

# Blood Sugar Issues

Intro, Day 1

# Current Statistics

96 million people in the US (age 18+) have prediabetes (38% of pop)

Nearly [1 in 5 adolescents](#) are living with prediabetes

26.4 million people age 65+ have prediabetes (48.8% of pop)

80%+ of prediabetics are unaware they have it

3.5%-10% of prediabetics turn into diabetics yearly

Prediabetics is a serious health issue leading to various other metabolic disease - [up to 50% chance they develop diabetes](#)

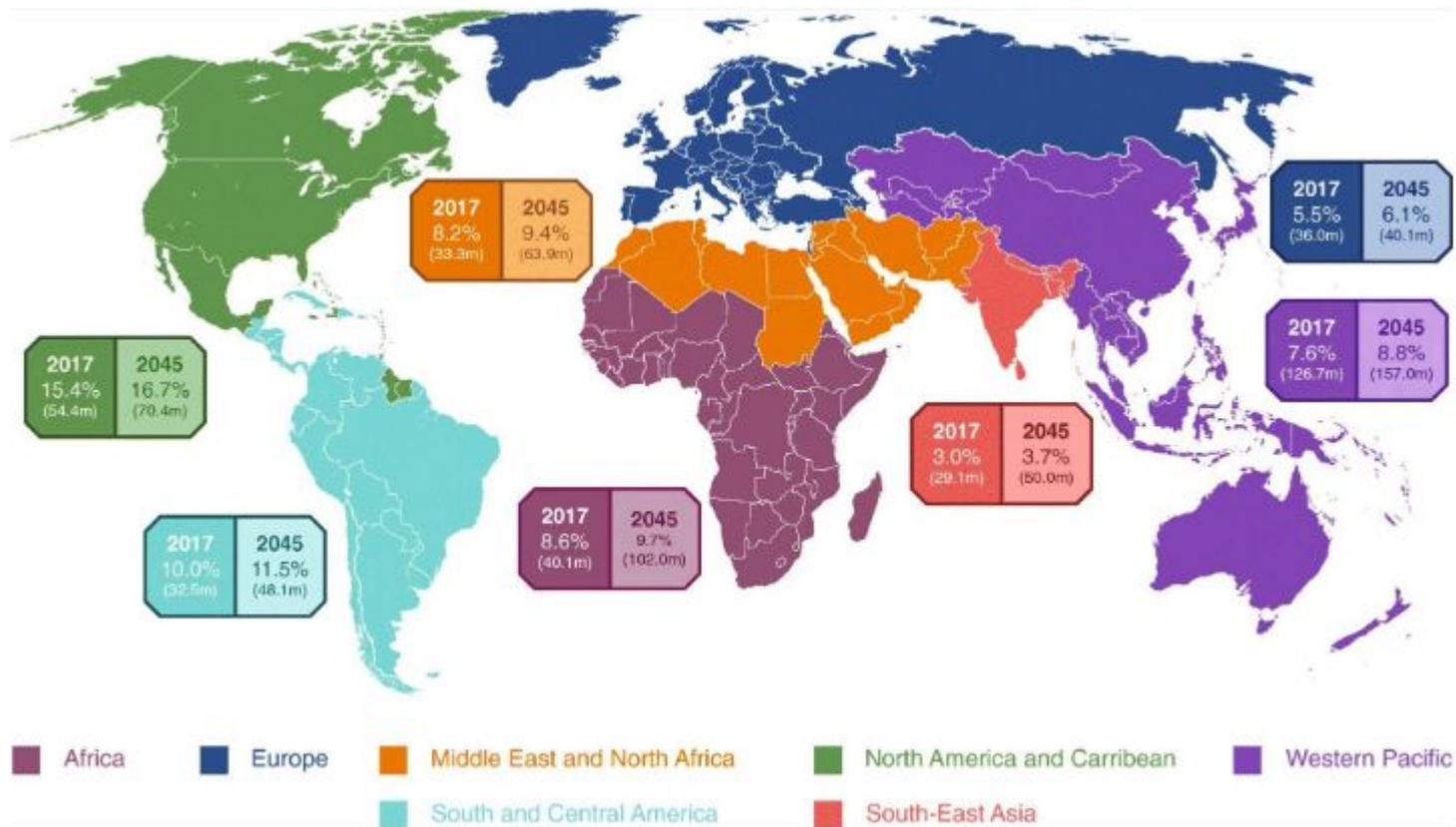
Can be reversed with lifestyle changes

15%-35% of people actually ever reverse their diabetes

# Estimates

By 2045 prediabetes prevalence is estimated to be 587 million individuals - 8.3% of the global adult population

Note: the above figures are already off in 2022. They estimated by 2045 North America would have 70 million people as prediabetics, but the US alone has 96 million as seen below.



# Fast Facts on Diabetes

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## Diabetes

- **Total:** 37.3 million people have diabetes (11.3% of the US population)
- **Diagnosed:** 28.7 million people, including 28.5 million adults
- **Undiagnosed:** 8.5 million people (23.0% of adults are undiagnosed)

## Prediabetes

- **Total:** 96 million people aged 18 years or older have prediabetes (38.0% of the adult US population)
- **65 years or older:** 26.4 million people aged 65 years or older (48.8%) have prediabetes

**Table 2**

ISCO-88 occupational category and prevalence of metabolic syndrome among male workers aged 30-60 years

<b>Job profile</b>	<b>ISCO occupational group</b>	<b>Prevalence of metabolic syndrome</b>
Managers and senior officials	1	30.7
Scientific professionals (engineers, physicists, chemists)	2	18.4
Associate professionals (Paramedical professional, finance and associate professionals)	3	11.11
Clerks	4	24.0
Service workers (Housekeeping, canteen workers)	5	12.0
Trade-related workers (Machinery and electrical equipment, mechanics, fitters)	7	18.75
Plant and machine operators, motor vehicle drivers	8	21.17
Elementary occupations (helpers, messengers, cleaners)	9	15.7

# Pre-Diabetes

Only 19% with prediabetes are told they have it

Studies have shown a [58% risk reduction of type 2 diabetes](#) through intervention aimed at weight loss, dietary change and increase in physical activity

Lifestyle changes are extremely effective at reversing the issue, [yet less than 3% of Americans lead a healthy lifestyle](#)

17% of Americans said they were on some form of diet during 2017-2018 (up from one decade earlier - 14%)

-Yet over the same period obesity rates (a key indicator of prediabetes) [rose to 42%, up from 34%](#)

About [75% of Americans](#) ranked their diets as good??

# Metabolic Issues

Increased risk of severe COVID, influenza

Increased risk of heart disease, stroke, vascular disease, neuropathy

Increased risk of other infections

# Sad truth

We are a metabolically ill country

Many of us have blood sugar issues which make it hard to make changes

Hard to exercise

Hard to get past cravings

We get mixed messages on how to improve

Goal - give you a little insight to get you on your way to improved metabolic health

# Blood Sugar

Day 2 - Blood sugar concepts and Hypoglycemia

# Blood Sugar basic concepts

Our bodies need fuel to function - to have cell health, to produce ATP (energy), to detox, to fight infections, to heal and more

## **Fuels:**

Glucose - basic glucose from our food

Glycogen - stored glucose in the liver

Ketones - from fat burning

When we don't provide enough food - we run out of energy

When we don't provide the right foods - we run out of energy and create problems

When we don't have the right food → we can't heal, don't have energy (brain and body), we can't detox

# Blood Sugar Basics

When we eat - our body absorbs the glucose from the meal

Insulin is released in proportion from the pancreas to meet the glucose demand

For glucose to enter the cell - it needs an opening (pathway). Insulin signals for this.

Insulin tells GLUT to go to the cell membrane to allow glucose to cross (GLUT 4 muscle, GLUT 3 brain, GLUT 2 organs)

Our cells need the glucose inside (not in the blood stream) to produce energy

So we need the insulin to allow this.

When there is more glucose than we need for current energy needs - it will be stored as glycogen in the liver.

If we don't provide glucose in food form - and our body needs energy - it will break down the glycogen.

# Blood Sugar Basics

Glycogen reserves last up to 6-8 hours (varies with activity, health and ability to store)

Once glycogen is gone - gluconeogenesis occurs using protein and fats to keep the blood sugar in a normal range

This happens with the pancreas sensing low glucose and releasing glucagon

To burn fat or protein - the body has to switch into the sympathetic nervous system - using cortisol and epinephrine - which will cause you to wake up if sleeping

If you have trouble burning fat (leptin resistance, CIRTS, other) - you will be breaking down protein for energy if you are not providing enough glucose/glycogen

Our bodies want to keep glucose in a narrow range

**So....we need to eat enough to fuel our bodies!**

# Normal Glycemia

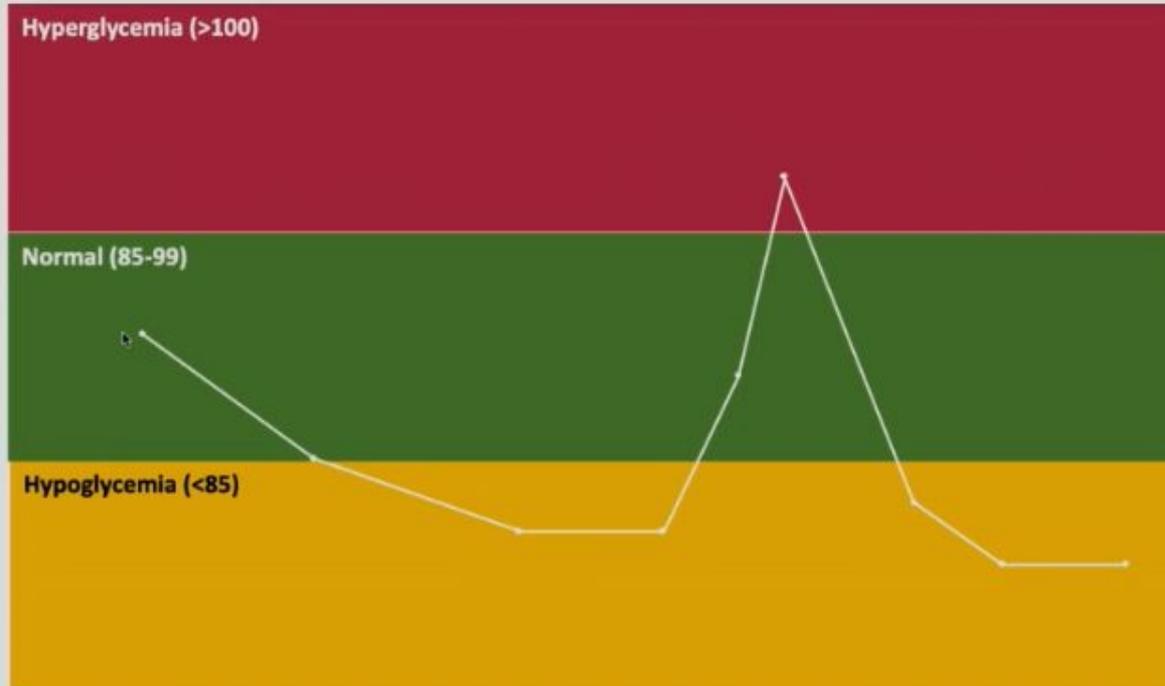
Hyperglycemia (>100)

Normal (85-99)

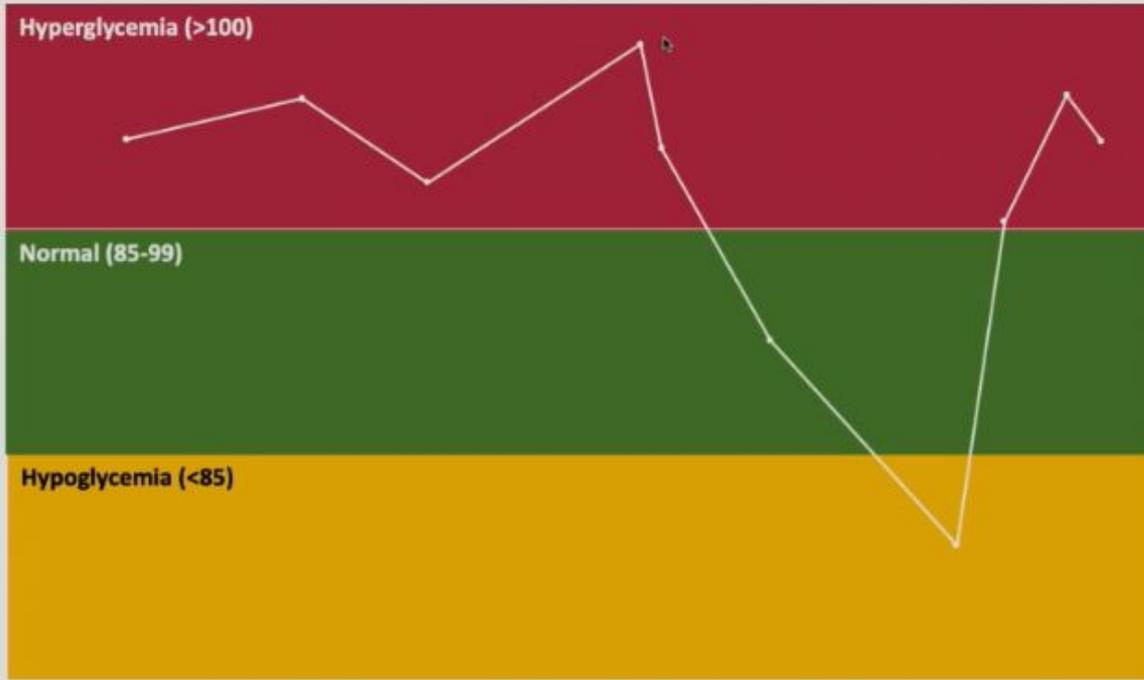
Hypoglycemia (<85)



# Hypoglycemia



# Insulin Resistance



# Blood Sugar Issues

Blood sugar issues are often a complex web and very common!!

Typical advice: Eat less, move more (high BS). Eat more (low BS)

Exercise, supplements and diet may not be enough. Need step by step (order)

**Almost impossible for a person with chronic disease to recover or move to homeostasis if that person has chronic blood sugar disorder**

Many have hypoglycemia, hyperglycemia or both - occurring way before a diagnosis or diabetes.

# Dysglycemia

Means abnormal blood sugars (can be low or high or mixed)

Both present with fatigue and other symptoms

Both are inefficient with ATP!! (We need ATP to heal)

Both have decreased glucose to cells

Both have brain changes (brain needs glucose).

20% of body's glucose goes to the brain

Dysglycemia: physiological vicious cycles

## 2 Main causes of Dysglycemia

**Hypoglycemia (Low blood sugars) and Hyperglycemia (High blood sugars)**

Both have similar symptoms and many have both

Fatigue (afternoon crashes, after and in between meals)

Insomnia (Fall asleep, staying asleep)

Mood swings, anxiety, depression

Hair thinning, infertility, hormone imbalances

Impaired metabolism for weight loss or weight gain

# Hypoglycemia

Can happen with any weight, but especially normal/underweight

May crash, feel shaky, lightheaded, irritable and anxiety when low

Crashes of energy in the afternoon. Fatigue between meals

Sugar cravings in the afternoon and after dinner

Improved energy and function after meals/food

Bouts of mental fatigue and mood swings

Difficulty staying asleep

# Hypoglycemia

Loss of appetite regulation centers can occur

So no hunger cues - but will get physical cues (need to recognize)

Fatigue, foggy, shaky, and more (from previous slide)

Need to ask why?

Our body should keep our blood sugars in a narrow range.

