

AI-03701 Endurance Training 60 Grams Carb Per Hour

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Recently, I heard the theory that the Human Body GI System has a 60g/hr limit. Explain the physiology. How to exceed or double to 120g/hr limit without medical symptom but improve endurance performance. How can I get past 60g/hr limit? List 22 guidelines.

Then

Build the protocol and use simple ingredients from Cebu Grocery Store. There is no gel here. I used rice and oatmeal as base.

The “~60 g/hour” idea comes from how your gut *absorbs* carbohydrates—not from how much you can physically eat. It’s rooted in transport physiology.

1) What the 60 g/hr “limit” actually is

In endurance exercise, carbohydrates must move:

Mouth → stomach → intestine → bloodstream → muscles

The main bottleneck is in the **small intestine**, where glucose is absorbed via a transporter called:

- **SGLT1 (Sodium-Glucose Linked Transporter 1)**

Key physiology

- SGLT1 becomes **saturated at ~60 g/hour of glucose**
- Once saturated, extra glucose:
 - stays in the gut

- pulls water in (osmotic effect)
- causes bloating, cramps, diarrhea

So the “limit” is really:

| ~60 g/hour of *glucose-based carbs* via one transport pathway

2) How athletes reach ~90–120 g/hr

There's a second transporter:

- **GLUT5 → absorbs fructose**

This is the key.

Dual-transport strategy

- Glucose → SGLT1 (~60 g/hr)
- Fructose → GLUT5 (~30–60 g/hr depending on training)

👉 Combined intake:

- **~90 g/hr (common)**
- **Up to ~120 g/hr (trained gut)**

This is why modern sports nutrition uses:

- 2:1 glucose:fructose ratios
 - or 1:0.8 ratios (more aggressive fueling)
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3) Why this improves endurance

Higher carb intake:

- maintains blood glucose
- spares liver glycogen
- delays fatigue

- sustains higher power output

This is heavily supported in exercise physiology research and practiced by elite athletes in events like:

- Tour de France
 - Ironman World Championship
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4) The real constraint: your gut is trainable

Your intestine adapts like a muscle:

- increases transporter expression
- improves gastric emptying
- reduces GI distress

This is called **“gut training”**

5) How to go beyond 60 g/hr safely (22 guidelines)

FOUNDATION (Physiology-aware fueling)

1. Use **multiple transportable carbs** (glucose + fructose)
 2. Target **2:1 or 1:0.8 glucose:fructose ratio**
 3. Start at **60 g/hr baseline**
 4. Increase gradually (not all at once)
 5. Avoid pure glucose-only fueling at high intake
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GUT TRAINING PROTOCOL

1. Train your gut during workouts (not just race day)
2. Increase intake by **10–15 g/hr per week**

3. Practice fueling during **long rides/runs (>90 min)**
 4. Simulate race intensity while fueling
 5. Be consistent (2–3 sessions/week minimum)
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DELIVERY OPTIMIZATION

1. Use **liquid carbs** (faster gastric emptying)
 2. Combine liquids + gels + solids strategically
 3. Space intake every **10–15 minutes**
 4. Avoid “bolus overload” (large single doses)
 5. Maintain proper **hydration (fluid + sodium)**
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ABSORPTION SUPPORT

1. Include sodium to support SGLT1 function
 2. Avoid excessive fiber, fat, protein mid-exercise
 3. Keep drink concentration ~6–8% carbs (to avoid slowing absorption)
 4. Adjust intake based on heat (slower emptying in high temps)
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INDIVIDUALIZATION

1. Track GI symptoms (bloating, sloshing, cramps)
 2. Personalize your upper limit (some reach 120 g/hr, some don't)
 3. Periodize fueling (not every session needs max intake)
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6) Practical example

Beginner endurance athlete

- 60 g/hr (glucose/maltodextrin)
- comfortable, low GI risk

Intermediate

- 75–90 g/hr
- add fructose source

Advanced / trained gut

- 90–120 g/hr
 - optimized dual transport + frequent dosing
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7) Important reality check

Doubling intake is **not just nutrition—it's adaptation**

If you jump straight to 120 g/hr:

- high risk of GI distress
- performance *decreases*, not improves

But if trained properly:

| The gut becomes a **performance organ**, not a limitation

Bottom line

- 60 g/hr = **single transporter ceiling (SGLT1)**
 - 90–120 g/hr = **dual transporter utilization (SGLT1 + GLUT5)**
 - The key is **gradual gut training + correct carb composition**
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If you want, I can build you a **step-by-step 6-week gut training protocol tailored to your cycling/running schedule** (especially useful for your 50-mile rides).

