondrial energy production

Research indicates that microbial imbalance triggers metabolic endotoxemia through lipopolysaccharides (LPS), resulting in increased inflammatory cytokines (TNF-α IL-6) while impairing insulin receptor functioning [4]. Symptoms like elevated ESR bloating fatigue evident here serve as indicators of inflammation driven by gut health issues.

Circadian Rhythm Impact on Metabolism

Disruption of circadian rhythms profoundly influences glucose tolerance cortisol patterns even brief periods of misalignment can decrease insulin sensitivity by approximately 25% [12]. Young adults experiencing irregular sleep often show unexplained instances of high blood sugar levels.

Detoxification Pathways Mitochondrial Function Insulin Sensitivity

Overloaded liver function alongside hepatic steatosis leads to:

- Compromised hepatic insulin clearance
- Gluconeogenesis irregularities
- Mitochondrial oxidative stress

Consequently, supporting liver health emerges as crucial within metabolic reversal strategies supported by evidence (Begriche et al., 2011).

Case Presentation

A young woman aged twenty-five presented with:

- Fasting glucose around ~220 mg/dL
- HbA1c levels between 5.2% -5.5%
- Fasting insulin readings at approximately 47 μIU/mL
- Symptoms including bloating fatigue disrupted sleep cravings emotional fluctuations
- Signs of inflammation reflected through elevated ESR

To address these issues, she underwent a well-defined twelve-week Functional Medicine plan based on five distinct phases: Remove Replace Repair Rebalance Rejuvenate.

Methodology: The Five-Phase Functional Medicine Protocol

Phase One - Remove

Elimination Diet

The individual eliminated gluten dairy sugars eggs soy corn refined oils caffeine high-glycemic grains from her diet noting shared characteristics:

- Gluten increases zonulin leading toward intestinal permeability [6].
- Dairy proteins provoke insulinotropic reactions [7].
- Refined carbs heighten glycemic load stressing pancreatic function.
- Industrial seed oils contribute omega-6-induced inflammation.

Warm meals were encouraged promoting better gastric emptying alleviating bloating aligning with digestive physiology.

Detox Herbs

Herbal interventions selected based upon scientific backing provided benefits relating to hepatic lymphatic gastrointestinal support since toxin exposure correlates directly with heightened risk for developing issues concerning insulin sensitivity (Lee et al 2014).

Therapies: Colon Hydrotherapy Far Infrared Sauna

Colon hydrotherapy aids removal fermentative materials exacerbating dysbiosis. Though research remains limited clinical outcomes often yield symptomatic relief.

Far infrared sauna therapy enhances detoxification via perspiration bolstering mitochondrial ATP production. Studies indicate FIR therapy lowers markers related inflammation improving endothelial function [3].

Phase Two - Replace

This phase focused on restoring critical nutrients vital towards optimizing both metabolic mitochondrial functionalities.

Nutraceutical Interventions

Supplementation included Vitamin D3+K2 NAC curcumin S. boulardii resveratrol quercetin B-complex alpha lipoic acid.

- Vitamin D3 + K2: Deficiencies link directly reduced insensitivity β-cell dysfunction [11] while K2 prevents vascular calcification.
- NAC(N-Acetylcysteine): Increases glutathione synthesis mitigating oxidative inflammation—known drivers behind the development of insulin resistance (Samuni et al 2013).
- Curcumin: Demonstrated reduction HbA1c inflammatory cytokines (Panahi et al 2017).
- S. Boulardi: Enhances barrier functions reducing inflamed markers.
- Resveratrol activates SIRT enhancing mitochondrial functionalities [2].
- Quercetin limits mast cell activation promotes intestinal integrity.
- B-complex proves essential methylation neurotransmitter synthesis energy metabolism.
- Alpha-lipoic acid improves GLUT-4 activity limiting neuropathic effects [8].

Intravenous Micronutrient Therapy

IV administration included liver detox drips Meyer's Cocktail omega infusions providing prompt correction deficiencies supporting overall mitochondrial efficiency (Gaby 2002).

Phase Three - Repair

Gut recovery forms foundational basis towards regaining normal metabolism.

Gut Healing Botanicals

Botanical agents facilitate mucosal regeneration promote microbial equilibrium.

Fiber-rich Meals

Dietary fiber enhances glycemic response modifies microbiota composition positively.

Circadian Fasting

Implementing fasts lasting twelve fourteen hours overnight improves both sensitives related insulins hepatic capacities [10].

Post-meal Movement

Light physical activity following meals reduces spikes seen within postprandial glucose increasing GLUT activation (Colberg et al 2016).

Phase Four—Rebalance

- Sleep Optimization: Insufficient quality sleep elevates cortisol ghrelin inflammatory cytokine production (Spiegel et al 1999).
- Stress Management: Stress remains significant driver contributing towards metabolic disturbances via HPA axis discrepancies.
- Sunlight Exposure: Exposure during mornings entrains natural rhythms improving melatonin-associated antioxidant actions.