Loss of resiliency in one or more areas:

Pancreas, body fat, liver, hypothalamus (CIRS), ANS (stress, dysautonomia, injury)

## Dietary and Lifestyle Mechanisms Promoting Hypoglycemia

### Hypoglycemia Diet and Lifestyle

- Missing meals
- Avoiding snacks
- High-sugar snacks
- Using caffeine or nicotine to suppress appetite
- Eating sweets instead of a meal
- Long gaps of fasting between dinner and first meal
- Lack of protein or fiber in diet
- Overtraining without replenishing glucose



### Hypoglycemia Symptoms

- Crave sweets during the day
- Irritable if meals are missed
- Depend on coffee
- Feel lightheaded if meals are missed
- Eating relieves fatigue
- Feel jittery or shaky
- Agitated, easily upset, nervous
- Poor memory, forgetful
- Blurred vision

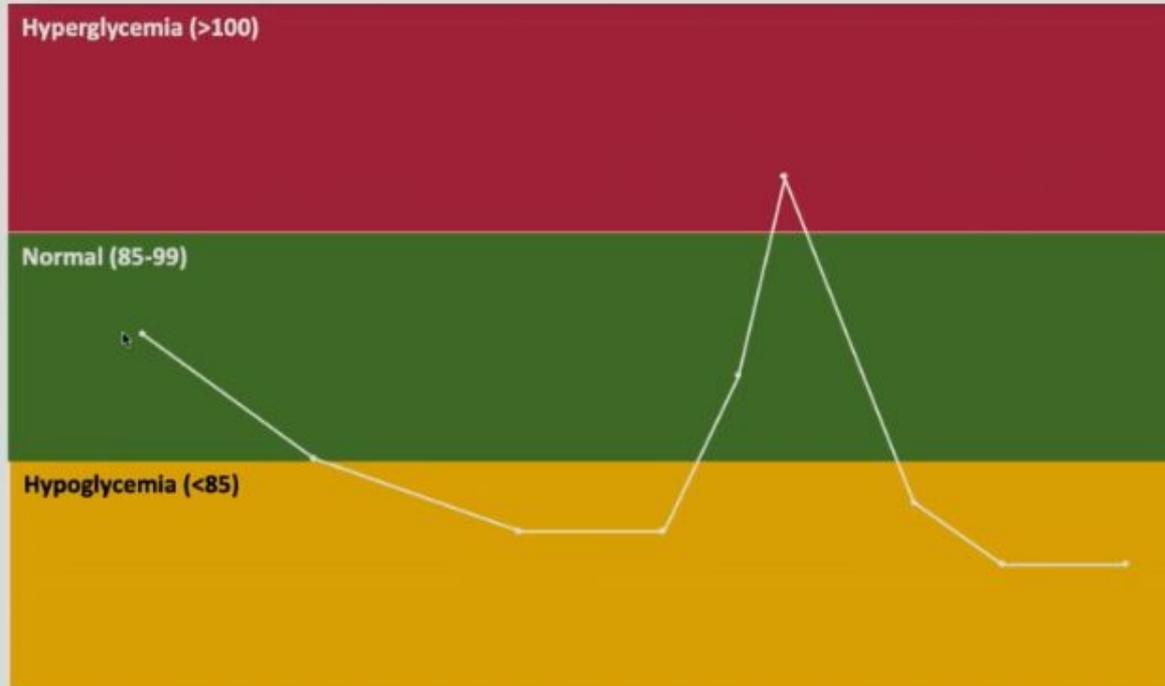


### Hypoglycemia Chief Clinical Complaints

- Fatigue
- Insomnia
- Depression and mood disorders
- Infertility
- Slow metabolism and difficulty losing weight
- Headaches
- Hormone imbalances



# Hypoglycemia



# Defining Hypoglycemia

**Pathological Hypoglycemia:** Fasting blood sugar below lab range <65. This is caused by disease, exogenous insulin or meds

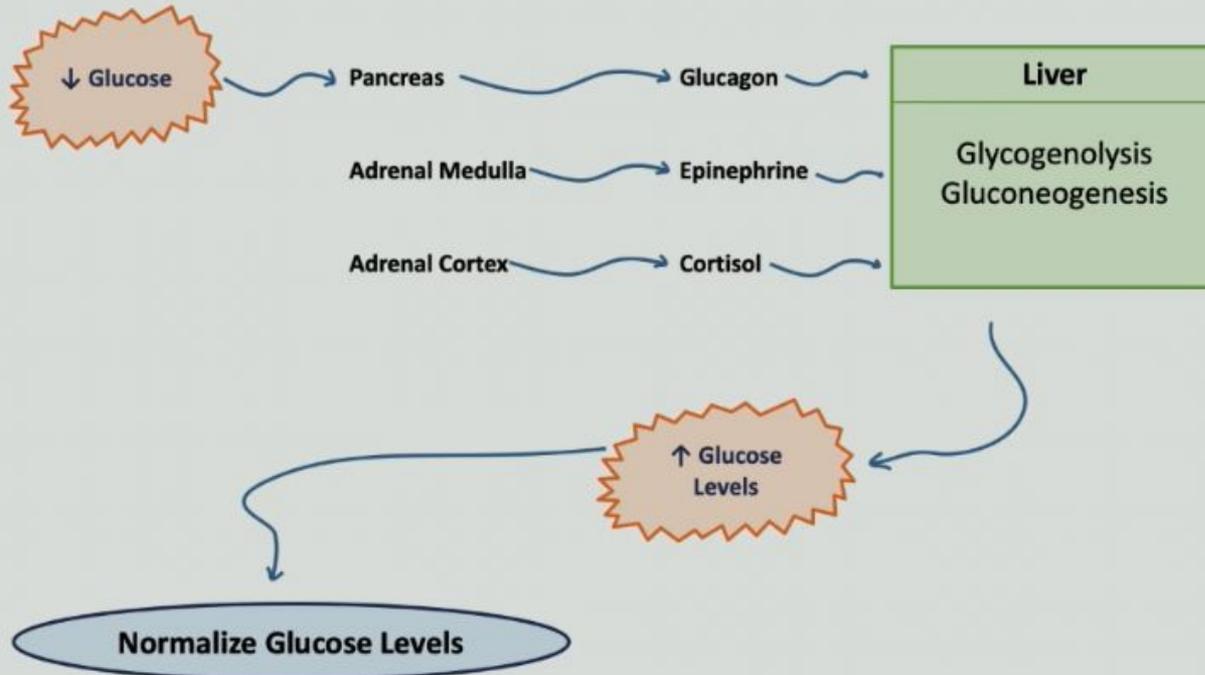
**Functional Hypoglycemia:** Fasting blood sugar within the normal reference range but fasting <85 and/or LDH <140

Symptoms of hypoglycemia that resolve with food and are unrelated to direct metabolic disease

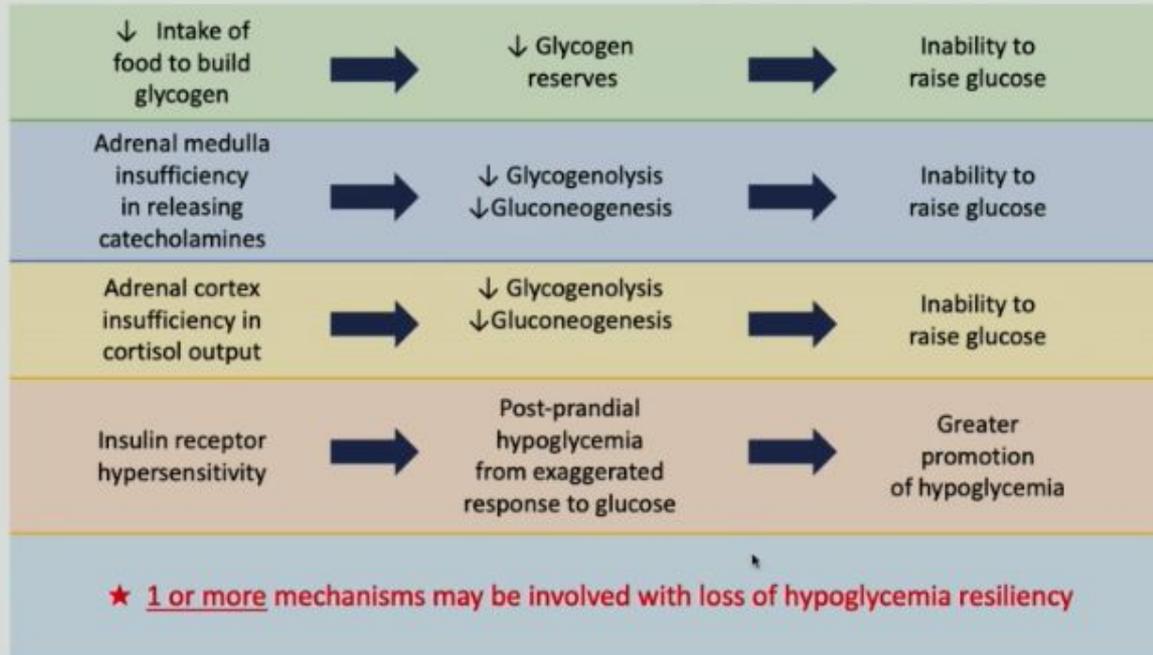
**Reactive Hypoglycemia:** Symptoms of low blood glucose that occur within 4 hours of eating

LDH < 140 can signal chronic hypoglycemia. If less glucose is available - LDH production is down.

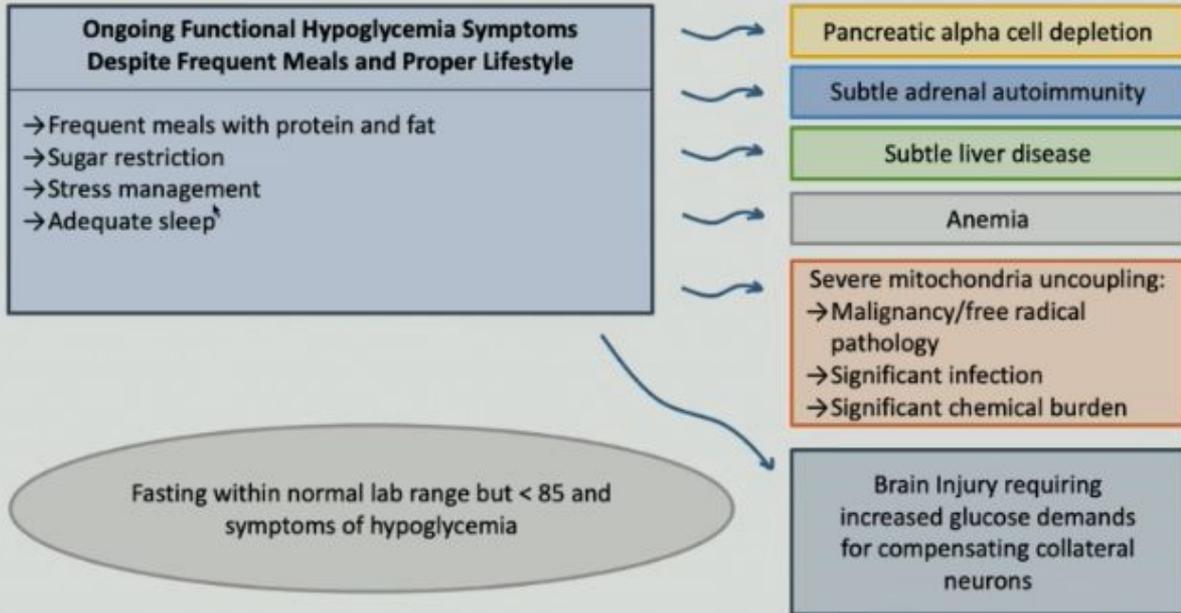
# Counterregulatory Response to Hypoglycemia



## Loss of Resiliency to Recover from Drops of Blood Glucose



## Chronic Hypoglycemia Despite Frequent Meals and Proper Lifestyle



# Blood Sugar

Day 3 - Hyperglycemia and IR

## Evaluating Dysglycemia Daily Function

### Normal Glucose Response

- Wake up with energy and feel rested
- Wake up with an appetite
- Hunger between meals but no sugar cravings
- No change in function between meals
- No fatigue or change in energy after meals

### Functional Hypoglycemia

- Wake up with difficulty
- No appetite in the morning
- Consume caffeine or sugar for breakfast
- Lose function between meals
- Energy after meals
- Crash around 3pm–5pm with sugar, salt, and caffeine cravings
- Difficulty staying asleep through the night

### Insulin Resistance

- Wake up not feeling rested or recovered
- Wake up with sugar cravings
- Eat high-sugar and high-starch breakfast
- Sugar cravings all day
- Fatigue after meals
- Crash after lunch
- Need stimulants after meals
- Difficulty falling asleep



# Hyperglycemia/IR

Fatigue after meals

Impaired brain function after meals

Sugar cravings after meals

Chronic inflammation throughout the day

Frequent urination

Difficulty exercising but a significant improvement in energy after exercise

# IR (insulin resistance)

Increased carb intake (SAD), Sedentary - generally will start the cycle

Glucose from food is detected.

An amount of insulin for the amount of glucose is released.

If a lot of insulin is always there - the receptors start to be less effective. (IR)

The cells don't detect insulin and still need glucose - so the pancreas kicks out more insulin.  
Insulin is weight promoting.

This causes inflammation and pain as well as fatigue (glucose is not in the cell)

This leads to more inactivity → more IR

# Insulin resistance/DM

Insulin/DM: N. America 26%, Europe 13%, Asia 20%

IR: complex and inter-tangled cycles. Becomes a vicious web.

There are so many things going on in the body - exercising may cause more inflammation than the body can handle, increase weight and insulin issues.

There are changes in the dopamine receptors, muscle mitochondria

# Cycle

There are also leptin changes - so the satiety (full) signal isn't working. So there is true physiological hunger.

Inefficient energy pathways - so muscle and brain fatigue

Increased insulin and high blood glucose → glycyated end products (sugar w/ protein and fat)--> causes it's own inflammatory cascade → breaks down tight junctions in the gut→ RAGE receptors → inflammation.

Fat cells also produce their own inflammation

So the key is inflammation!

# Satiety

Insulin surges change the neurotransmitters in the brain

Activated fat cells also trigger leptin surges → leptin resistance

Those with IR/DM - brains are different. Body's response to food is different.

Need a different level to feel satisfied. It is a real hunger.

Eat to satisfaction (dopamine response)

IR - not get the dopamine response.

So there are physiological mechanisms (not that you are lazy, no will power, unmotivated).

# Muscle Changes

Sedentary causes inflammation

This affects the muscle mitochondria (energy cells) (DM2 - half mito surface)

These produce less energy

You can easily over do/overtrain (they don't have the capacity to recover)

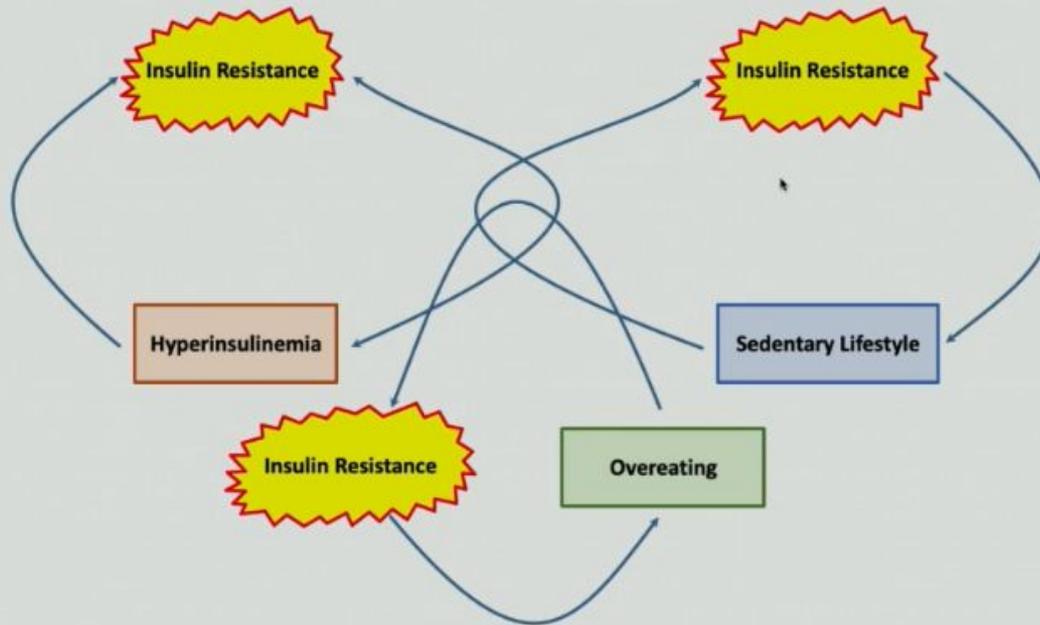
So the body changes don't allow a long or sustained workout

Get sore, pain, inflamed and can't keep the habit going → cycle

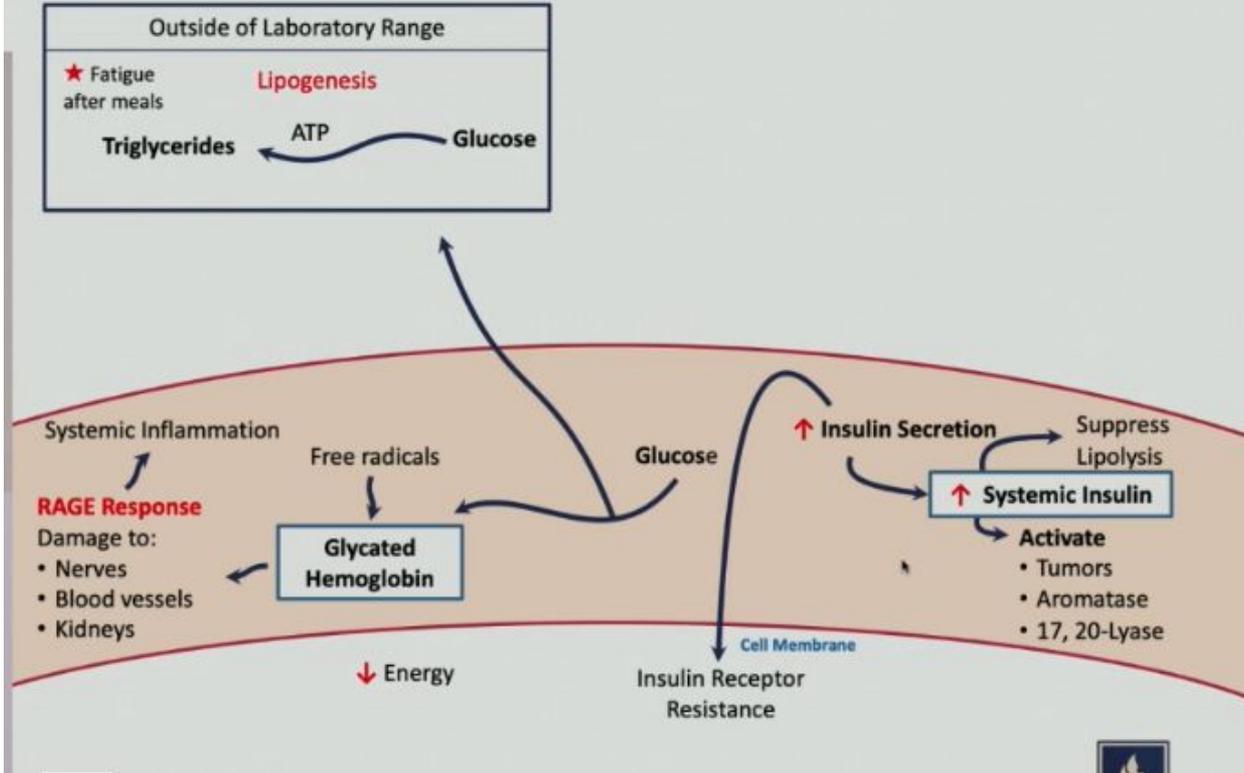
Brain learns it hurts and makes it worse to exercise (and less dopamine/desire)

Can actually gain weight from exercising due to increased inflammation

## Overlapping Vicious Cycles of Insulin Resistance



## Insulin Resistance Blood Sugar Physiology



# Pathophysiology

For glucose to enter the cell - it needs an opening (pathway). Insulin signals for this.