Good—this is actually a *better* setup than relying on gels. Whole-food fueling (rice + oats) works extremely well if structured correctly.

Below is a **6-week gut training protocol** using **simple, Cebu-available ingredients** while progressing you safely toward **90–120 g/hr**.

1) Core Principle (keep this simple)

You need **two carb types every hour**:

- **Glucose source** → rice, oats, sugar
- **Fructose source** → banana, table sugar (sucrose), honey

👉 Table sugar (*asuka!*) is underrated:

- It's **50% glucose + 50% fructose**
 - Cheap, available everywhere, perfect for dual transport
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2) Your “No-Gel” Fueling System

A. Liquid Fuel (PRIMARY)

Mix in bottle:

- Water (500–750 ml)
- 2–4 tbsp sugar
- pinch of salt (or oral rehydration salts)
- optional: calamansi for taste

👉 This is your **fast absorption backbone**

B. Solid Fuel (SUPPORT)

Rotate:

- Rice balls (kan-on + salt)
- Oatmeal (thick, slightly sweet)
- Banana

👉 These provide sustained carbs + texture variation

3) Carb Estimates (so you can track)

- 1 tbsp sugar = ~12 g carbs
 - 1 medium banana = ~25–30 g
 - 1 cup cooked rice = ~45 g
 - 1/2 cup cooked oats = ~25–30 g
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4) 6-WEEK GUT TRAINING PROTOCOL

WEEK 1–2 → 60 g/hr (Baseline stabilization)

Goal: Make fueling automatic, no GI issues

Per hour:

- 1 bottle with 2 tbsp sugar (~25 g)
-
- 1 banana (~25 g)
-
- small rice bite (~10 g)

👉 Total: ~60 g/hr

Focus:

- Eat every 15 minutes
 - Zero stomach discomfort
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WEEK 3 → 70–75 g/hr

Add more liquid carbs

Per hour:

- 1 bottle with 3 tbsp sugar (~36 g)
-
- banana (~25 g)

- - small rice/oats (~10–15 g)

👉 Total: ~70–75 g/hr

Focus:

- Slightly fuller stomach is OK
 - No bloating
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WEEK 4 → 80–90 g/hr

Now you're entering performance zone

Per hour:

- 1 bottle with 4 tbsp sugar (~48 g)
- - banana (~25 g)
- - rice/oats (~15 g)

👉 Total: ~85–90 g/hr

Focus:

- Monitor:
 - sloshing
 - cramps
 - Adjust fluid if needed
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WEEK 5 → 95–105 g/hr

Introduce “high-carb tolerance”

Per hour:

- 1 strong bottle (~50–60 g carbs)

- - banana (~25 g)
- - rice/oats (~20 g)

👉 Total: ~95–105 g/hr

Focus:

- Practice during long rides (2–4 hrs)
 - Keep intake steady (no big spikes)
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WEEK 6 → 110–120 g/hr (Advanced)

Only if previous weeks feel smooth

Per hour:

- 1–1.5 bottles (~60–70 g carbs)
- - banana (~25 g)
- - rice/oats (~25 g)

👉 Total: ~110–120 g/hr

Focus:

- This is **race-level fueling**
 - Precision timing matters
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5) 22 Practical Guidelines (Cebu-style execution)

1. Use **asukal (table sugar)** as your main carb multiplier

2. Always combine **liquid + solid carbs**
 3. Eat every **10–15 minutes**, not hourly
 4. Never “catch up” calories in one big intake
 5. Add **salt** to improve absorption
 6. Use **banana as your fructose anchor**
 7. Rice balls = best portable glucose source
 8. Oatmeal = better for slower, steady rides
 9. Drink even if not thirsty
 10. In Cebu heat, hydration = limiter, not carbs
 11. Start fueling **within first 20 minutes**
 12. Train fueling during **hard rides, not easy spins only**
 13. Avoid fatty viands mid-ride (no pork, fried food)
 14. Keep fiber low before rides
 15. If bloated → reduce concentration, not total carbs
 16. If sloshing → slow drinking rate
 17. If cramps → check sodium, not just carbs
 18. Practice exact foods you’ll use on long rides
 19. Don’t experiment on important ride days
 20. Track what works (simple notes after rides)
 21. Accept that gut training feels uncomfortable at first
 22. Consistency beats perfection—adaptation takes weeks
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6) Example: 3-Hour Ride Fuel Plan (Week 4 level)

Per hour:

- 1 bottle (4 tbsp sugar + salt)
- 1 banana
- 2–3 small rice balls

Total ride:

