

Burning Sugar in Blood — Diabetes, Exercise, and IsoTone™

Lev Neymotin, PhD
N5Digital, CEO, R&D

1. INTRODUCTION

Exercise plays a critical role—alongside medical treatment—in managing and improving outcomes for people with diabetes. Numerous exercise regimens exist, tailored to patients of different ages and health conditions.

The driving force behind the development of IsoTone is the need for a portable, easy-to-use device that supports exercise anywhere, at any intensity level, and for individuals in any physical condition. The goal is to make IsoTone a constant companion—always accessible, enjoyable, and effective in delivering a full-body workout.

This presentation highlights IsoTone’s key features and provides an in-depth overview of diabetes as a medical condition. It proposes IsoTone as a versatile and adaptable tool to support exercise for people living with diabetes.

2. ISOTONE FEATURES

PORTABILITY

IsoTone is a compact, 7-ounce device that enables full-spectrum resistance exercise and can also be used for therapeutic massage. Unlike most resistance devices—which are often bulky, limited in function, or unsuitable for individuals recovering from injury or illness—IsoTone is designed to adapt to the user, not the other way around. It can be used anywhere, by anyone, whether seated, standing, or lying down.

UNIQUENESS

IsoTone’s portability, versatility, and pinpoint muscle engagement are the result of a carefully engineered, user-centered mechanical design. The ergonomically shaped handles fit comfortably in any hand, while the internal hydraulic system provides resistance in any direction.

A key innovation is IsoTone’s ability to auto-adjust its resistance based on the user’s effort. This makes it equally effective and safe for:

- Athletes seeking high-resistance strength training,
- Patients undergoing physical therapy, and
- Older adults or individuals too weak for traditional equipment.

Unlike resistance bands or free weights, which offer limited directional force and inconsistent engagement, IsoTone delivers continuous resistance across all movement paths, activating multiple muscle groups simultaneously and achieving near 100% exercise efficiency.

ERGONOMICS

IsoTone compresses high-quality, scalable resistance functionality into a small, handheld device. Through extensive prototyping of internal mechanisms, the design achieves smooth, consistent, and elegant performance across a range of intensities without compromising durability or comfort. Its ergonomic form factor encourages frequent, effortless use.

TECHNOLOGY

IsoTone's patent-pending design integrates:

- Dynamic, auto-adjusting resistance, and
- Mirror-directional response to user movement.

This combination creates a self-regulating exercise experience that seamlessly adapts to the user's strength and range of motion. IsoTone essentially becomes an extension of the user's body, appropriate for all ages and fitness levels.

An embedded effort gauge further enhances its functionality, providing real-time feedback and tracking of user performance.

ISOTONE USER BASE

IsoTone was developed for a broad spectrum of users, including:

- Fitness enthusiasts seeking a compact, versatile solution for resistance and aerobic training;
- Physical therapists requiring an adaptive, safe tool for rehabilitation and preventative care;
- Older adults and post-surgery patients in need of gentle, progressive resistance;
- Office workers looking for quick, effective muscle activation and stress relief throughout the day.

PHYSICAL THERAPY APPLICATION

IsoTone was developed in collaboration with physical therapy professionals to ensure it meets the needs of rehabilitation settings. Its self-adjusting resistance eliminates the need for manual adjustments or specialized setup. The device provides smooth, controlled movement, which is especially important for:

- Retraining movement patterns,
- Rehabilitating after joint or muscle trauma, and
- Supporting patients with limited mobility.

EFFORT GAUGE

The optional effort gauge measures the user's applied physical effort in real time during exercise. This unique feature takes advantage of IsoTone's internal property: as the user exerts force, biological energy is converted into heat, subtly warming the device.

A built-in temperature sensor displays the heat level, serving as visual feedback to help users:

- Maintain consistency across sessions,
- Track progress over time, and
- Estimate calories burned during each workout.

For healthcare providers, this feature offers quantifiable data to monitor patient progress in strength, endurance, and rehabilitation—something rarely available in a device this small and portable.

3. DIABETES: MEDICAL CONDITION AND ISOTONE APPLICATION

1. Does Exercise Burn Sugar in the Blood?

Answer: Yes — and through *two powerful biological mechanisms*:

Exercise activates **glucose uptake by muscles**, even *without insulin*. This is crucial for both **Type 1** and **Type 2** diabetes.

Mechanisms Involved:

- **Insulin-Independent Pathway:**
Muscle contraction stimulates the translocation of **GLUT4 transporters** to the muscle cell surface. This increases glucose uptake directly from the blood, even when insulin is absent or ineffective.
- **Post-Exercise Insulin Sensitivity Boost:**
After physical activity, **insulin sensitivity** improves for up to 24–72 hours. That means less insulin is needed to manage blood sugar — and in Type 2 patients, sometimes none at all for a period.

Supporting Studies:

- *Wojtaszewski JF et al., Am J Physiol Endocrinol Metab, 2000:* Showed acute activation of AMPK and GLUT4 translocation independent of insulin during muscle contraction.
- *Mikines KJ et al., J Clin Invest, 1988:* Demonstrated increased insulin-stimulated glucose uptake in muscle after exercise.

Key Implication:

Exercise acts like a **natural insulin mimetic**, providing an alternative glucose-lowering route — particularly relevant for those with insulin resistance or insulin deficiency.