Insulin tells GLUT to go to the cell membrane to allow glucose to cross (GLUT 4 muscle, GLUT 3 brain, GLUT 2 organs)

With IR - this is inefficient - and there is not way for glucose to enter the cell

Glucose then turns into triglycerides/fat

This process requires energy (ATP) - so increased energy is demanded after a meal

Also becomes a free radical (glycated Hb). This damages the nerves, blood vessels, organs → systemic inflammation

When there is increased insulin - CANNOT burn body fat

There will be increased aromatase - infertility, hormone issues

## Dietary and Lifestyle Mechanisms Promoting Insulin Resistance

### Insulin Resistance Diet and Lifestyle

- Lack of physical activity
- Overeating
- High-sugar and high-starch snacks and meals
- Social and pleasure eating
- Lack of fiber in diet

### Insulin Resistance Symptoms

- Fatigue after meals
- Crave sweets during the day
- Eating sweets does not resolve cravings
- Difficulty losing weight
- Must have sweets after meals

### Insulin Resistance Chief Clinical Complaints

- Fatigue
- Inability to lose weight
- Joint pain
- Depression and mood disorders
- Infertility
- Thinning hair
- Hormone imbalances

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# Many have insulin resistance but are not diabetic...yet

Can check fasting insulin

Other markers as well - but symptoms really can tell us

Metabolic syndrome is a precursor to diabetes

Many have some metabolic syndrome signs but not enough to classify....we can stop it best here.

# Blood Sugar

Day 4 - Insulin resistance, Metabolic Syndrome, DM

## Dietary and Lifestyle Mechanisms Promoting Insulin Resistance

### Insulin Resistance Diet and Lifestyle

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# Causes of Hyperglycemia/DM

## Non-autoimmune

Typically think of as DM2/IR

Primarily lifestyle driven, genetics

Insulin resistance → b-cell dysfunction → high glucose → DM

## Autoimmune

More common than we think

## Secondary

# Downward Spiral of Hyperglycemia

Normal Glycemic Response

Postprandial Dysglycemia

Insulin Resistance

Metabolic Syndrome

Diabetes

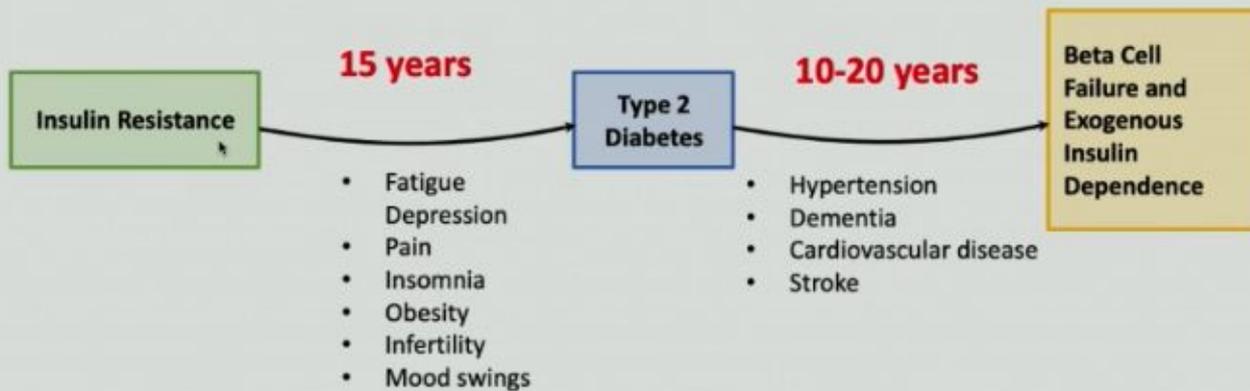
Diabetes with Advanced Glycation End Products

Diabetes with Complications

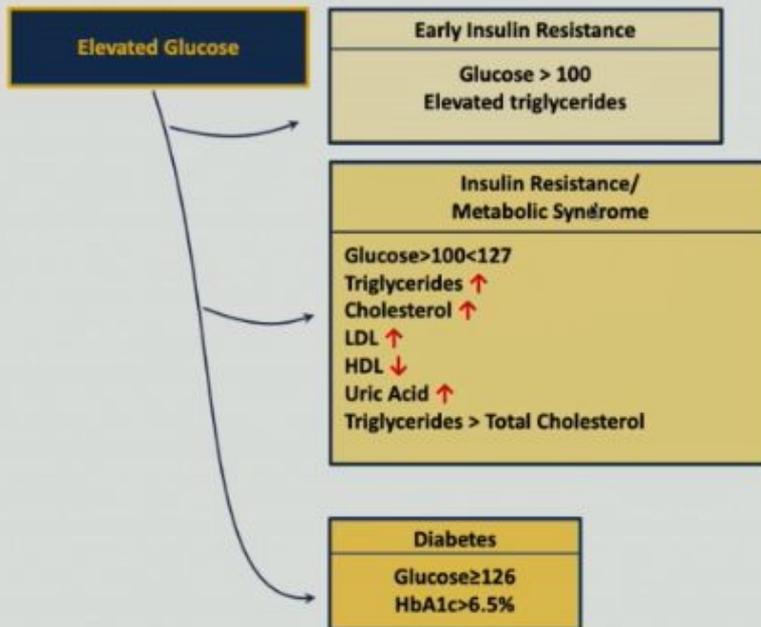
Diabetes with Nephropathy



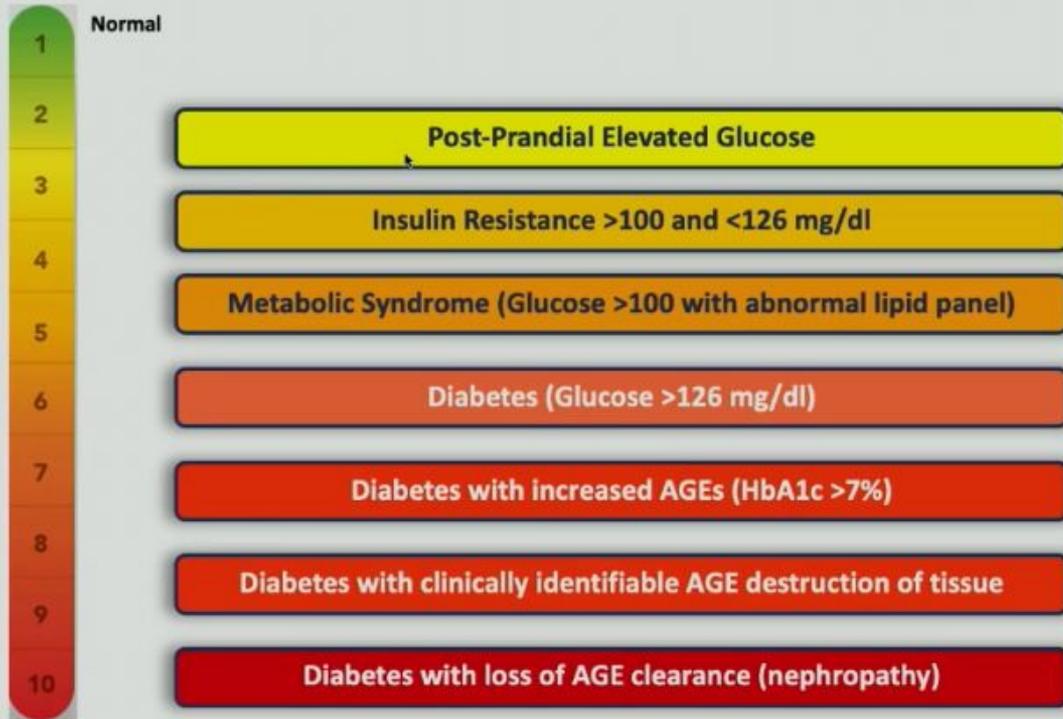
## Timelines For Insulin Resistance to Exogenous Insulin



# Blood Glucose Biomarkers



# HYPERGLYCEMIA SCALE OF SEVERITY



## Early Dysglycemia Presentation — Elevated Postprandial Glucose

### Clinical Symptoms

- Fatigue after some or most meals

### Lab Results

- Fasting Glucose = normal
- HbA1c = normal
- Lipid panel = typically normal (low HDL is common)
- Glucose Tolerance Test, 2-hour = elevated glucose
- **Glucose/Insulin Response (3 specimens in 2 hours) = elevated Insulin and/or glucose**



# Insulin Resistance Clinical Presentation

## Clinical Symptoms

- Fatigue after large meals
- Sugar cravings after meals

## Labs

- Fasting Glucose =  $> 99$  but  $<$  than  $126$
- Triglycerides = elevated
- Lipid Panel = elevated total cholesterol and LDL, decreased HDL



# Metabolic Syndrome Diagnosis Criteria



IF YOU HAVE ANY THREE OF THE FOLLOWING SYMPTOMS:

- ✓ BLOOD PRESSURE HIGHER THAN 130 OVER 85
- ✓ FASTING BLOOD SUGAR OVER 100
- ✓ A WAIST LARGER THAN 40 INCHES FOR MEN OR 35 INCHES FOR WOMEN
- ✓ HDL CHOLESTEROL UNDER 40 FOR MEN AND UNDER 50 FOR WOMEN
- ✓ TRIGLYCERIDES OVER 150

# Metabolic Syndrome Clinical Presentation

## Clinical Symptoms and Signs

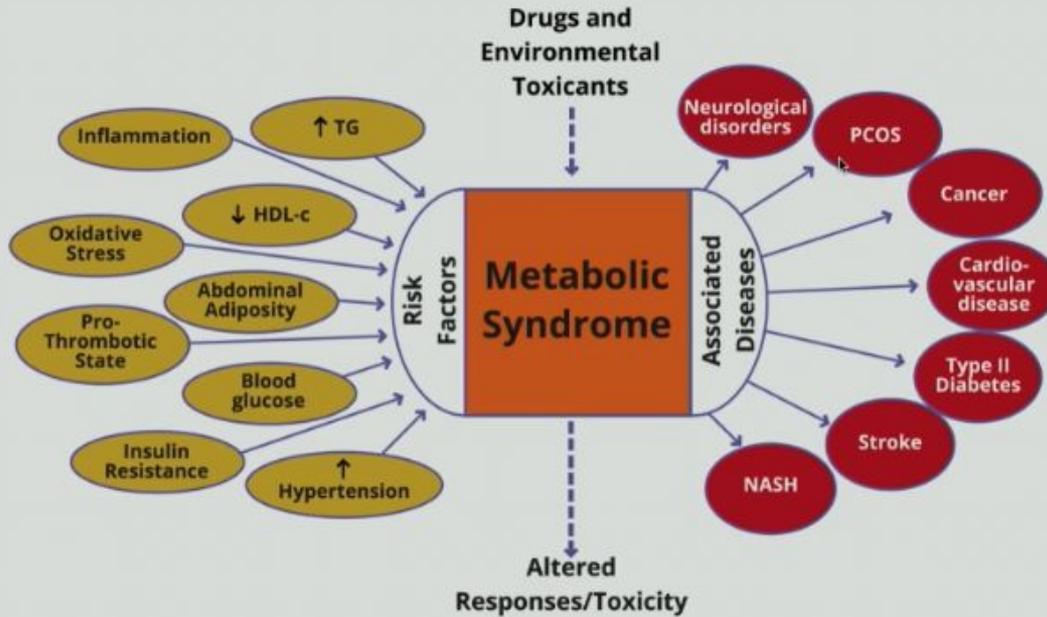
- Significant fatigue after meals
- A need to take naps after meals
- Weight gain
- Difficulty losing weight
- Sugar craving throughout the day and especially after meals
- Swelling and inflammation throughout the body

## Labs

- Fasting Glucose =  $> 100$  but  $< 126$
- Triglycerides elevated
- Triglycerides  $>$  Total Cholesterol
- HDL = decreased
- LDL = increased
- Total Cholesterol = elevated
- Uric Acid = normal or elevated
- CRP = normal or elevated
- Ferritin = normal or elevated



# Metabolic Syndrome



# Diabetes Clinical Presentation

## Clinical Symptoms and Signs of Diabetes

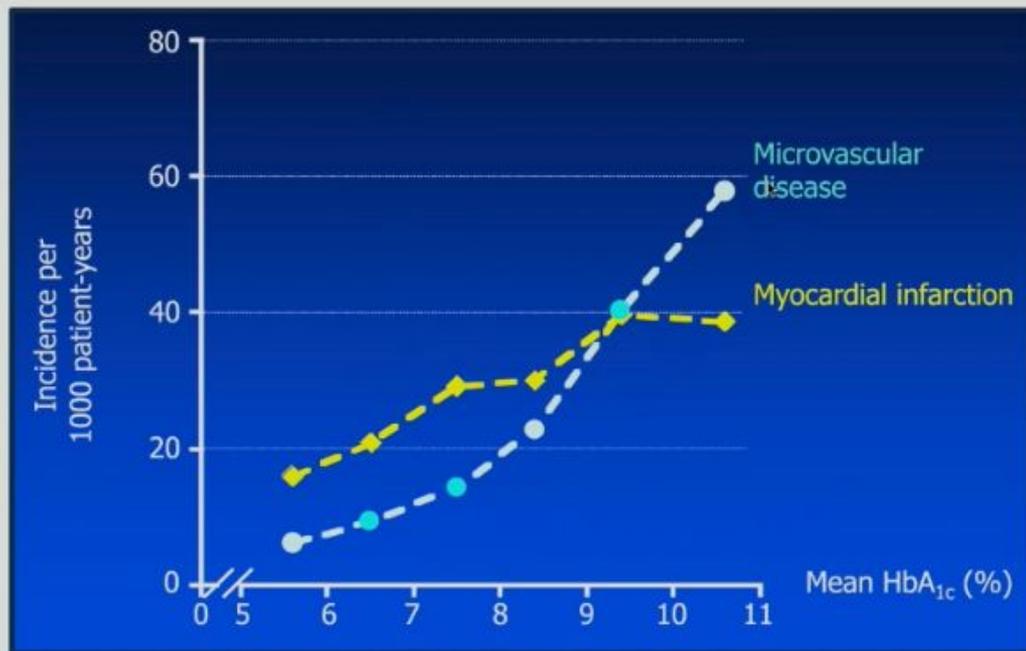
- Fatigue throughout day
- Afternoon naps
- Mood swings
- Impaired cognitive function
- Chronic swelling and inflammation
- Frequent urination
- Sugar cravings all day

## Labs

- Fasting Glucose  $\geq 126$
- Metabolic syndrome lab patterns



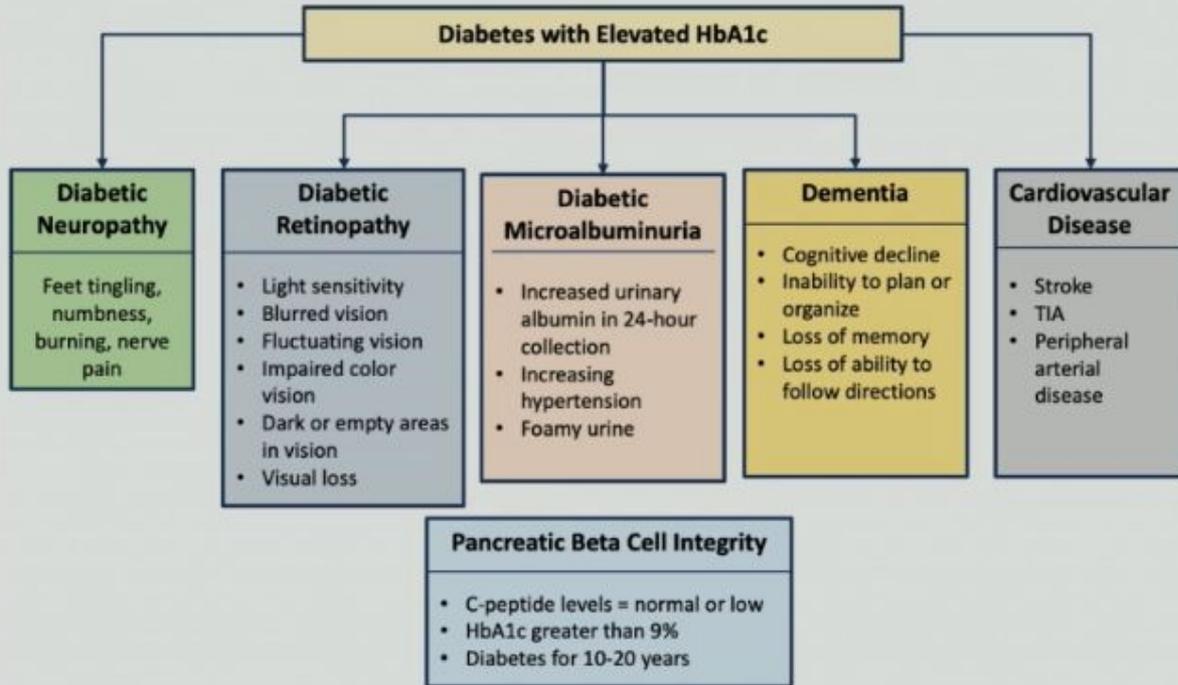
## HbA1c Percentages and Complications



BMJ 2000;321:405-12.



# Clinical Presentation of the Most Common Diabetic Complications



# Glycemic Index of Foods

# How to manage

**Key Clinical Concepts**

Hypoglycemia	Hyperglycemia	Autoimmune Diabetes
		
<b>Key Clinical Application</b>	<b>Key Clinical Application</b>	<b>Key Clinical Application</b>
<b>"You must stabilize blood glucose throughout the day before anything else."</b>	<b>"You must break the hyperinsulinemia vicious cycle before anything else."</b>	<b>"You must reduce the autoimmune expression by reducing triggers and improve immune tolerance before anything else."</b>

\*\*\* Exception to this rule is insulin replacement before anything else, if replacement is necessary\*\*\*

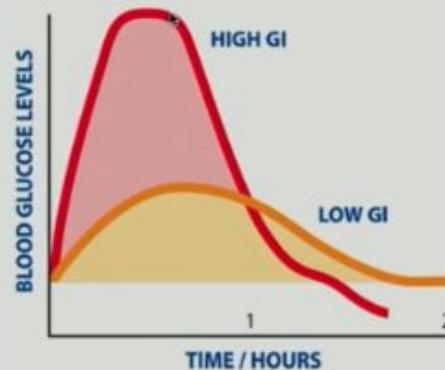


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# Glycemic Index Versus Glycemic Load

## Glycemic Index (GI)

The **glycemic index (GI)** assigns a numeric score to a food based on how drastically it makes blood sugar rise. Foods are ranked on a scale of 0 to 100, with pure glucose (sugar) given a value of 100. The lower a food's glycemic index, the slower blood sugar rises after eating that food.