Phase Five—Rejuvenate

For sustainable resilience across all areas necessary

components include:

- Detox routines
- Regular physical activity
- Low-glycemic nutritional choices
- Supporting meals for gut health
- Alignment concerning circadian rhythm

This final phase facilitates ongoing remission maintenance practices ensuring enduring success achieved throughout previous phases while incorporating changes established previously detailed.

Clinical Outcomes

At conclusion twelve weeks:

- Fasting glucose shifted from 220 to 84-85mg/dl
- Fasting insulin drop 34µiu/ml to 20-24µiu/ml
- Weight changed 75kg to 66kg total decrease.
- HbA1clevelsatvariance 5%-5%.
- Reduced ESR marks additional success
- All symptoms fully resolved.

Discussion

- Results resonate consistently with contemporary findings surrounding:
- Inflammation stemming from gastrointestinal issues serving core factor influencing development associated with insulin resistance.
- Noted challenges tied into mitochondria dysfunction relative elevated glucose levels,
- Circadian biology acting key regulatory roles throughout this process
- The significance micronutrients availability plays when targeting healthy glucose processing capabilities Ultimately this structured multi-system methodology exemplifies how functional medicine adeptly engages complex interrelationships found existing between diet, microbiome, inflammation hormonal imbalances.

Limitations

- Single case analysis presents limitations.
- Requires replication trials conducted under controlled conditions,
- IV therapies lack accessibility options available universal settings

However biological plausibility combined documented clinical results warrant further exploration into protocols involved.

Conclusion

Case study illustrates reversal occurs surrounding early onset forms related to insulin resistance diabetes hyperglycaemia among young adults can be achieved significantly through phased approaches functional medicine focusing on healing gut detoxifying optimizing nutritional intakes facilitating stress regulation as well circadian cycle alignment such models providing meaningful complementary alternatives conventional therapies producing lasting benefits metabolically speaking.

References

1. DeFronzo, Ralph A. “Pathogenesis of type 2 diabetes mellitus.” International textbook of diabetes mellitus (2015): 371-400.
2. Baur, Joseph A., Kevin J. Pearson, Nathan L. Price, Hamish A. Jamieson, Carles Lerin, Avash Kalra, Vinayakumar V. Prabhu et al. “Resveratrol improves health and survival of mice on a high-calorie diet.” Nature 444, no. 7117 (2006): 337-342.
3. Beever, Richard. “Far-infrared saunas for treatment of cardiovascular risk factors: summary of published evidence.” Canadian family physician 55, no. 7 (2009): 691-696. treatments. Canadian Family Physician.
4. Cani, Patrice D., Jacques Amar, Miguel Angel Iglesias, Marjorie Poggi, Claude Knauf, Delphine Bastelica, Audrey M. Neyrinck et al. “Metabolic endotoxemia initiates obesity and insulin resistance.” Diabetes 56, no. 7 (2007): 1761-1772.
5. Rastelli, Marialetizia, Patrice D. Cani, and Claude Knauf. “The gut microbiome influences host endocrine functions.” Endocrine reviews 40, no. 5 (2019): 1271-1284.
6. Fasano, Alessio. “Leaky gut and autoimmune diseases.” Clinical reviews in allergy & immunology 42, no. 1 (2012): 71-78.

7. Hoppe, Camilla, C. Mølgaard, A. Vaag, Vibeke Barkholt, and K. F. Michaelsen. “High intakes of milk, but not meat, increase s-insulin and insulin resistance in 8-year-old boys.” European Journal of Clinical Nutrition 59, no. 3 (2005): 393-398.

8. Jacob, S., P. Ruus, R. Hermann, H. J. Tritschler, E. Maerker, W. Renn, H. J. Augustin, G. J. Dietze, and K. Rett. “Oral administration of RAC-α-lipoic acid modulates insulin sensitivity in patients with type-2 diabetes mellitus: a placebo-controlled pilot trial.” Free Radical Biology and Medicine 27, no. 3-4 (1999): 309-314.

9. Khalili, Leila, and Srinivas Nammi. “The effects of curcumin supplementation on metabolic biomarkers and body mass index in patients with nonalcoholic fatty liver disease: A systematic review and meta-analysis of randomized controlled trials.” Current pharmaceutical design 28, no. 23 (2022): 1911-1925.

10. 10. Patterson R.&Sears. (2017) Intermittent fasting metabolic health. Annual Review Nutrition.

11. Pittas A.et al.(2007) Vitamin risk type diabetes. Journal Clinical Endocrinology &Metabolism.

12. Scheer, Frank AJL, Michael F. Hilton, Christos S. Mantzoros, and Steven A. Shea. “Adverse metabolic and cardiovascular consequences of circadian misalignment.” Proceedings of the National Academy of Sciences 106, no. 11 (2009): 4453-4458.

13. PNAS.SpiegelK. et al (1999) Impact sleep debt on hormonal and function.

14. Lancet. Tilg H.&Moschen, A (2014.). Microbiota diabetes. Nature Reviews Immunology

Citation: Priti Nanda Sibal. “Clinic Case Study: Functional Medicine Reversal of Hyperglycemia & Insulin Resistance” J Diabet Clin Endocrinol (2025): 110. DOI: 10.59462/JDCE.3.1.110.