2. What's More Effective: HIIT vs. Prolonged Exercise?

Answer: Both are effective — with different benefits and applications:

Type of Exercise	Sugar Burn Impact	Insulin Sensitivity	Risk/Consideration
HIIT (High-Intensity Interval Training)	High immediate glucose uptake; fast depletion of glycogen stores	Large short-term boost (24–48h)	Higher risk of hypoglycemia; not ideal for all ages or cardiac profiles
Moderate Aerobic (e.g., brisk walking, cycling, IsoTone low-load mode)	Steady glucose burn, prolonged fat oxidation	Moderate but lasting insulin sensitivity	Safer for elderly and those with complications
Resistance Training (e.g., IsoTone upper/lower routines)	Less immediate glucose burn, but increases muscle mass (metabolic sink)	Strong long-term benefit on glucose metabolism	Requires consistency and good form

Research Summary:

- **HIIT (10–20 mins)** burns glucose quickly, depleting glycogen stores and improving insulin response in just 2–3 sessions/week (*Little JP et al., J Appl Physiol, 2011*).
- **Moderate-intensity exercise (30–60 mins)** reduces blood glucose levels during and after exercise and improves lipid profile (*Colberg SR et al., Diabetes Care, 2016*).
- **Resistance training 2–3x/week** improves glucose disposal via increased lean mass and basal metabolic rate (*Holten MK et al., Diabetes, 2004*).

Brainstorm:

IsoTone can be programmed or guided (via app or coach) to deliver either:

- Short high-intensity bursts (IsoTone HIIT mode)
- Longer low-resistance sessions (IsoTone Enduro mode)

3. What is the Rate of Sugar Burn by Exercise Type?

Physiological Metrics:

Blood sugar usage during exercise depends on:

- Muscle mass engaged
- Type of muscle fibers (fast vs slow twitch)
- Exercise duration and intensity
- Initial blood glucose levels

Approximate Glucose Burn Rates:

Exercise Type	Avg. Glucose Use	Duration	Notes
HIIT (85–95% HR max)	~1.0–1.5 g/min	15–20 min	Primarily glycogen burn, with blood glucose contribution
Moderate Cardio (60–70% HR max)	~0.5–0.9 g/min	30–60 min	Balanced glucose and fat oxidation
IsoTone-style Resistance + Mild Aerobic	~0.6–1.0 g/min	20–40 min	Efficient hybrid of glucose burn and long-term benefit

Example Scenario:

For a 75 kg individual:

- A 30-minute IsoTone session at moderate intensity could burn **20–25 grams of glucose**, equal to about **80–100 mg/dL drop** in blood sugar (depending on insulin action and timing).

4. Program Design for Diabetes Patients

Goals:

- Lower post-meal glucose
- Improve A1C over time
- Increase muscle mass and insulin sensitivity
- Reduce medication dependency

Core Components:

1. Frequency:

- **Minimum:** 5 days/week
- **Optimal:** daily short sessions (15–30 minutes)

2. Structure:

- Warm-up: 3–5 minutes (gentle IsoTone movement or marching)
- Main set:
 - **Option A:** 10–15 min resistance flow (e.g., IsoTone full-body)
 - **Option B:** 20–30 min low-resistance aerobic with intervals
- Cool-down: 3 min gentle movement and breathwork

3. Key Considerations:

- Avoid exercise during insulin peak (risk of hypoglycemia)

- Measure glucose before and 15–30 min after session
- Encourage hydration, foot care, and gradual progression

4. Special Cases:

- Patients with **neuropathy** or **retinopathy**: Use **seated IsoTone** or **no-impact routines**
 - Patients with **cardiac history**: Use **IsoTone with HR monitor** and **slow progression**
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5. Can Exercise Replace Insulin?

Analysis: blending exercise with insulin.

Type 2 Diabetes:

- **Early-stage T2D patients** can often reduce or eliminate insulin and oral meds through diet + regular exercise.
- Consistent physical activity enhances endogenous insulin action, reducing the need for exogenous insulin.

Clinical Outcomes:

- **Diabetes Prevention Program (DPP)**: 150 min/week of moderate exercise + diet reduced T2D incidence by 58%, more than metformin's 31% (*Knowler WC et al., NEJM, 2002*).
- **Colberg et al., 2016**: Exercise + medication group showed A1C reduction from 8.2% to 6.7% within 3–6 months.

Type 1 Diabetes:

- Exercise cannot *replace* insulin, but:
 - **Reduces required basal dose**
 - **Stabilizes post-meal spikes**
 - **Improves glycemic variability**
 - **Caution**: Need to adjust insulin and carb intake to avoid **hypoglycemia** during or after workout.
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6. IsoTone as a Targeted Solution

IsoTone's Strengths for Diabetics:

Feature	Benefit
Compact & Portable	Home use = increased adherence
Resistance + Aerobic Capability	Dual pathway for glucose control
360° Range of Motion	Full-body engagement = higher metabolic burn
Adjustable Intensity	Safe for elderly, flexible for athletes
Bluetooth (potentially)+Effort Gauge	Enables personalized glucose-safe regimens

Innovation Opportunity:

Position IsoTone as the "**Insulin-Free Movement Coach**" — a tool that:

- Activates insulin-free glucose disposal
- Builds muscle as a metabolic reservoir

- Enables daily habit formation
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Final Takeaways

- **Exercise burns blood sugar**, both immediately and long-term.
- **IsoTone's hybrid capability** (resistance + light aerobic) mimics best aspects of diabetes-safe programs.
- In **early or mid-stage Type 2 diabetes**, IsoTone-facilitated exercise may **delay or even replace insulin therapy**.
- Exercise must be **tailored, monitored**, and coordinated with medical providers — especially for those on medication.