The amount of carbohydrate in the reference and test food must be the same.



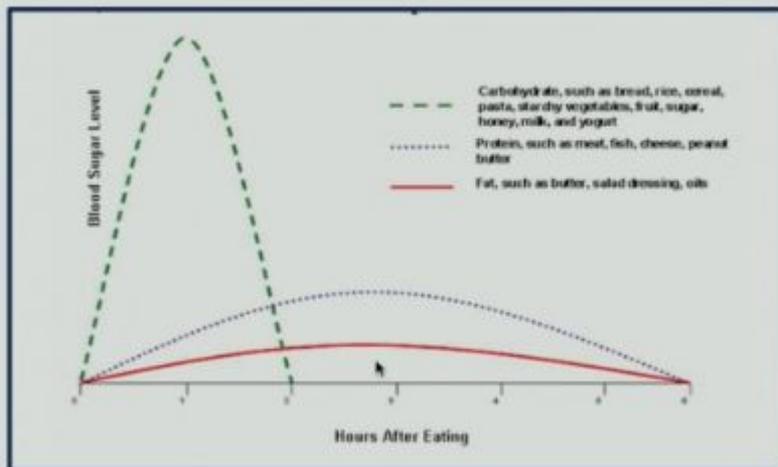
# Glycemic Index

Low GI (<55), Medium GI (56-69) and High GI (70>)

Grains / Starches		Vegetables		Fruits		Dairy		Proteins	
Rice Bran	27	Asparagus	15	Grapefruit	25	Low-Fat Yogurt	14	Peanuts	21
Bran Cereal	42	Broccoli	15	Apple	38	Plain Yogurt	14	Beans, Dried	40
Spaghetti	42	Celery	15	Peach	42	Whole Milk	27	Lentils	41
Corn, sweet	54	Cucumber	15	Orange	44	Soy Milk	30	Kidney Beans	41
Wild Rice	57	Lettuce	15	Grape	46	Fat-Free Milk	32	Split Peas	45
Sweet Potatoes	61	Peppers	15	Banana	54	Skim Milk	32	Lima Beans	46
White Rice	64	Spinach	15	Mango	56	Chocolate Milk	35	Chickpeas	47
Cous Cous	65	Tomatoes	15	Pineapple	66	Fruit Yogurt	36	Pinto Beans	55
Whole Wheat Bread	71	Chickpeas	33	Watermelon	72	Ice Cream	61	Black-Eyed Beans	59
		Cooked Carrots	39						
Muesli	80								
Baked Potatoes	85								
Oatmeal	87								
Taco Shells	97								
White Bread	100								
Bagel, White	103								



## Insulin Response to Food Types



# Key points

The more fiber - the lower the glycemic index

Balancing foods at all times is important to glucose absorption

Understanding our individual effects of various foods is important

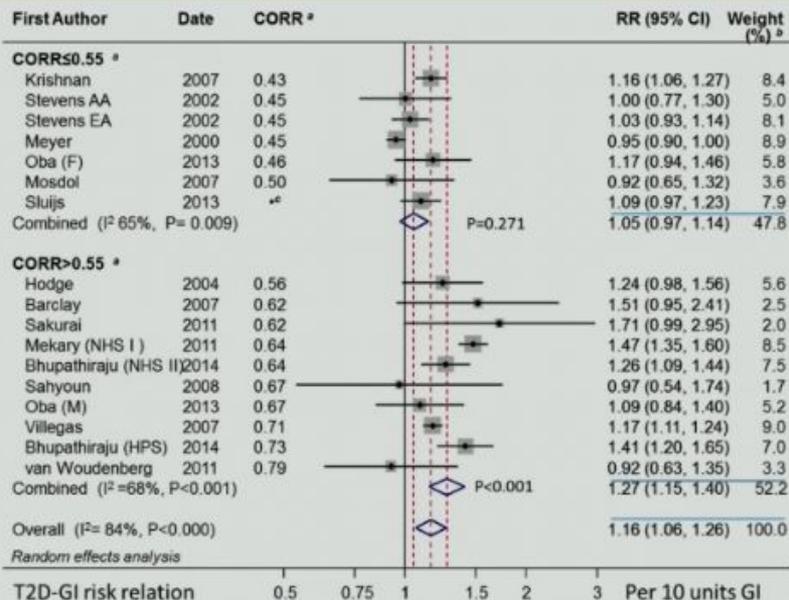
Easy to test

Information is power

Glycemic Load, Index

Net carbs

# Dietary Glycemic Index and the Risk of Type 2 Diabetes



“In conclusion, among adults initially in good health, diets higher in GI or GL were robustly associated with incident T2D.”





**Note gluten-free bread is refined and uses high glycemic sources such as tapioca, rice, potatoes, etc.**

Some patients who go on a gluten-free diet and change to gluten-free pasta, bread, snacks, etc. may increase their insulin spikes.



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### Glycemic Load (GL)

The glycemic load (GL) is an equation that takes into account the planned portion size of a food as well as the glycemic index of that food. Glycemic Load =  $GI/100$  multiplied by the net grams of planned carbohydrate (net carbohydrate is the total grams of carbohydrate minus the dietary **fiber**).



## Glycemic Index Versus Glycemic Load

Food	Glycemic Index	Serving Size	Glycemic Load
Peanuts	14	¼ cup	1
Grapefruit	25	½ large	1.4
Kidney beans	28	1 cup	7
Cheese pizza	30	2 slices	5.1
Skim milk	32	1 cup (8 oz)	4
Lowfat yogurt (plain)	33	1 cup	10.2
Apple, raw	38	1 medium	6
Pear, raw	38	1 medium	4
All Bran cereal	38	1 cup	9
Spaghetti (white, boiled 5 minutes)	38	1 cup	15
Spaghetti (white, boiled 15 minutes)	44	1 cup	18
Orange, fresh	48	1 medium	4.4
Banana, fresh	52	1 large	12.4
Snickers candy bar	55	1 bar	22.1
Honey	55	1 Tbsp	11.9
Brown rice (boiled)	55	1 cup	18
Oatmeal (cooked)	58	1 cup	11.7
Raisins	64	2 Tbsp	27.3
White rice (boiled)	64	1 cup	23
White table sugar	68	2 tsp	7
Popcorn (air popped, plain)	72	2 cups	5.7
Watermelon	72	2 cups	4.3
White bread	73	1 slice	10
Doughnut	76	1 medium	17
Russet potato (baked)	76	1 medium	23
Rice cakes	78	3 cakes	17
Jelly beans	78	10 large	22
Corn Flakes	81	1 cup	21
Carrots, boiled	92	½ cup	3.9

Sources: *Linus Pauling Institute, Oregon State University, 2005*  
<http://www.glycemicindex.com/>

Key	Low	Medium	High
Glycemic Index	55 or less	56 - 69	70 or higher
Glycemic Load	10 or less	11 - 19	20 or higher



# Fiber

Fiber really important for how quickly glucose absorbed in the gut (also SCFAs and microbiome)

Higher fiber - less spike (slow glucose absorption)

Good for all dysglycemia issues!

Adding fiber to foods can help dampen glucose and insulin response

Supplementing any meals (or snacks) with fiber capsules can reduce glycemic load (and is a good binder!)

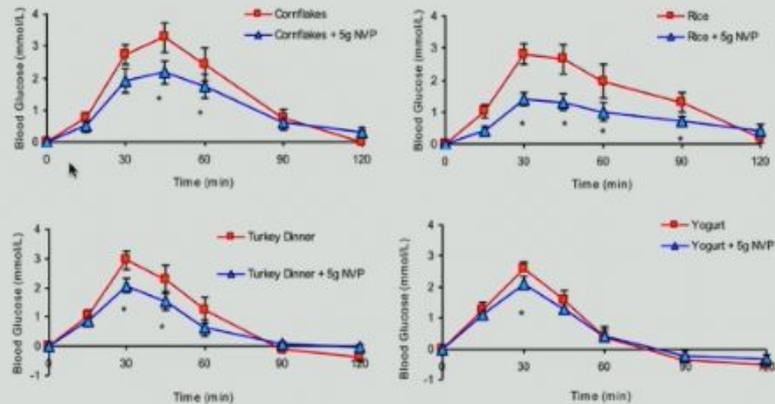
1 capsule 1 g fiber (3-5 capsules with meal). Decreased glycemic response (hypo or hyper) - significant impact!

Split with each meal - not at a separate time

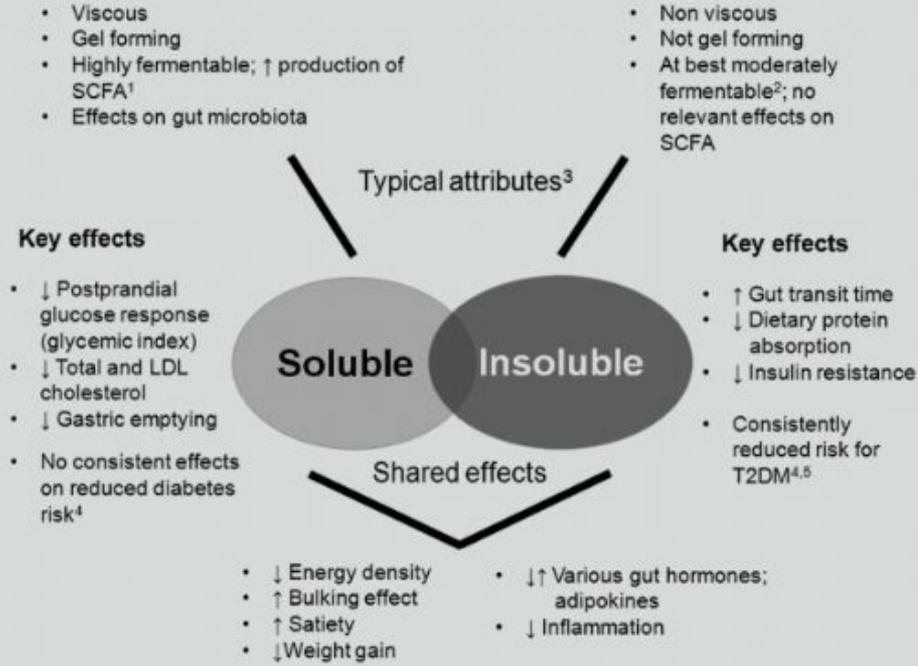
Fiber can help the microbiome issues we see in DM: Increase SCFA's, change microbiome composition, Increase incretin

May initially get bloating and distention. Work up slowly! (Even if higher fiber diet - try to see if it helps!!)

# The Impact of Adding Fiber to Meals



**Figure 1** Effect of adding 5 g of a novel fiber to commonly consumed meals on postprandial glycemia: Incremental postprandial blood glucose responses after cornflakes, rice, roast turkey dinner or fruit yogurt with or without 5 g of NVP. Data are expressed as Mean  $\pm$  SEM, \*significant difference in incremental blood glucose levels ( $p < 0.05$ ).



# Summary

Lowering the glycemic load of food can decrease the amount of glucose your blood sees - decreasing the insulin needed.

This will result in less spikes and crashes and more even blood sugars

# Blood Sugar - day 6

Lowering blood sugar swings, IR

# Managing glucose loads

- Watching glycemic load, glycemic index
- So eating low carb basically
- However, there will be higher glycemic foods we want to or will eat
  - We can add protein and fat to help
  - We can add fiber in foods or as a supplement with meals/foods
- Avoid plain carbs at any time (for both high and low BS issues)
  - Always aim to add in fat, protein

# Examples

Apples - add a nut butter

Trail mix with a little chocolate

Fruit - add a handful of nuts, cinnamon

Add oils, protein and nuts to salads/veggies

Hummus with carrots and higher glycemic vegetables

# Other advice

Watch grains, potatoes

Gluten and dairy??

Use vegetables in place of grains (spaghetti squash, zucchini noodles, cauliflower rice)

# Blood Sugar - Day 7

Causes

# Causes of blood sugar dysregulation

Lifestyle promoting - even well intentioned

Toxins and other underlying illnesses that tax the system

GI issues

Brain injuries, trauma

Adrenal gland, chronic stress - Organ dysfunction

Underlying disease

Genetics (Load the gun, environment pulls the trigger)

It is preventable or reversible for most, especially early

# What does that mean?

We can't just supplement blood sugar, diet and exercise

Look at kidney, liver, brain, microbiome

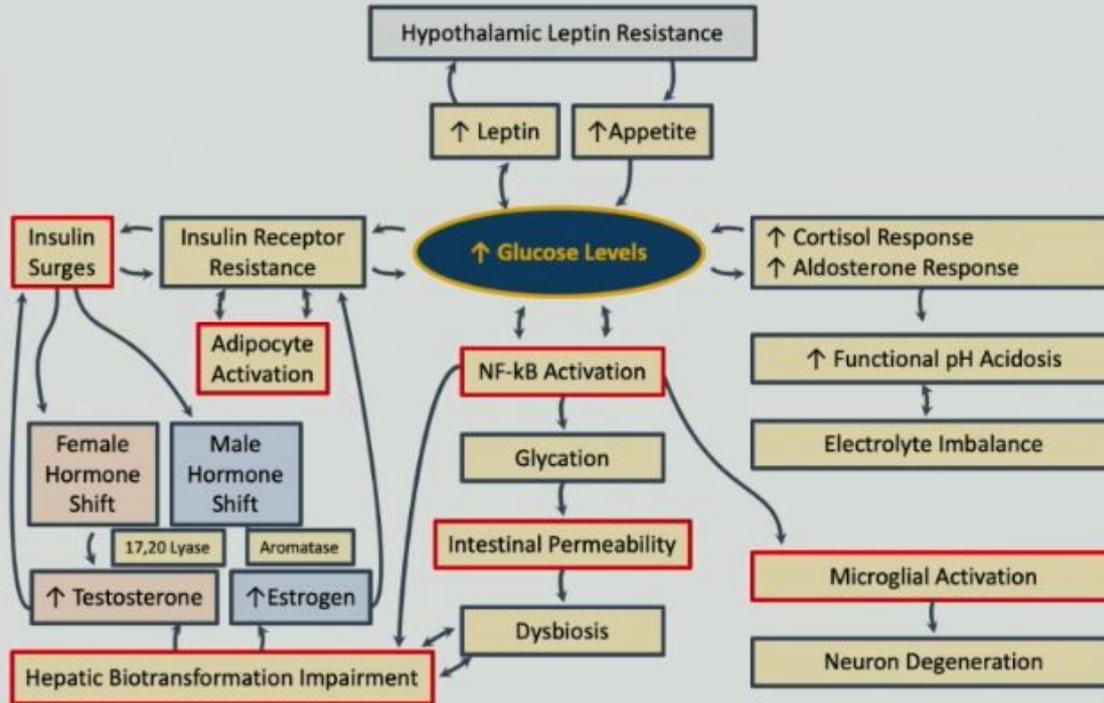
Check dysautonomia

Manage cortisol and stress

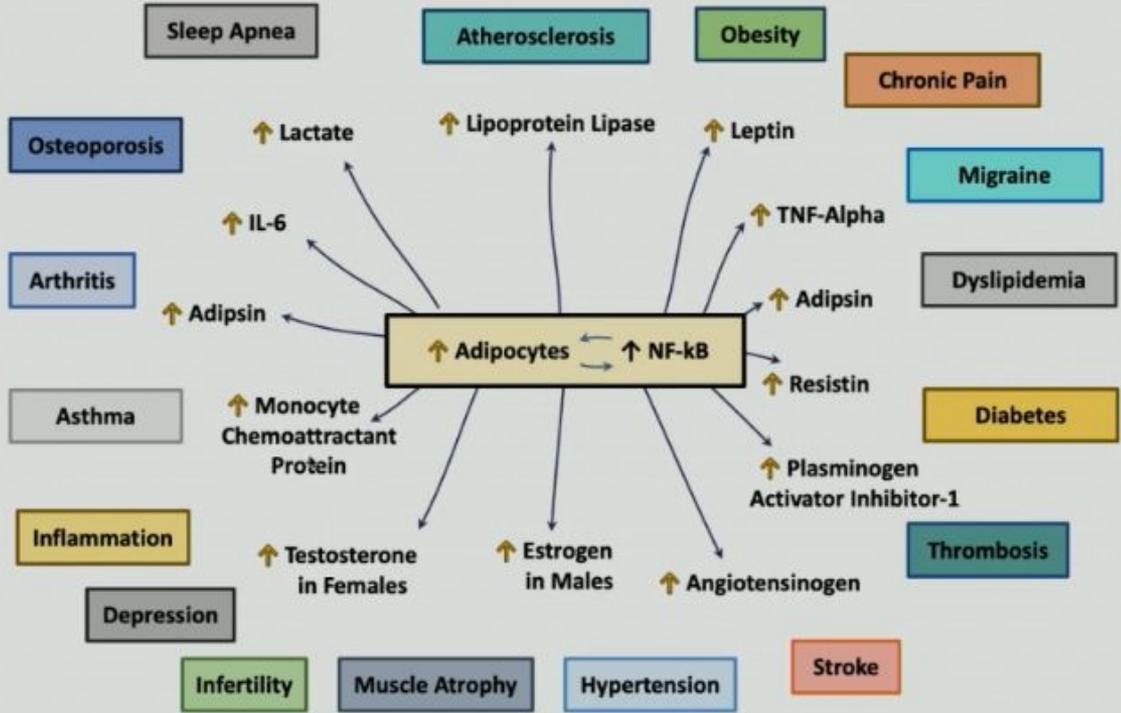
Regulate circadian rhythm

Check gallbladder and support

## The Physiological Web of Excess Glucose



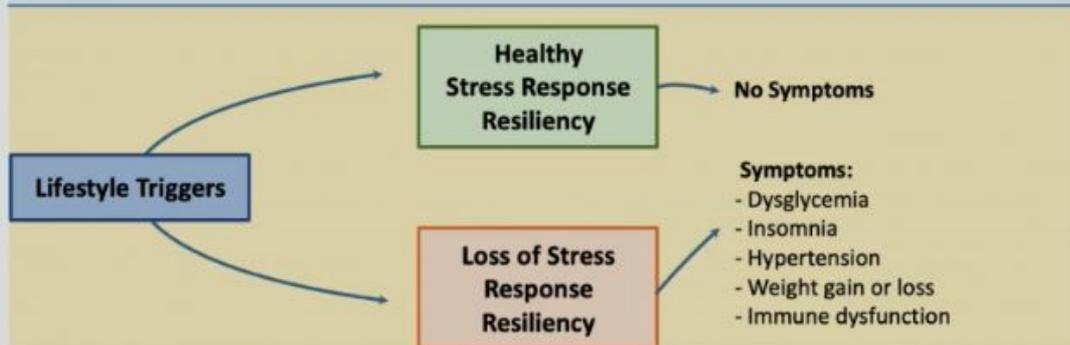
# Adipocyte Activation and Chronic Disease