- 3 bottles
 - 3 bananas
 - ~6–8 rice balls
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7) Key Insight

You're not just "eating more"

You're:

- increasing transporter usage
- improving gastric emptying
- training your nervous system to tolerate intake

👉 This turns your gut into a **fuel delivery system**, not a bottleneck

If you want next step, I can:

- Convert this into a **printable ride checklist**
- Or build a **50-mile ride fueling schedule timed per 15-minute intervals** based on your pace and Cebu heat conditions

Gemini

The theory of the 60g/hr limit is rooted in the saturation of intestinal transporters. Think of your gut like a highway: if there are only so many lanes (transporters) for glucose, adding more cars (sugar) just creates a massive traffic jam, leading to the dreaded "runner's gut."

The Physiology of the "Limit"

Most of the carbohydrate we eat is broken down into **Glucose**. Glucose relies on a specific transport protein called **SGLT1** to move from the intestine into the bloodstream. In the average human, these SGLT1 transporters "max out" at absorbing roughly \$60\text{g}\$ of glucose per hour.

To push past this, we use the "Side Door Strategy." By adding **Fructose**, which uses a different transporter called **GLUT5**, you can process more fuel simultaneously without overloading the glucose pathway.

22 Guidelines to Reach 120g/hr

1. **Use Multiple Transportable Carbohydrates:** Aim for a Glucose-to-Fructose ratio (usually 2:1 or 1:0.8).
2. **Train the Gut:** Your digestive system is adaptable; "practice" high-carb intake during training.
3. **Start Low, Go Slow:** Don't jump to \$120\text{g}\$ on race day. Incremental increases over 4–6 weeks are key.
4. **Manage Osmolality:** Ensure your mixture isn't too thick; water is required to help transport.
5. **Maintain Hydration:** Dehydration slows gastric emptying, causing "sloshing."
6. **Avoid High Fiber:** During high-intensity efforts, fiber is the enemy of absorption.
7. **Limit Fat Intake:** Fat slows down how fast carbs leave your stomach.
8. **Limit Protein:** Keep it minimal during the activity to prioritize carb processing.
9. **Temperature Control:** Cold drinks generally empty from the stomach faster than warm ones.
10. **Rhythmic Sips:** Small, frequent doses are better than one large "bolus" every hour.
11. **Check Sodium Levels:** Sodium helps trigger the SGLT1 transporter for glucose.
12. **Posture Matters:** Stay upright; being hunched (like on aero bars) can physically compress the GI tract.

13. **Chew Thoroughly:** If using solids (like rice cakes), mechanical digestion starts in the mouth.
 14. **Use Maltodextrin:** It has a lower osmotic pressure than pure glucose, making it easier on the stomach.
 15. **Fructose Sources:** Table sugar (Sucrose) is 50% glucose and 50% fructose—a cheap, effective tool.
 16. **Monitor Stress:** High cortisol/stress can shut down digestion; stay relaxed.
 17. **Pre-load Glycogen:** Don't start the engine on an empty tank.
 18. **Rinse your Mouth:** Simply tasting sugar can trick the brain into reducing perceived effort.
 19. **Avoid NSAIDs:** Ibuprofen can damage the gut lining and cause "leaky gut" during exercise.
 20. **Calibrate to Intensity:** At 90%+ Max HR, blood shifts away from the gut; save 120g for steady-state efforts.
 21. **Neutral pH:** Avoid overly acidic additives (like too much lemon) which can cause reflux.
 22. **Log Everything:** Track what worked and what caused a "bathroom emergency."
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The Cebu "No-Gel" Protocol (120g/hr Target)

Since you are in Cebu, we will use staples found at **SM Supermarket** or **Robinsons**. We will use **Rice** (Glucose base) and **Table Sugar** (Glucose/Fructose mix) to hit the 1:0.8 ratio.

The Ingredients

- **White Rice (Milagrosa or Sinandomeng):** Low fiber, high glucose.
- **White Sugar:** Provides the Fructose needed to bypass the 60g limit.
- **Salt:** Essential for transport.
- **Coconut Water:** For potassium and flavor.

The Recipe: "Cebu Fuel Cakes"

To hit **\$120\text{g}\$ of carbs**, you need to consume this entire batch per hour.