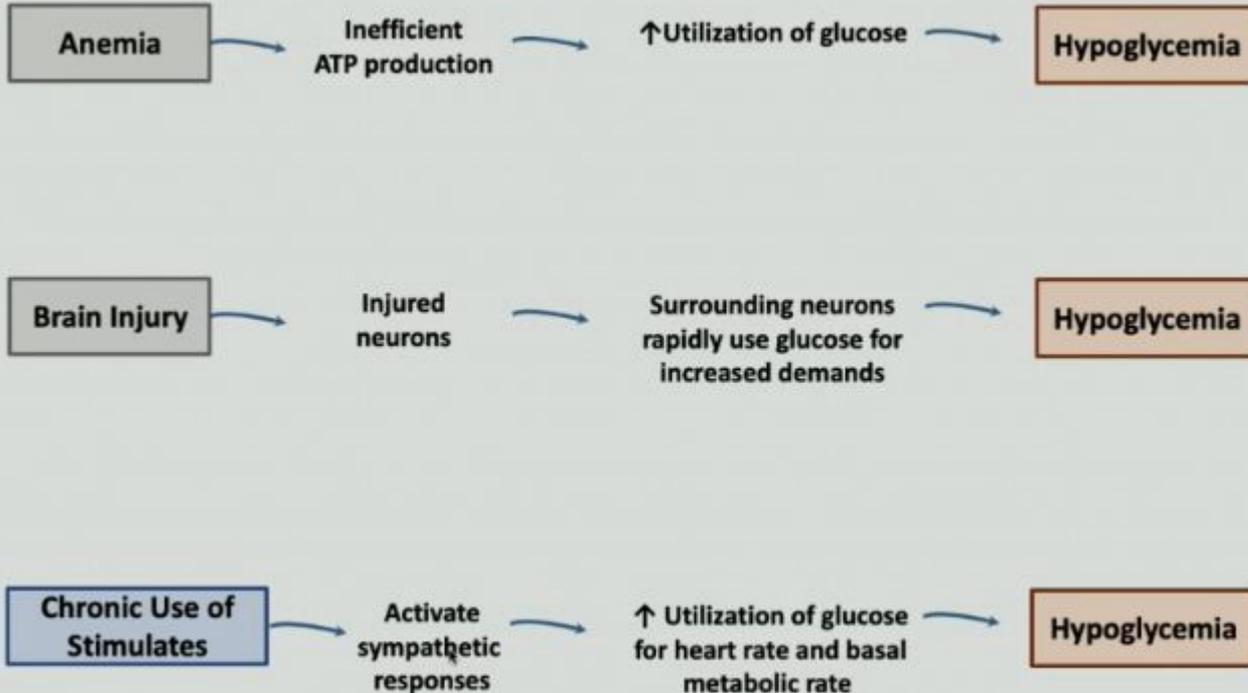
## Lifestyle Factors that Increase Adrenal Demands

### Lifestyle Factors

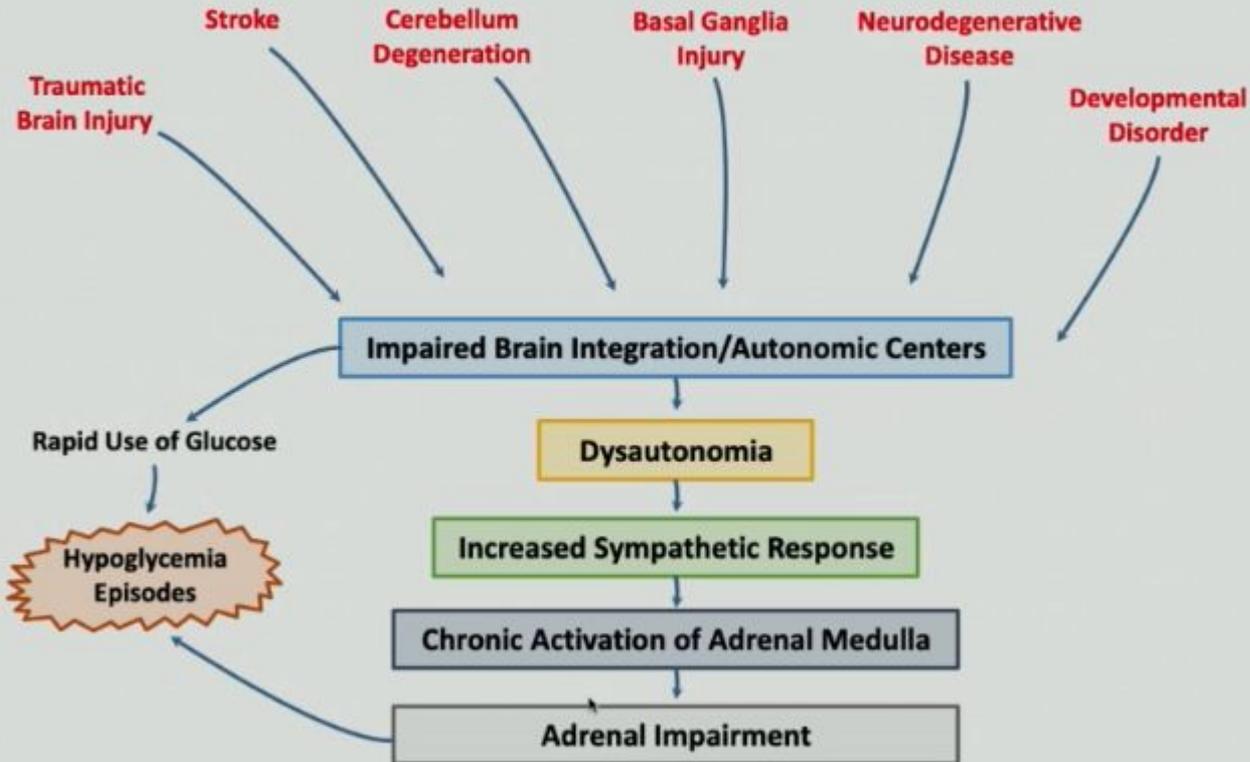
- Overtraining =  $\uparrow$  Long-term glucose demand
- Overworking =  $\uparrow$  Long-term glucose demand
- Lack of sleep =  $\uparrow$  Long-term glucose demand
- Psychological stress =  $\uparrow$  Long-term glucose demand
- Missing meals = Rapid need to stabilize glucose
- Excess simple sugars = Rapid need to stabilize glucose



## Metabolic Imbalances that Rapidly Use Glucose



# Dysautonomia and Adrenal Dysfunction



# Blood Sugars - Day 8

Treatment Options

# How to manage

**Key Clinical Concepts**

Hypoglycemia	Hyperglycemia	Autoimmune Diabetes
		
<b>Key Clinical Application</b>	<b>Key Clinical Application</b>	<b>Key Clinical Application</b>
<b>"You must stabilize blood glucose throughout the day before anything else."</b>	<b>"You must break the hyperinsulinemia vicious cycle before anything else."</b>	<b>"You must reduce the autoimmune expression by reducing triggers and improve immune tolerance before anything else."</b>

\*\*\* Exception to this rule is insulin replacement before anything else, if replacement is necessary\*\*\*



4

# Downward Spiral of Hyperglycemia

Normal Glycemic Response

Postprandial Dysglycemia

Insulin Resistance

Metabolic Syndrome

Diabetes

Diabetes with Advanced Glycation End Products

Diabetes with Complications

Diabetes with Nephropathy

Stage 1

Clinical Strategy

- Increase exercise
- Reduce complex carbohydrates
- Reduce simple sugars

Stage 2

Clinical Strategy

- Exercise after inflammation is reduced
- Ketogenic diet and intermittent fasting
- Avoid dietary AGEs

Stage 3

Clinical Strategy

- Chronic kidney disease diet
  - Limited protein
  - Limited salt
  - Limited potassium and phosphorus



# Stage 1 - Hyperglycemia, IR

Exercise with highest intensity without overtraining to optimize insulin signalling

Low carb diet to reduce insulin surges

Monitor fasting and postprandial glucose (insulin is able)

Supplemental support to improve insulin signalling

## Popular Low-Carbohydrate Diets

**Mediterranean Diet**



**Paleo Diet**



**South Beach Diet**



# Stage 2 - Metabolic Sx, DM (in order)

Ketogenic diet and then adding in IF (aggressively decreasing hyperinsulinemia)

Supplemental support for the AMPK and sirtuin pathways for insulin signalling

Increase anti-inflammatories and antioxidants to remove additional inflammation

Exercise AFTER inflammation is reduced (when insulin surges are down and inflammation reduced)

Breaking out of insulin cycles - then building muscle mitochondria.

Increase intensity and duration slowly

Avoiding dietary AGEs

Gut support and repair - microbiome and permeability

Reduction of toxins that affect obesity, endocrine glands and DM - optimize biotransformation

# Dietary Considerations with Hyperinsulinemia/Diabetes

## Level 1

Increase fibers, reduce simple sugars, decrease carbohydrate loads, decrease meal size, prevent late night snacking



- 1-2 weeks
- Sugar cravings must be gone

## Level 2

Ketogenic diet with high fiber



- 3-8 weeks
- Keto-adapted and hunger in the morning has stopped

## Level 3

Intermittent fasting with high fiber



## Level 4

Intermittent fasting with ketosis and high fiber



## Level 1 Management of Hyperinsulinemia

- No sweets or artificial sweeteners
- No fruits
- Carbohydrates at a portion size that does not cause fatigue
- Increase vegetables (except potatoes, yams)
- Meal portion size that does not cause fatigue
- No late-night snacking after dinner

**Two Clinical Goals for Level 1**  
**1) Eradicate all sugar cravings**  
**2) Eradicate fatigue after meals**

\* Goals can be easier to achieve with exercise and/or nutraceuticals\*



**Level 2**  
**Ketogenic diet with high fiber**

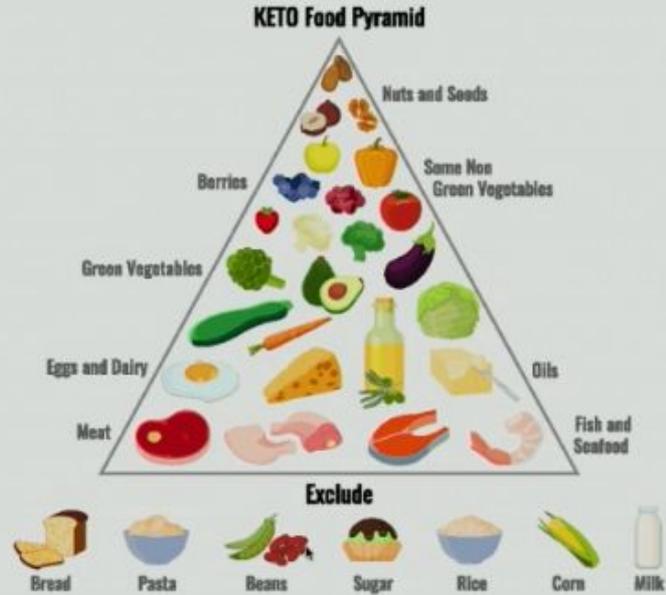


**70% fat, 25% protein, 5% carbohydrates**

< 20-40 grams of carbohydrates per day



# Ketogenic Pyramid



### Level 3

#### Intermittent fasting with high fiber

#### Time-restricted eating

- **14/10 Method:** 14 hour fast / 10-hour eating window
- **16/8 Method:** 16 hour fast / 8-hour eating window
- **20/4 Method:** 20 hour fast / 4-hour eating window

Time-restricted eating is the best method to control insulin patterns



# Intermittent Fasting

Not eating, then eating - different amounts of time

Prolonged fasting - multiple days - catabolic (break down muscle)

IF - keeps in anabolic state (keeps muscle)

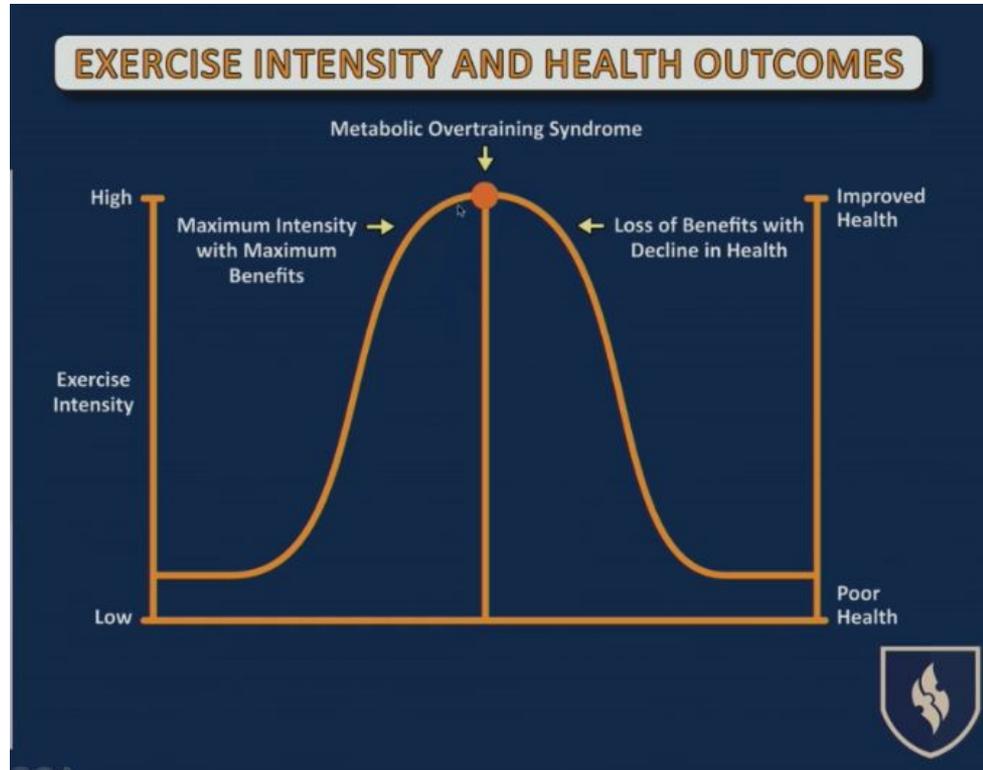
Cannot go right to this until we get into keto for awhile. Body gets used to using ketones for fuel, enzymes more efficient.

Wake up after keto for awhile - and can go to 11-12 without energy crashes with no food (keto-adapted)

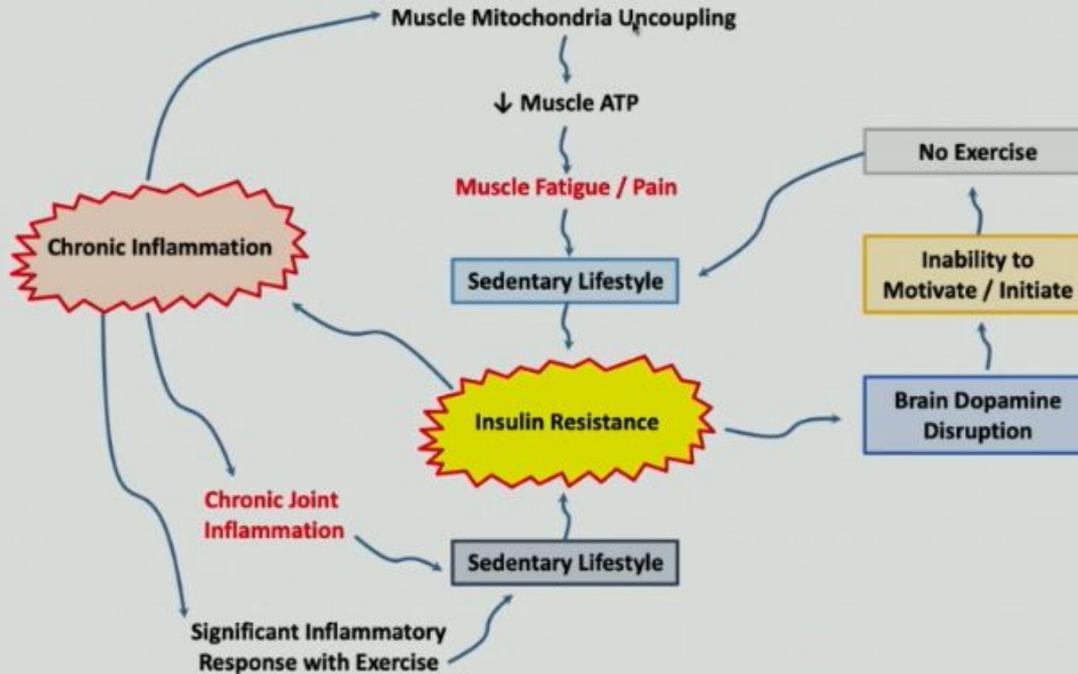
Without this adaption - will crash, not feel well, get moody, etc...

Continue high fiber!!

# Exercise



## Vicious Cycle of Sedentary Lifestyle with Insulin Resistance



# Exercise

Once ready:

The more intense - the more effective in lowering BS levels

(HIIT) - even short periods.

More intense → more inflammation - so start slow and work up

The more frequent and intense - the better control (ex 3x/week)

Short for intense - 7 minute workout.

Then do other less intense as you want

# Overall concepts

Exercise once inflammation resolved (after 4-6 weeks of program).

Some early and may feel it/ready

Key = no pain, recovers okay

Can feel like you can do the same thing every day (give yourself recovery time)

Overtraining - gain weight and plateau

# Supplements

Have to have dietary and lifestyle changes

Cannot supplement out of diabetes/IR/dysglycemia

Need to reduce insulin surges and the way our cells respond to insulin as well as other pathways

# Other lifestyle

Sleep

Detox

Destress

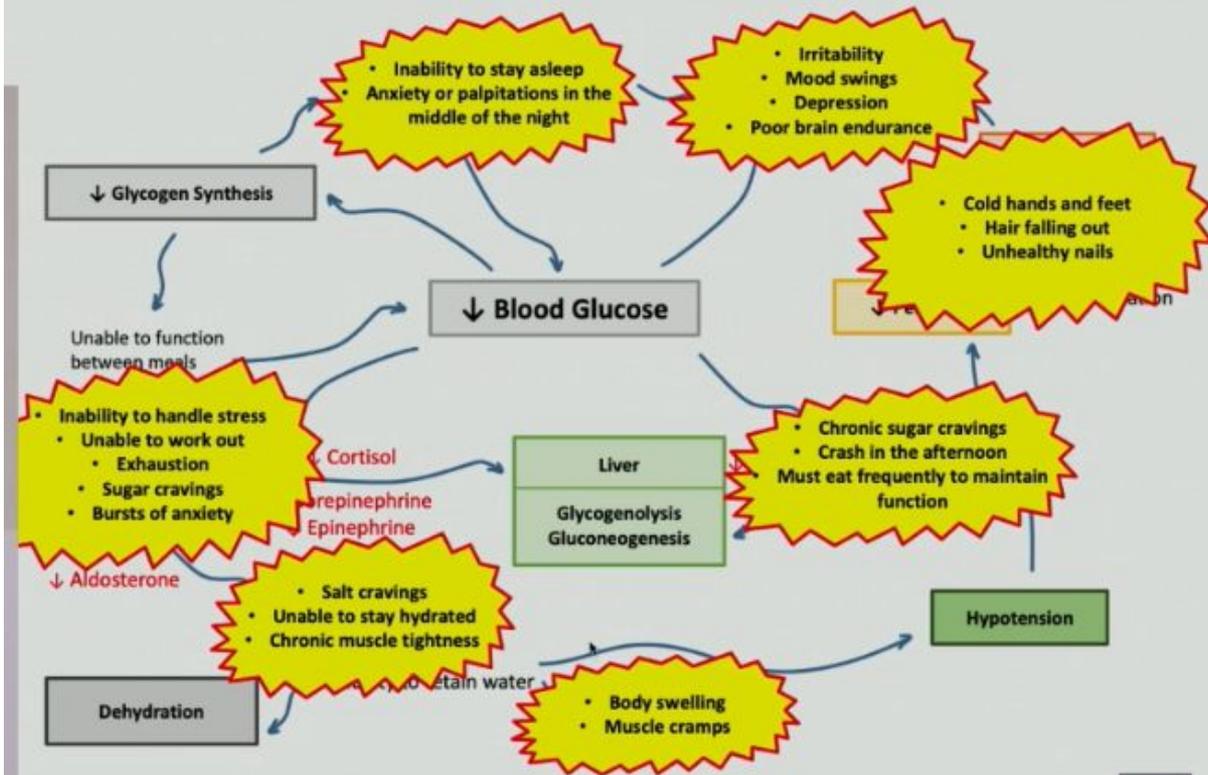
Work on trauma

Move, nature

Social connection

Positive peer and social interactions (esp with food)

# Hypoglycemia Physiological Web



# Hypoglycemia

## Typical Hypoglycemic Daily Diet

### Breakfast:

- Skip breakfast
- Tea with honey
- Coffee with sugar
- Fruit yogurt
- Smoothie/green drink

*No appetite or sugar craving*

### Snack:

- Fruit or sweets

*Sugar cravings*

### Lunch:

- Salad with protein
- Skip lunch
- Smoothie

### Snack:

- Fruit or sweets

*Afternoon energy crash and sugar cravings*

### Dinner:

- Veggies and meat

### Snack:

- Fruit or sweets

*Sugar cravings after dinner*



# Hypoglycemia

Improvement in energy, focus, concentration with food → hypoglycemia

Focus ends up on glucose spikes

Cut Fruit, fruit juice, high GI foods. Add more vegetable fibers, protein and fats

Don't feel energy after eat! Means went too long without eating. Should not notice function up and downs

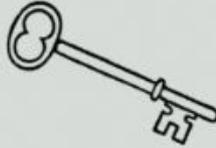
These up and downs are harmful to the body

Reduce or eliminate caffeine, and nicotine (herbal teas okay)

Avoid overtraining

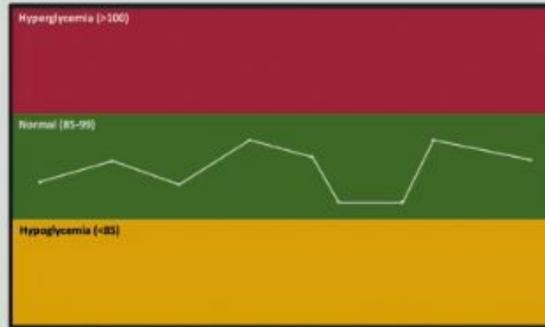
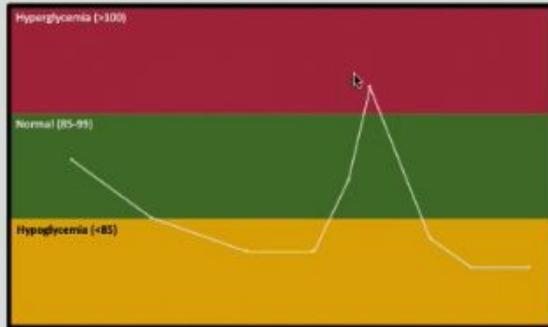
Get enough sleep to feel rested in the morning

# Hypoglycemia Management



## Key Clinical Application

**“You must stabilize blood glucose throughout the day before anything else.”**



## 2 Key factors for managing Hypoglycemia

Low glycemic Foods with protein, fats and fibers

Must eat frequently enough to avoid blood sugar drops

# Dietary recommendations

Permitted Foods:

Vegetables, meats, lentils

Non-Permitted Foods:

Sweets, starches, no fruits initially

Basically low-carb or keto

# Sample Menu

Breakfast: Protein (fish, chicken, sardines, eggs, etc..) and veggies

Snack: Nuts/nut butters, Veggies, Humus

Lunch: Salad with protein

Snacks: Nuts/nut butters, Veggies, Humus

Dinners: Veggies and meat

Snacks: Nuts/nut butters, Veggies, Humus

## 5 Clinical Outcomes to Determine if blood glucose is stabilized

- No energy crashes throughout the day (fatigue, irritability, loss of brain function, etc...)
- No sugar cravings throughout the day
- There is not a feeling of “back to normal” after eating
- You notice hunger cues before loss of function
- Can sleep through the night (enough glycogen/ketones)

# Once 5 clinical outcomes are achieved..

Fruit and carbohydrates can be added back in slowly

The frequency and dosages of higher glycemic foods back into the diet will be determined individually (by the response)

Must follow a diet and maintain all 5 clinical outcomes associated with blood sugar stability as you reintroduce higher glycemic fruits

If this doesn't work → look at metabolic issues/pathology

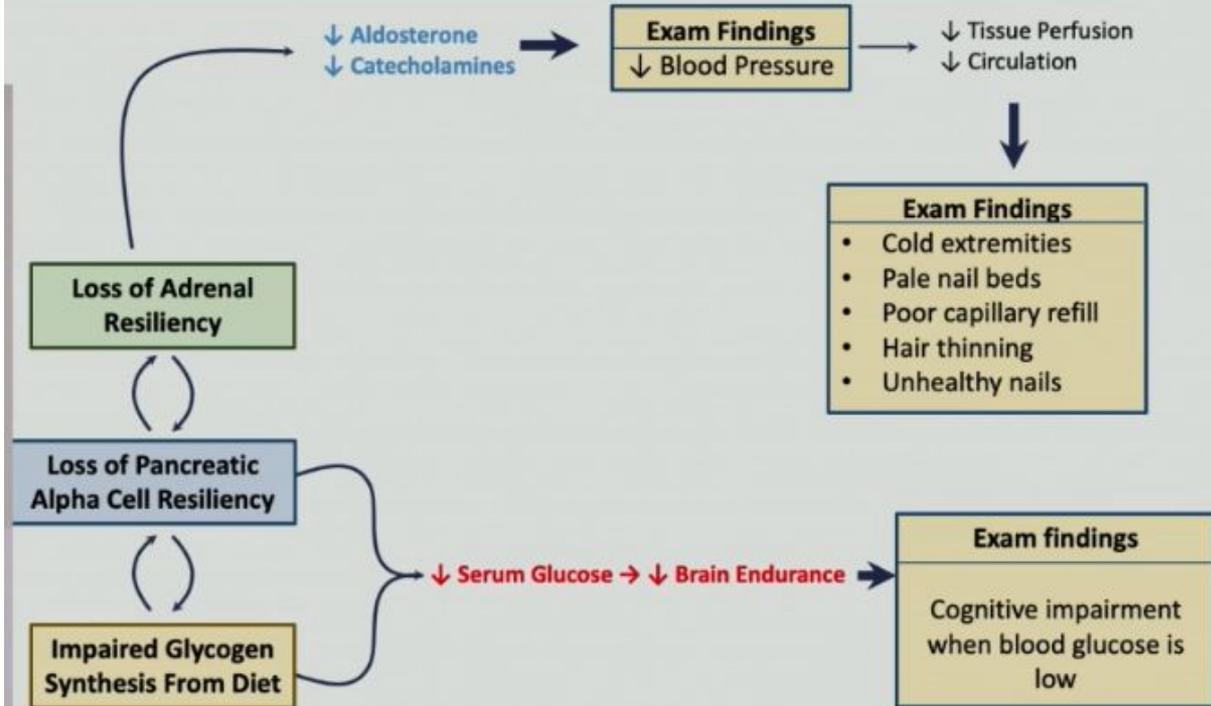


# Blood Sugars - Day 9

Measuring/Labs



## Physical Exam Findings of Functional Hypoglycemia (No Pathology)



## Laboratory Tests For Functional Hypoglycemia

### Routine Lab Tests for Functional Hypoglycemia

**Fasting Glucose** → Hypoglycemia

**LDH** → Hypoglycemia if LDH < 140

**Lipid Panel** → General health

**Comprehensive Metabolic Panel-14** → General health and electrolytes

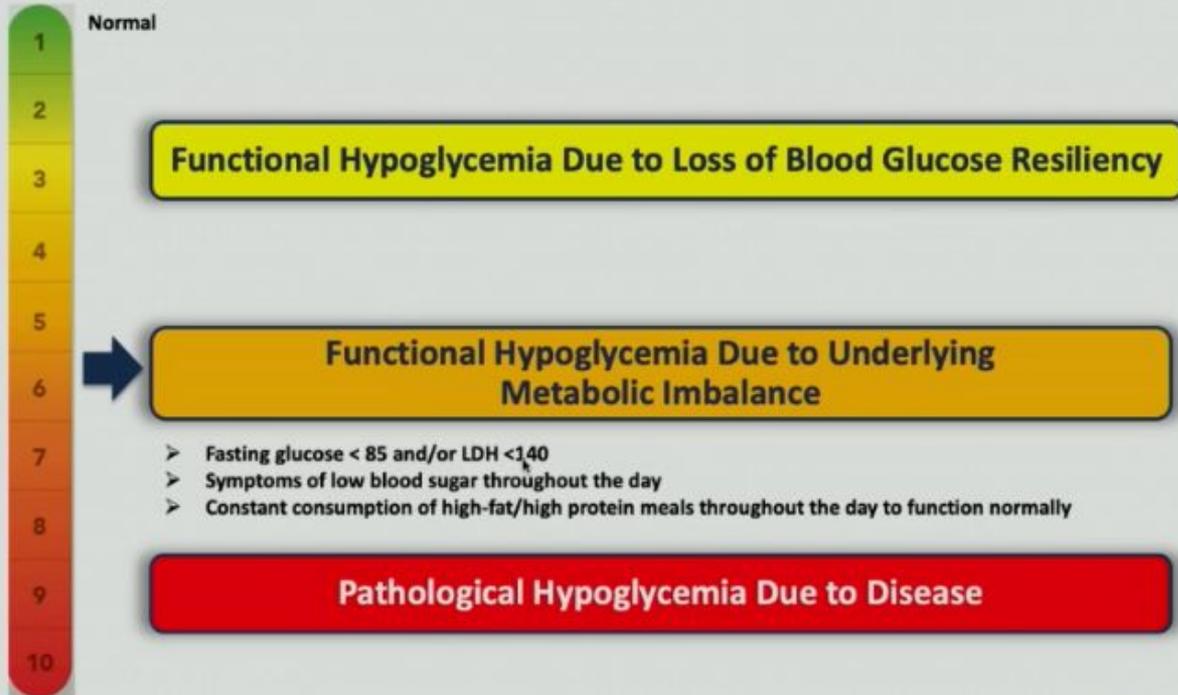
**Glucose/Insulin Response (3 Specimens)** → If post-prandial hypoglycemia is suspected

### Functional Medicine Labs for Hypoglycemia

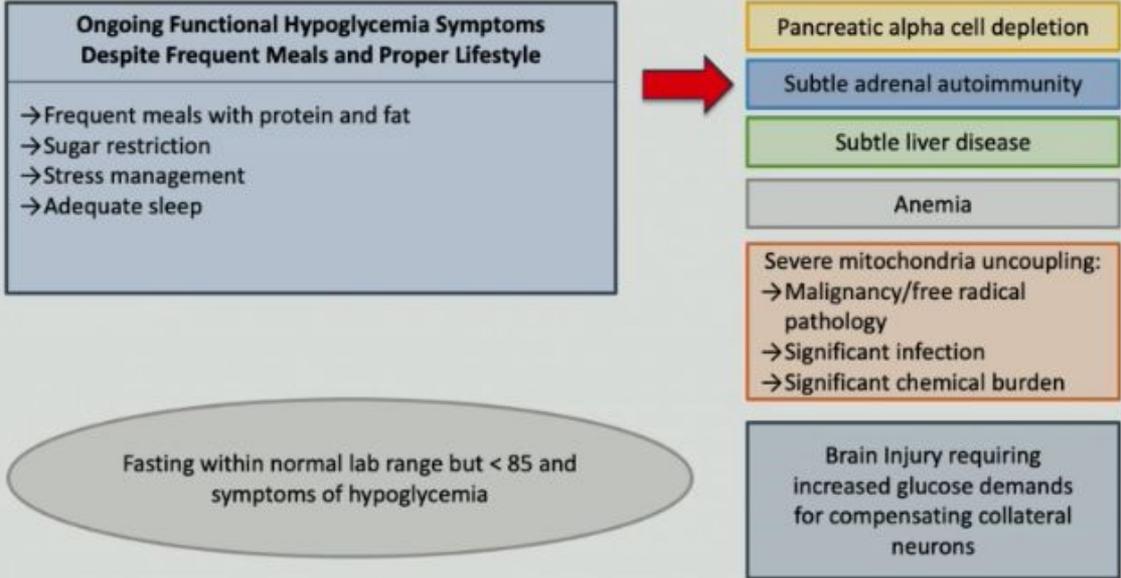
**Adrenocortex Stress Profile with Cortisol Awakening Response** → Cortisol output throughout the day



# Hypoglycemia Scale of Severity



# Chronic Hypoglycemia Despite Frequent Meals and Proper Lifestyle



# Laboratory Screen For Chronic Hypoglycemia Despite Frequent Meals

## Routine Blood Tests for Hypoglycemia Patterns

**Fasting Glucose** → Severity of hypoglycemia

**Fasting Insulin** → Insulinoma

**Comprehensive Metabolic Panel-14** → Transaminases, electrolytes, total proteins, globulin, GFR → Metabolic diseases

**CBC with differential** → Anemia and immune activation

**Erythrocyte Sedimentation Rate (ESR)** → Inflammation

**C-Reactive Protein (CRP)** → Inflammation

**Lipid Panel** → Lipid metabolism

**Prealbumin** → Protein malabsorption

**C-Peptide** → Insulinoma or pancreatic failure

**Adrenal 21-Hydroxylase Antibodies** → Adrenal autoimmunity

**Anti-Adrenal Antibodies** → Adrenal autoimmunity

IF ALL LAB TESTS NORMAL

Medication -  
Induced  
Hypoglycemia

Nutraceutical-  
Induced  
Hypoglycemia

Dysautonomia

Traumatic Brain Injury / Demyelination

Neurodegenerative



# Bottom Line

Evaluate if and why you have low BS

Manage other contributors - stress, circadian rhythms

Food is the number one treatment

Supplements can be helpful (but will not cure)

# Laboratory Tests for Insulin Resistance, Metabolic Syndrome, Diabetes

## Routine Laboratory Tests for Insulin Resistance Patterns

**Fasting Glucose** → Severity of insulin resistance  
**HbA1C** → Glycation  
**Fructosamine** → Glycation  
**Glycomark** → Hyperglycemic spikes  
**Glucose/Insulin Response (3 Specimens)** → If post-prandial, dysglycemia is suspected  
**Comprehensive metabolic Panel - 14** → GFR, creatinine, total protein, electrolytes  
**Lipid Panel** → Lipid metabolism  
**CBC with differential** → Anemia and immune function  
**C-Peptide** → Insulin production  
**Erythrocyte Sedimentation Rate (ESR)** → Inflammation  
**C-Reactive Protein (CRP)** → Inflammation  
urinalysis → Proteins, ketones, osmolarity