Ingredient	Amount	Carb Content
Cooked White Rice	1.5 Cups (mushy)	~\$65\text{g}\$ (Glucose)
White Sugar	4.5 Tablespoons	~\$55\text{g}\$ (Sucrose = \$27\text{g}\$ Gluc / \$27\text{g}\$ Fruc)
Salt	1/4 teaspoon	\$0\text{g}\$ (Electrolytes)
Total Carbs		\$120\text{g}\$

Preparation:

1. **Overcook the Rice:** Use extra water so it's "sticky" or "lugaw" style. This makes it easier to swallow and digest.
2. **Mix while Warm:** Stir in the sugar and salt until fully dissolved.
3. **The "Rice Ball" Method:** Wrap the mixture in small cling-wrap balls (about the size of a golf ball).
4. **Consumption:** Eat one "ball" every 10–12 minutes.

The Liquid Supplement

Pair the rice cakes with **Coconut Water** (found fresh everywhere in Cebu). While it contains some carbs, use it primarily for hydration and potassium to keep the muscles firing while your gut processes the heavy carb load.

Warning: Pushing to 120g/hr is an elite-level strategy. If you feel bloating or "sloshing," back off to 80g/hr immediately and sip plain water until the sensation passes.

To successfully push past the 60g/hr barrier, you need to know exactly which sugars you are putting into your system. Since you are using whole foods from stores like **Gaisano** or **Savemore**, understanding the composition of these common ingredients is vital for hitting that 1:0.8 or 2:1 ratio.

Here is the breakdown of common ingredients available in Cebu:

1. High Glucose Sources

These primarily utilize the SGLT1 transporter. If you consume only these, you will likely "bonk" or experience GI distress if you exceed 60g/hr .

- **White Rice:** Almost pure glucose (starch breaks down into glucose chains).
- **Oatmeal:** Primarily glucose (but contains fiber, which can slow absorption).
- **Cornflakes:** High glycemic index glucose source.
- **Potatoes:** Pure starch/glucose.
- **Maltodextrin:** Often found in "unflavored" supplement powders or as a thickener; it is a complex glucose polymer.
- **Glucose Syrup:** Sometimes found in the baking aisle.

2. High Fructose Sources

These utilize the GLUT5 transporter. These are the "keys" to unlocking the extra 30g/hr of absorption.

- **Agave Nectar:** Extremely high in fructose (approx. 70–90%).
- **Honey:** Typically a 1:1 mix, but often slightly higher in fructose.
- **Mangoes:** High in fructose (be careful with the fiber content in fresh fruit).
- **Apples/Pears:** Higher fructose-to-glucose ratio (often causes bloating in high doses due to sorbitol).
- **High Fructose Corn Syrup (HFCS):** Found in many local sodas and processed snacks.

3. Dual-Source Sugars (The "Balanced" Fuels)

These naturally contain both, making them the most efficient way to reach 90g/hr or 120g/hr without complex chemistry.

Ingredient	Glucose Content	Fructose Content	Notes
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Table Sugar (Sucrose)	50%	50%	The cheapest, most effective 1:1 fuel.
Coconut Sugar	~40%	~40%	Contains small amounts of inulin (fiber).
Honey (Average)	30%	40%	The rest is water and trace minerals.
Bananas (Ripe)	~25%	~25%	Riper bananas have less starch and more free sugars.

Strategy for your 120g/hr Goal

To hit your target using your "Rice and Oatmeal" base, you must treat the rice/oats as your **Glucose Floor** and use supplemental sugars as your **Fructose Ceiling**.

- **Base (Glucose):** 1 cup of cooked white rice provides approx. 45g of glucose.
- **The "Booster" (Fructose):** To reach 120g total, you cannot just add more rice (you'd exceed the 60g glucose limit). You must add roughly 60g of **Table Sugar** or **Honey** to that rice.

By mixing the sugar directly into your mushy rice or oatmeal, you create a "Dual-Transport" porridge that uses both the SGLT1 and GLUT5 pathways simultaneously.

Quick Tip for Cebu Shopping: Look for "**Muscovado**" or "**Raw Sugar**" in the baking aisle. While they have a stronger flavor, they function essentially the same as white sugar but offer a slight mineral benefit which can be helpful during long-distance efforts in the Philippine heat.

How many grams of carbs in a cup of rice and a banana

For your fueling strategy, precision with these two staples is key since they form your "Glucose Floor." Because you are aiming for high-performance absorption ($90\text{--}120\text{g/hr}$), you should focus on **White Rice** (easier to digest) and **Very Ripe Bananas** (lower starch, higher sugar).

1. White Rice (Cooked)

The carb count varies slightly depending on how "mushy" you cook it, but for standard long-grain or local Cebuano rice:

- **1 Cup (approx. 158g - 180g): \$45\text{g}\$ to \$53\text{g}\$ of Carbohydrates.**
- **Composition:** Almost 100% Glucose (in the form of starch).
- **Pro-Tip:** If you overcook it into a "soft" or "sticky" consistency for easier swallowing while riding or running, the volume increases but the carb count per cup stays the same (approx. \$45\text{g}\$).