## Functional Medicine Labs for Insulin Resistance Patterns

Adrenocortex stress profile with cortisol awakening response  
Urinary Glyphosate Test, Urinary Toxic Non-Metal Chemical Profile → Endocrine Disruptors, Obesity, Diabetogens  
Comprehensive Stools Analysis



# Blood Glucose Patterns

## Elevated Glucose

### Postprandial Dysglycemia

Glucose = Normal  
Postprandial Insulin  $\uparrow$  and/or Glucose  $\uparrow$

### Early Insulin Resistance

Glucose > 99  
Elevated triglycerides

### Insulin Resistance/ Metabolic Syndrome

Glucose > 99 but < 127  
Triglycerides  $\uparrow$   
Cholesterol  $\uparrow$   
LDL  $\uparrow$   
HDL  $\downarrow$   
Uric Acid  $\uparrow$   
Triglycerides > Total Cholesterol  
GlycoMark < 10

### Diabetes

Glucose  $\geq$  126  
HbA1c  $\uparrow$   
Fructosamine  $\uparrow$   
GlycoMark < 10



## Diabetic Complications

HbA1c >7.0  
↑ Glycation



### Increased Risk for Complications

- Diabetic neuropathy
- Diabetic retinopathy
- Eye trouble
- Kidney failure
- Heart disease
- Hypertension
- Stroke
- Peripheral arterial disease
- Wounds that do not heal
- Urological dysfunction
- Erectile dysfunction
- Gangrene
- Blindness
- Amputations



## Laboratory Tests that Monitor Glycemic Control

### Measures Glycation

HbA1c

- Measures glycation process of the past 3–4 months
- Gold-standard biomarker for glycation
- Predictive biomarker for diabetic complications

Fructosamine

- Intermediate glycation marker to HbA1c
- Measures glycation response of the past 1–3 weeks

### Measures Glycemic Spikes

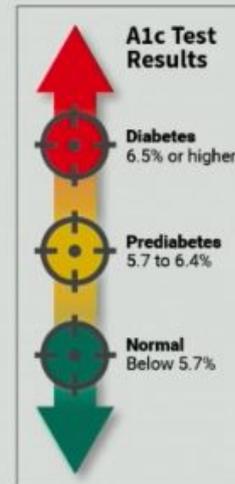
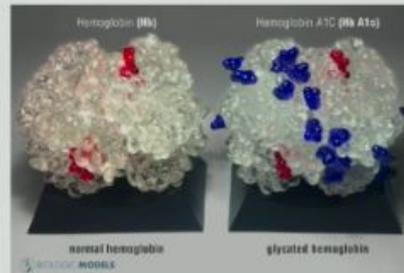
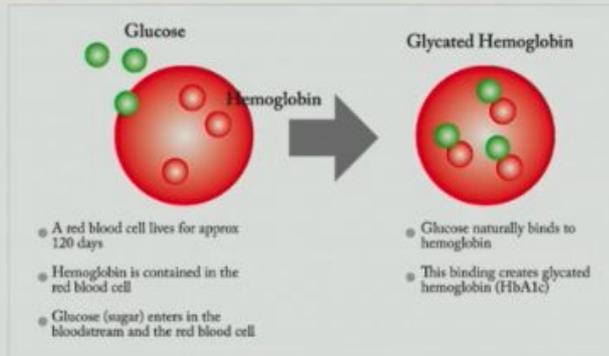
GlycoMark  
(1,5-Anhydroglucitol)

- Measures hyperglycemic excursions (spikes) for the past 1–2 weeks



## Hemoglobin A1c (HbA1c)

The HbA1c test is a measurement of how many red blood cells have sugar attached. So HbA1c of 7%, means that 7% of the red blood cells have sugar attached to them.



# Sugar and the brain

Brain degeneration begins at A1C 5.5

GLUCOSE 105 - significant associated with dementia

Consider checking uric acid as well

# Home ways to check blood sugars

Blood glucose monitor - checking at various points of the day

Good for fasting, 2 hours after a meal

Not at night - not reflective

Often better paired with insulin - which is not available at home

CGM - continuous glucose monitors

# CGM's

Download data to your phone

Show trends, patterns

Can give you an idea of your overall pattern

Smooth

Up and down

Drops at night

Exercise tolerance

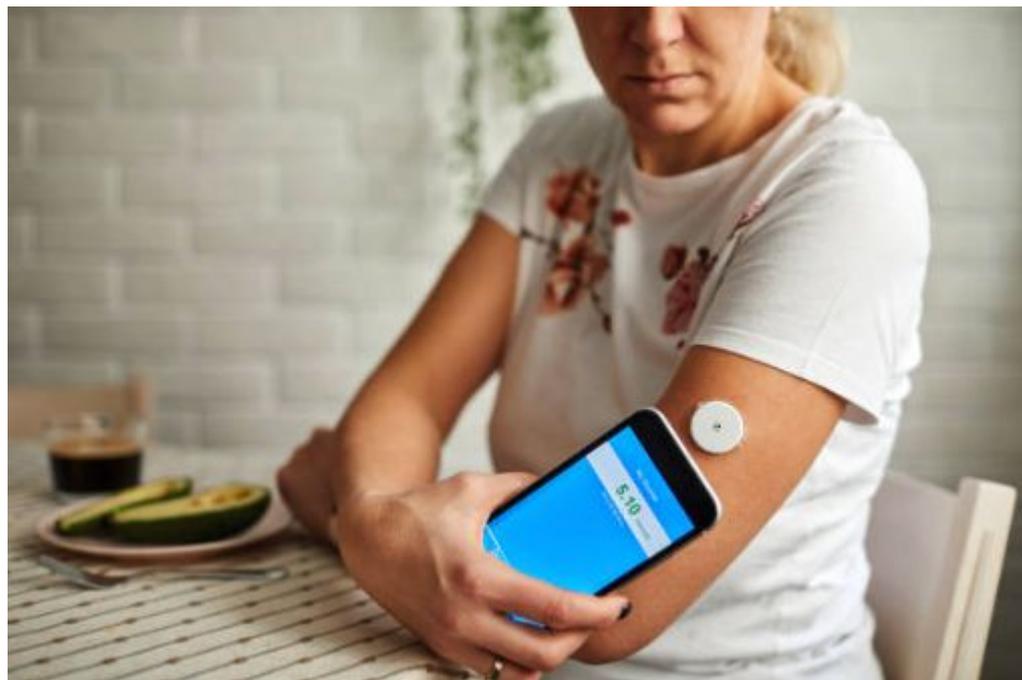
Certain foods

# CGM's

2 weeks of data

Comes with alarms for highs and lows

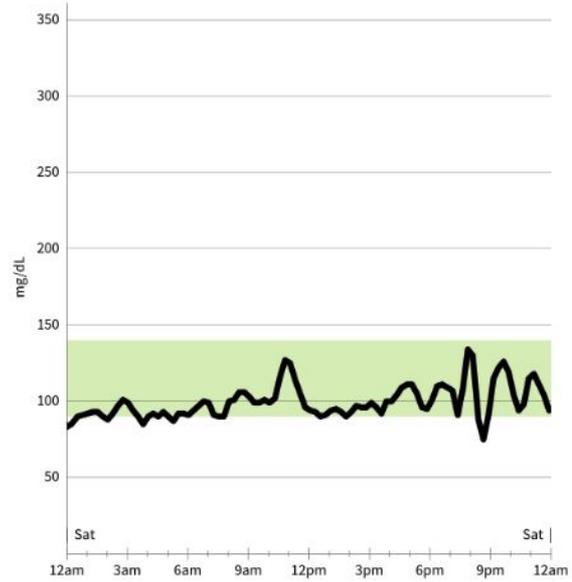




# DAILY GRAPH

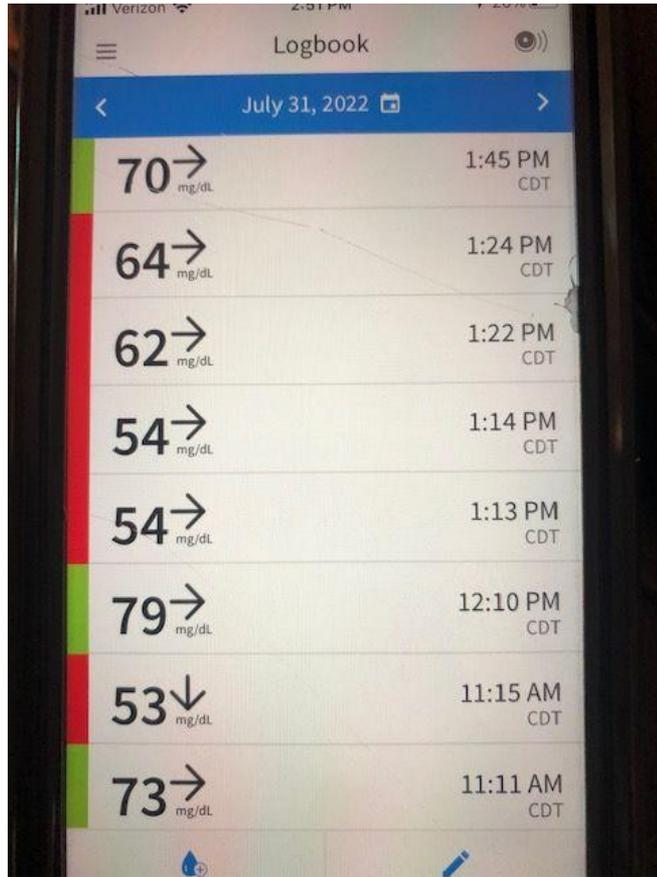


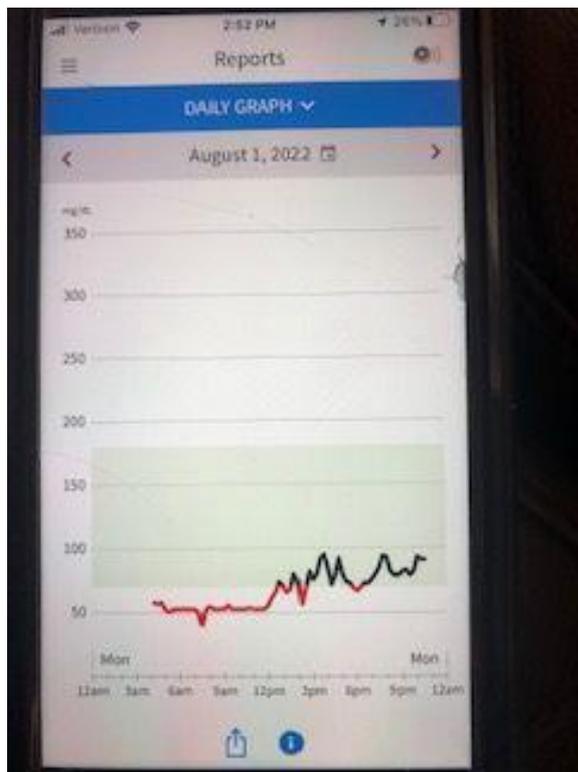
March 9, 2019





394 x 497







DAILY GRAPH ▾



August 4, 2022 📅



mg/dL

350

300

250

200

150

100

50

Thu

Thu

12am

3am

6am

9am

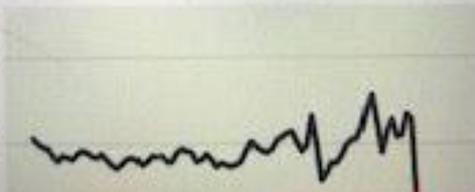
12pm

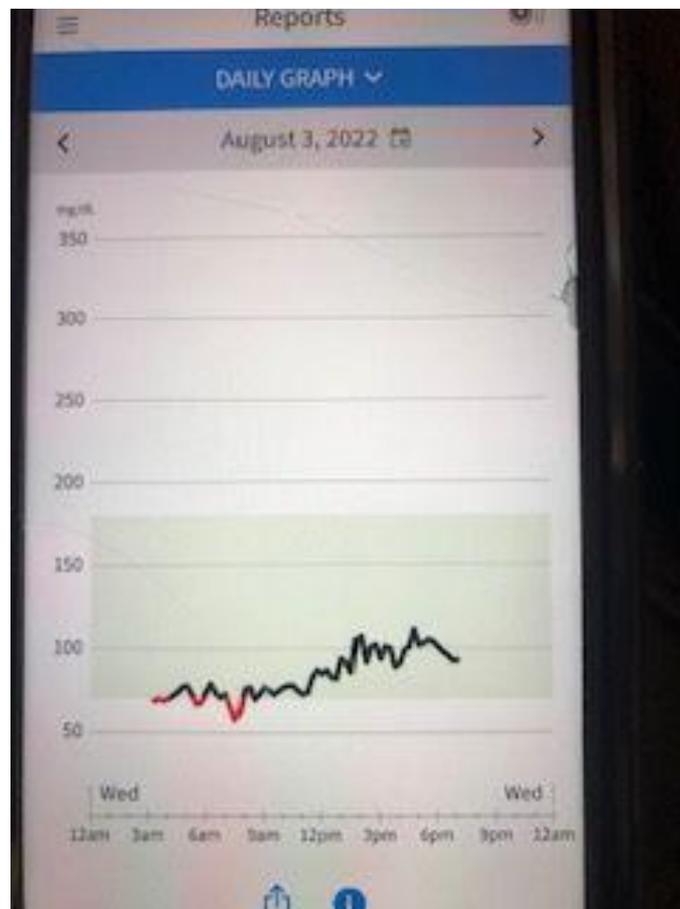
3pm

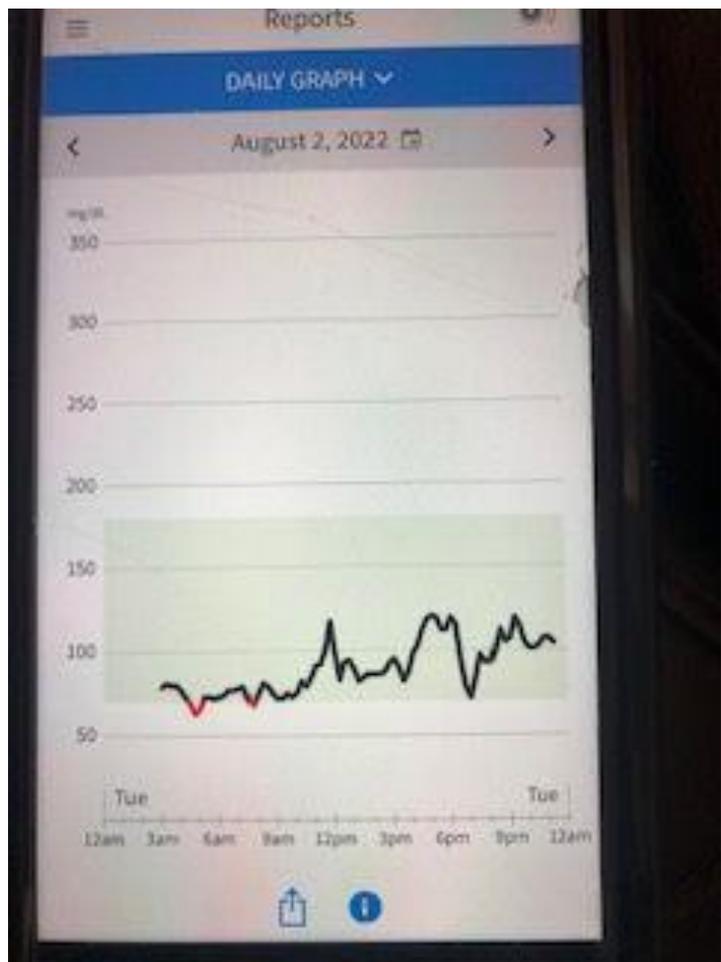
6pm

9pm

12am









# Day 10

Summary

# Blood sugar dysregulation

Very common - and hard to detect with regular testing

Can very much affect how you feel and function

Can affect your ability to heal from chronic issues

Food responses to foods varies widely

We can use this information to help heal and regulate

We can use this information to prevent future disease

# What to do next...

1. Do nothing
2. Consider low carb food plan, keto if you feel you have bs issues
  - a. Under a provider's guidance if keto
3. Be more aware of how various foods and food combinations make you feel.
  - a. Try new ways of mixing foods, eating, eating patterns
4. Own research and trial and error
5. Get a glucometer
  - a. Do some various times of checking - fasting, 2 hr PP, after exercise, etc..
  - b. Evaluate those numbers?
6. Do some labs at your clinic
7. Get a CGM - need a prescription and then someone to help interpret data
  - a. Get one from your regular doctor
  - b. Get one from Theia

# CGM's

Nutrisense offers its customers a variety of packages that range in price from **\$175 for a two-week program to \$160 a month for an 18-month commitment**. And January charges \$288 for its “Season of Me” introductory program that includes two glucose monitors and access to the company's app for three months.