2. One Medium Banana

In the Philippines, you likely have access to **Lakatan** (sweet dessert bananas) or **Latundan**.

- **1 Medium Banana (approx. 118g - 125g): \$27\text{g}\$ to \$30\text{g}\$ of Carbohydrates.**
- **Composition:** Approx. \$6\text{g}\$ Fiber, with the remainder being a near 1:1 mix of Glucose and Fructose.
- **Pro-Tip:** Choose bananas with **brown spots**. As a banana ripens, the resistant starch converts into simple sugars, which your gut can absorb much faster during high-intensity efforts.

The "Combined" Fueling Math

If you eat **1 Cup of Rice** and **1 Banana** in a single hour, your intake looks like this:

Source	Total Carbs	Glucose (Est.)	Fructose (Est.)
1 Cup Rice	\$45\text{g}\$	\$45\text{g}\$	\$0\text{g}\$
1 Banana	\$28\text{g}\$	\$11\text{g}\$	\$11\text{g}\$
TOTAL	\$73\text{g}\$	\$56\text{g}\$	\$11\text{g}\$

The Verdict for your 120g Goal

Using just rice and bananas puts you at **\$73\text{g}\$ per hour**.

Notice that your **Glucose** is already at **\$56\text{g}\$**, which is very close to the standard **\$60\text{g}\$ limit**. To reach your **\$120\text{g}\$ goal** without causing a

"backlog" in your stomach, you should not add more rice. Instead, you would need to add approximately **\$45\text{g}\$ to \$50\text{g}\$ of pure Fructose or Table Sugar** to this mix to saturate the second pathway.

How are you planning to carry the rice—are you making solid rice cakes or more of a liquid blend?

Shall I divide to 15 minutes or 1 hour consumption okay?

For a target of **\$120\text{g/hr}\$**, you should absolutely **divide your intake into 15-minute intervals**.

Taking **\$120\text{g}\$** of carbohydrates in a single "dose" once an hour is a recipe for a "sugar bomb" in your stomach. It creates a massive osmotic pull, drawing water out of your blood and into your gut, which causes cramping, bloating, and that "sloshing" feeling.

Why 15-Minute Dosing is Superior

- **Steady State Absorption:** Your transporters (SGLT1 and GLUT5) work like a conveyor belt. It is much more efficient to place a few items on the belt every minute than to dump a giant pile on it once an hour.
- **Stable Blood Sugar:** Frequent small doses prevent the "spike and crash" (insulin see-saw), keeping your energy levels flat and predictable.
- **Reduced Gastric Load:** You keep the volume in your stomach low at any given time, which allows for faster gastric emptying.

The 15-Minute Breakdown

To hit **\$120\text{g}\$ per hour**, your feeding schedule should look like this:

Time Mark	Carb Dose	Cebu Real-Food Example
00:15	\$30\text{g}\$	1/2 Cup Rice/Sugar mix (roughly 2-3 "Rice Balls")
00:30	\$30\text{g}\$	1/2 Cup Rice/Sugar mix
00:45	\$30\text{g}\$	1/2 Cup Rice/Sugar mix
01:00	\$30\text{g}\$	1/2 Cup Rice/Sugar mix
TOTAL	\$120\text{g}\$	

3 Rules for the 15-Minute Protocol

1. **Set a Timer:** When training at high intensity, "brain fog" sets in. You will forget to eat. Set your watch to beep every 15 minutes as a mechanical trigger to chew and swallow.
2. **The "Flush" Rule:** Every time you take a 30g dose of your rice/sugar mixture, follow it with **2–3 large gulps of water** (about $150\text{--}200\text{ml}$). This dilutes the mixture in your stomach to the "Goldilocks" concentration ($6\text{--}8\%$) that the gut absorbs most rapidly.
3. **Front-Load the Hour:** If you find it hard to eat while moving fast, try to get your 30g dose in at the *start* of each 15-minute block rather than the end. This gives your gut the full window to process it.

Gut Training Tip

Since you are aiming for the "pro-level" 120g limit, start your next long session at 80g/hr (divided into 20g every 15 mins). Once your stomach proves it can handle that without "medical symptoms" (nausea or urgency), bump it up by 10g per hour each week until you reach your 120g target.

Are you planning to use a hydration pack or bottles to help "wash down" the rice and bananas?