The **price** of **NutriSense** CGM Subscriptions ranges from \$199.00 to \$350.00 per month depending on the minimum commitment period

Uses Abbott freestyle libre 2 as well

Levels costs \$199 for an annual membership fee plus the cost of the continuous glucose monitoring kit which includes two 14-day sensors for \$199 per month. (no personal touch - all app based)

<https://www.fithealthymomma.com/nutrisense-vs-levels/>

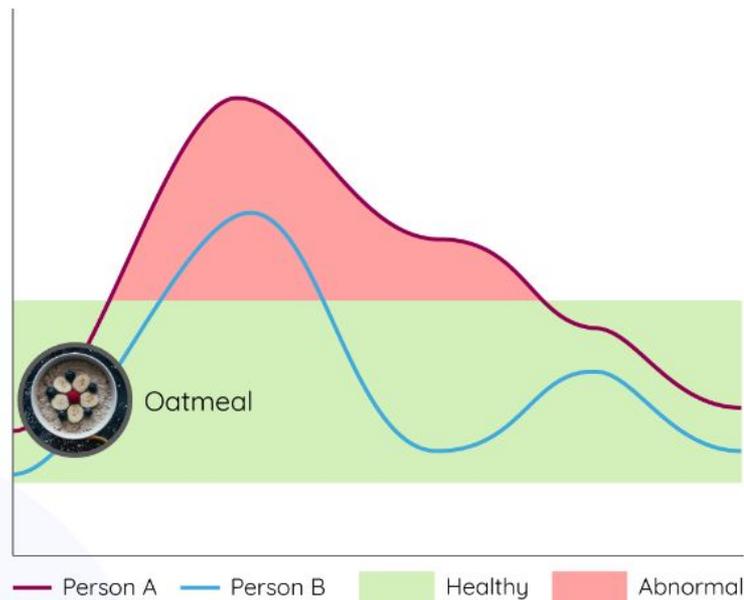
<https://www.gowellnessco.com/nutrisense-vs-signos-cgm-better/>

Theia + Flourish Health

# Understand Your Body

Same Food. Different People.

[How it works →](#)



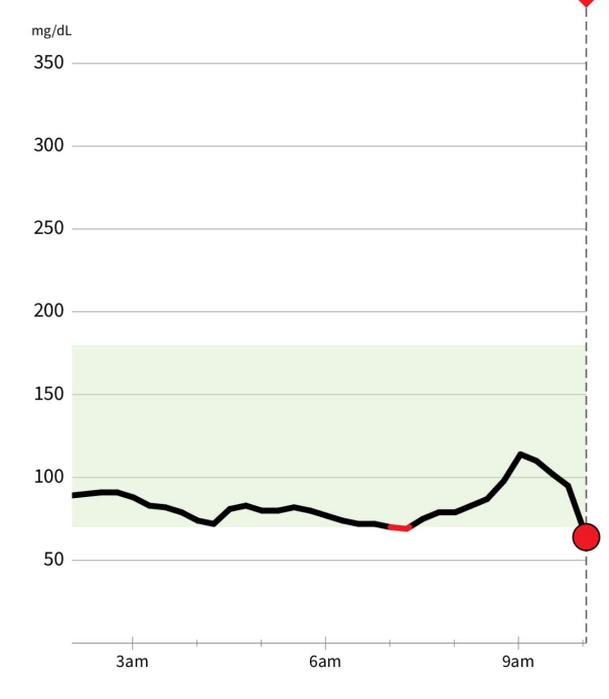
<https://theiahealth.ai/a/flourishmd>

# Theia Health

1. 2 CGM's with Good RX
2. App to download and look at scores
3. Health coach that will be looking at the dashboard weekly (1 hour/week)
4. Weekly interaction and suggestions based on scores
  - a. 30 minute call/30 minute prep
5. 8 hours of health coaching time in 1 month
6. Total cost of the program \$497
  - a. Pay \$433, \$63.77 to pharmacy using Good Rx prescription

**LOW GLUCOSE** 10:03 AM

**64** ↓  
mg/dL





# Reports

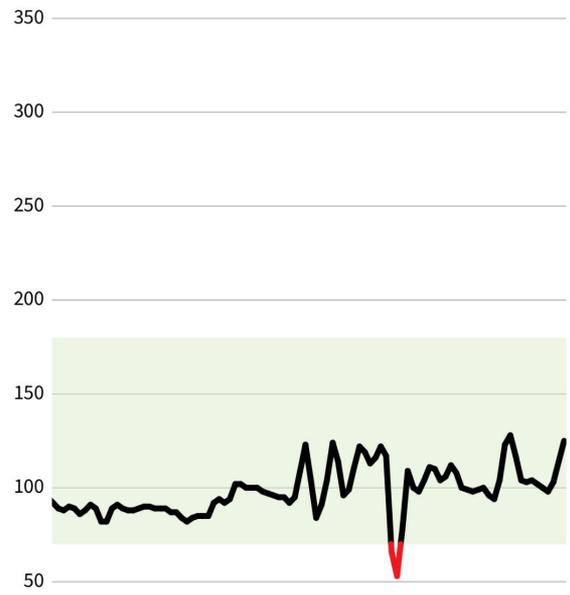


## DAILY GRAPH ▾

< September 30, 2022 >



mg/dL



Fri | 12am 3am 6am 9am 12pm 3pm 6pm 9pm 12am





# Reports

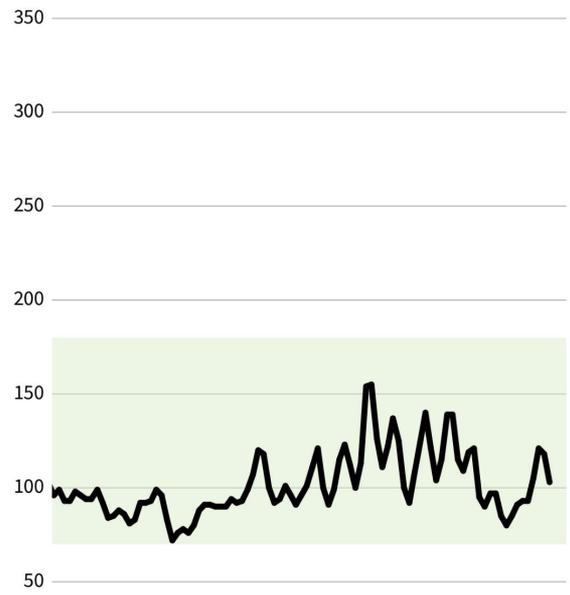


## DAILY GRAPH ▾

< September 27, 2022 >



mg/dL

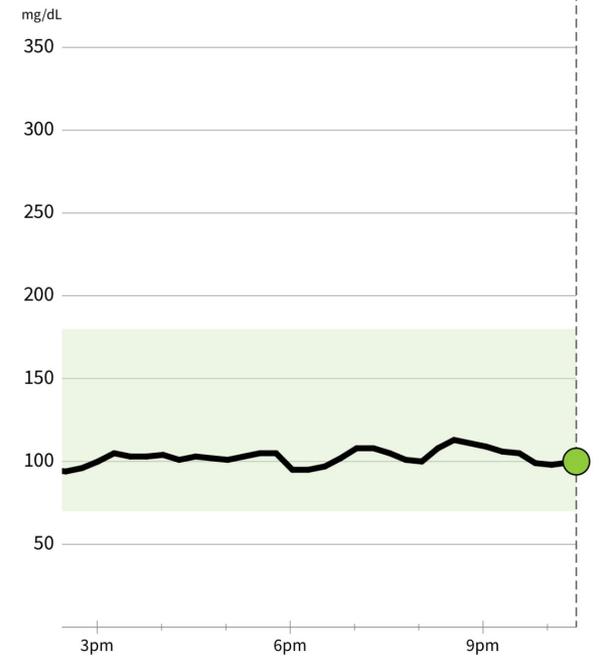


Tue | 12am 3am 6am 9am 12pm 3pm 6pm 9pm 12am | Tue



GLUCOSE IN RANGE 10:26 PM

100 →  
mg/dL

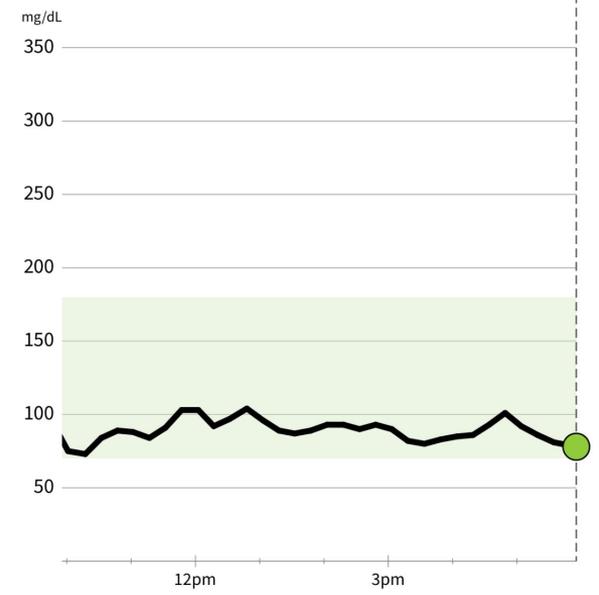


ADD NOTE

Alarms Unavailable

GLUCOSE IN RANGE 5:55 PM

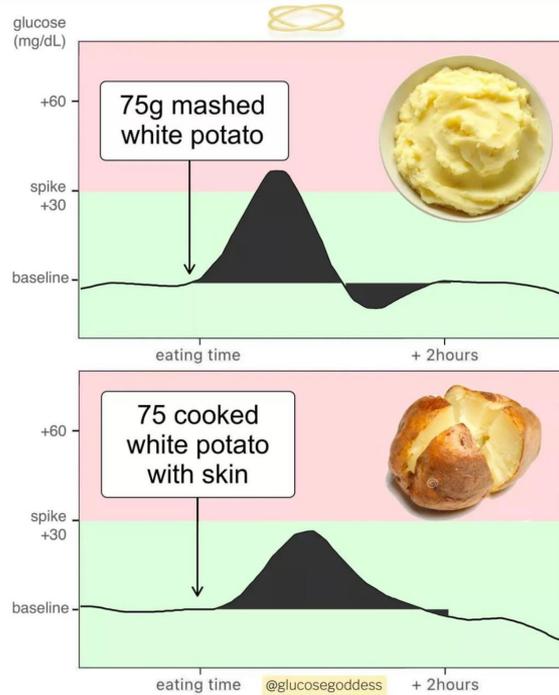
78 →  
mg/dL



ADD NOTE

Suggested Posts

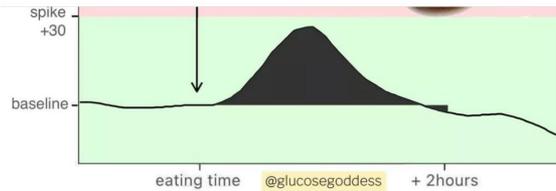
Older Posts



9,482 likes



## Suggested Posts

[Older Posts](#)

9,482 likes

**glucosegoddess** 🍌 The best way to eat potatoes for our glucose levels, is with the skin on! The skin is the original « clothing »! The skin contains fiber, and fiber slows down the absorption of glucose into the blood.

🍏 This idea of eating the skin applies to all fruits and vegetables – if you can, keep it on.

Also, if you put some clothes on your potatoes, you're all set!

👉 Slide for details!

--

¡La mejor manera de comer patatas para mantener estables nuestros niveles de glucosa es con la piel! La piel contiene fibra y la fibra ralentiza la absorción de glucosa en la sangre.

🍏 Este concepto de comerse la piel se aplica también a todas las frutas y verduras: si puedes, cómete la piel.

Y si además le pones algo de ropa a tus patatas, ya lo



# Resources

Glucose Goddess

Others: Mark Hyman, Chris Kresser, Dr. Terry Wahl's

Caution with "diabetic" sites, some dieticians



# How food affects my body

Every food that you ingest has a [“glycemic index”](#) which is a ranking system of how food affects your blood glucose. With Theia, you will be able to clearly see the glycemic response of any food you eat.

More specifically you will be able to understand complexity around glycemic responses in the following ways:

Food combos - the types of foods consumed together vs. by themselves can cause glucose to change differently.

Time variables - there is data that shows the same meal eaten in the morning vs. at night could yield a drastically different glucose response.

Carb types - the same carb content in one type of food vs. another could generate vastly different glycemic responses.

Personal differences - you and a friend could eat the same exact meal and the glucose responses could be polar opposites.

Lifestyle choices - if you sleep 4 hours/night vs. 8 hours/night you will experience much different glycemic responses.

# Increase my energy

Although there is no conclusive literature that shows an impact between glucose levels and energy in healthy non-diabetic individuals, there is lots of data that shows otherwise in type 1 & type 2 diabetics.

Your brain's primary energy mechanism is glucose and major glucose dysregulation (type 1&2 diabetes) is linked to [fatigue, reduced alertness and low energy levels](#).

The occurrence of fatigue and low energy in type 1&2 diabetes always revolves around spikes or dips in their glucose levels.

Tiredness from high blood sugar levels: when glucose levels are high, our body produces insulin to transport that glucose from our blood into our cells which they use as energy. If it takes the extra time to get rid of excess glucose, there is reason to believe you could feel tired (hence the “post meal slump”)

Tiredness from too low blood sugar levels: when glucose levels fall too low, our bodies don't have enough energy to fuel our cells. Thus, in this instance you could feel more lethargic or sluggish.

Either way there are signs that show normalizing your glucose levels has grounds to improve energy levels.

# Lose unwanted weight

The most common weight loss advice is to count calories and get into a [deficit in order to lose weight](#).

There are large amounts of [studies](#) that prove this strategy to be effective, however it does miss the role of hormones and their contribution to effective weight loss.

The primary hormone that is involved in weight gain and fat storage is insulin. Insulin tells your cells to use glucose from the blood and if there is excess, it's stored as fat.

Blood glucose is highly correlated to insulin levels - thus, if blood glucose is high then insulin is high, which is triggering our bodies to store fat, not burn it.

We need to get our bodies into a controlled insulin state so that it can trigger the body to burn fat.

In summary: if insulin is constantly high, the body never gets triggered to burn fat.

# Improve mental clarity and focus

There is good clinical research backing the connection between mental clarity/focus and glucose levels. In one [specific study](#) non-diabetic women with higher fasting and post-meal glucose showed a decreased performance on memory tests. Men in this study did not.

In a second [study](#) however, a group of non-diabetic participants were all given a glucose tolerance test (essentially the test was to ingest a high amount of glucose). The test categorized the respondents into “better, average & worse” glucose regulators. The group categorized as “worse glucose regulators” had the highest post glucose consumption peaks and were the slowest to stabilize them. This group performed the poorest on a number of verbal memory tests given to them.

If you can avoid spikes up or down in glucose then the data suggests that it's reasonable to assume you would experience better focus and mental clarity overall. We would stipulate that this is especially true after meals at the very least.

# Improve exercise performance

We have found one area of athletic performance that glucose monitoring can help optimize: high intensity aerobic exercise.

The body burns either glucose or fat when exercising. The source it uses depends on the intensity of the exercise and in general people use fat when endurance training with a [VO2max](#) below 60%. Alternatively most people use glucose when training with a VO2max of above 80% is reached.

There is something called the "bonk" which is when athletes experience complete depletion of their glucose stores while training and get hit with a massive amount of fatigue and exhaustion (hypoglycemic state).

Glucose monitoring in this type of training can help time when to ingest more carbs to refuel the glucose levels - prior to burnout. This was merely a guess before.

Outside of this use case, we have not found or gathered enough data to support glucose monitoring improving exercise performance yet.

On the spectrum of using exercise to improve health, we did want to call out a few things:

Timing your exercise in order to stabilize glucose levels could add to your health long term (refer to the optimal glucose levels section for more details)

Having a glucose monitor may increase the amount of exercise you do - acting as an accountability and measurement tool

# Extend life

There is no direct clinical data that shows extension of life by monitoring and optimizing glucose. There are in theory, many ways that would suggest it could have an impact.

The primary potential longevity extending factor is the clinical data that has shown a significant % reduction of disease (as outlined in our optimal glucose level guide). This of course doesn't guarantee greater longevity, it merely shows that you reduce variables that can impede longevity - primarily metabolically related diseases.

Other factors that can be considered as variable mitigating to extend longevity:

Reducing cellular dysfunction - cellular dysfunction occurs when excess glucose in the body starts sticking to proteins, fats and our DNA. This process is called [glycation](#) which can prevent proteins from functioning correctly in the body. The impairment of any bodily function in theory could have some effect on aging.

DNA damage - free radical molecules attack essential macromolecules in our body including DNA. These assaults cause [damage](#) which is a process called oxidation. Chronically high glucose levels [generate more oxidative stress](#) in our bodies. Higher amounts of free radicals have been linked to numerous diseases. Reducing free radicals potentially has some longevity benefits - merely by reducing the % of getting disease.

Energy processing disruption - Mitochondria is the energy source of all cells. Mitochondrial dysfunction appears in many diseases of aging and hyperglycemic states accelerate these changes. Less energy dysfunction could have some effect on aging given that you are reducing the % chance of getting a disease.

Inflammation - one of the bodies lead defensive mechanisms. Short term inflammation is great - think when you sprain a wrist and inflammation kicks in to heal it. Issues arise when there is a constant state of inflammation - it has the ability to permanently damage cells. Constant inflammatory states increase the risk of diseases like cancer, diabetes and heart attacks. Avoiding disease and heart attacks theoretically could show impact on longevity.

Altering Gene Function - There is a gene that responds to changes in blood sugar: (hTERT) which helps protect DNA integrity when cells are divided. There have been studies that show [reducing glucose](#) activates the hTERT gene in just four. Keeping cell integrity intact could have some longevity benefits to it.

Impairment of blood vessels - consistent insulin resistance and blood pressure [cause damage to blood vessel walls](#). The damage comes in the forms of the secretion of inflammatory and clotting chemicals. There is also [science](#) that shows excess insulin can lead to arteries to harden. All of these complications have the potential to cause disease/health issues which if avoided could help impact longevity.



## The Severity On Health

Prediabetes [puts people at risk of developing](#) Type 2 diabetes, heart disease and stroke. It's a serious health condition.

[Other associations](#) with prediabetes show early forms of:

nephropathy

chronic kidney disease

small fibre neuropathy

diabetic retinopathy

increased risk of macrovascular disease

[3.5% to 10%](#) of prediabetics develop diabetes every year.

Current demographics

Health ramifications of metabolic disease - early and late

High BS, low BS, mixed

Interventions

Resources: Drop acid, hyman, AI - Wahl's, membership

# What now?

1. Keto
2. Detox → food plan
3. Trial
4. Nothing
5. Small goals, accountability partner, learn on own
6. Monitor
  - a. Ketomojo
  - b. Reli-on
  - c. CGM

