

Sweet Tech: Navigating Diabetes with Nutrition and Innovation

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Disclosures

We have no financial relationships with pharmaceutical companies, biomedical device manufacturers or distributors, or others whose products or services may be considered related to the subject matter of the educational activity.



Objectives

1. Demonstrate how to integrate nutrition and technology into daily diabetes management.
2. Examine the impact of technological advancements on diabetes outcomes.
3. Identify challenges and considerations for use of GLP-1 agonists on weight loss, nutrition, and diabetes management.

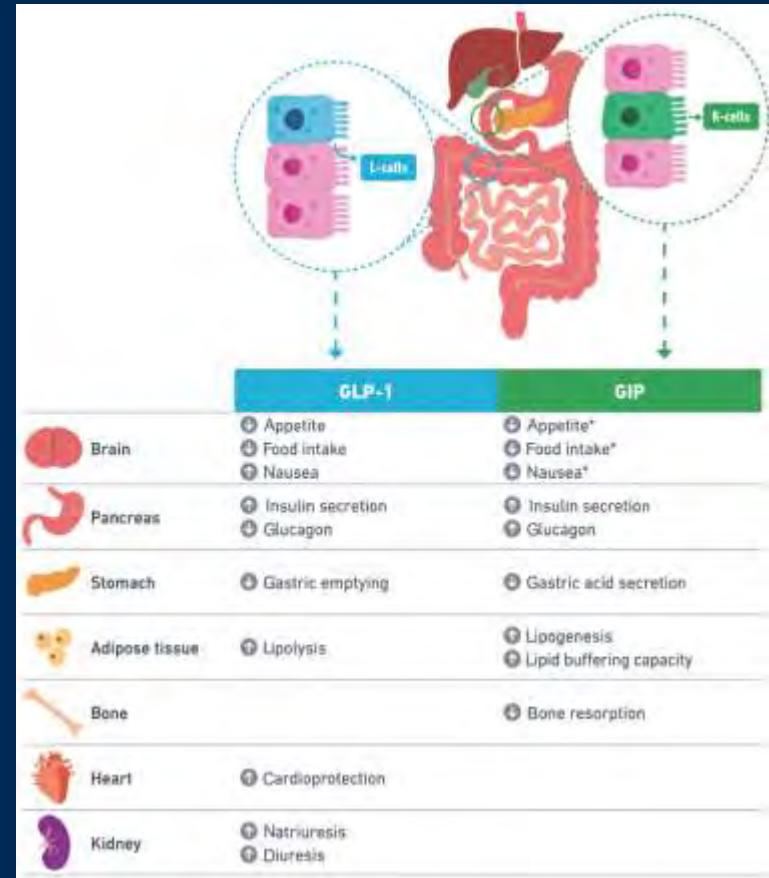


Case Study # 1

GLP-1 & GIP Management and Considerations

GLP-1 & GIP₆

- Incretin hormones
- T2DM patient selection:
 - A1C above goal
 - Presence of ASCVD
 - Weight loss
 - CKD
- Contraindications:
 - T1DM
 - Hx of pancreatitis
 - Medullary thyroid cancer or multiple endocrine neoplasia
 - Gastroparesis



Patient - RH

- 62 y/o female
- Roux-en-y 2013 / Reversal 2018 (malnutrition & gastric ulcers)
- No DM medications between 2013-2020
- Dec 2020-Sep 2023 on/off GLP-1 (Trulicity & Ozempic)
 - Unintentional weight loss
 - Poor appetite
 - GI discomfort
- Sep 2023 – Started Mounjaro 2.5 mg
 - Patient-driven
 - No titration of dose
 - Stopped 12/2023
 - Re-started 1 month later

Other DM Medications:

- Lantus
- Jardiance
- Tradjenta/Humalog (refused)

GLUCOSE STATISTICS AND TARGETS

August 19, 2023 - September 1, 2023 14 Days

Time CGM Active: 81%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose 159 mg/dL

Glucose Management Indicator (GMI) 7.1%

Glucose Variability 31.1%

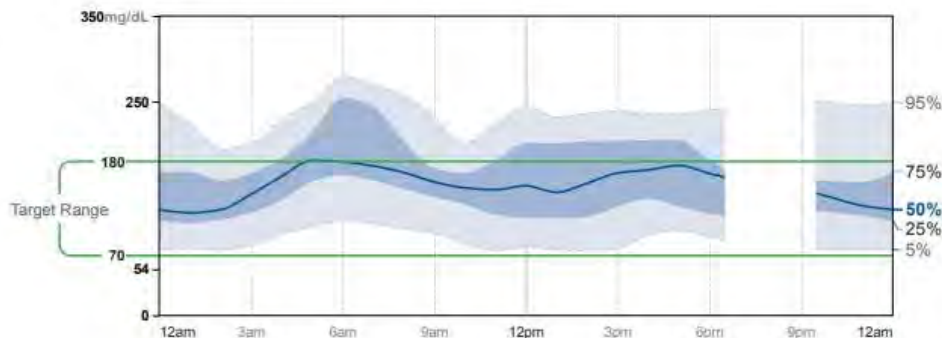
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



Pre-Mounjaro

Medications:

- Lantus 12 units
- Jardiance 10 mg
- Tradjenta 5 mg (refused)
- Humalog SS (refused)

Diet:

- B- eggs + sausage sandwich
- L- Skip
- D- Meatloaf + potatoes w/gravy + green beans
- S- chips, nuts, cinnamon bears, cheese toast



GLUCOSE STATISTICS AND TARGETS

November 4, 2023 - November 17, 2023

14 Days

Time CGM Active:

81%

Ranges And Targets For Type 1 or Type 2 Diabetes

Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 48min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial

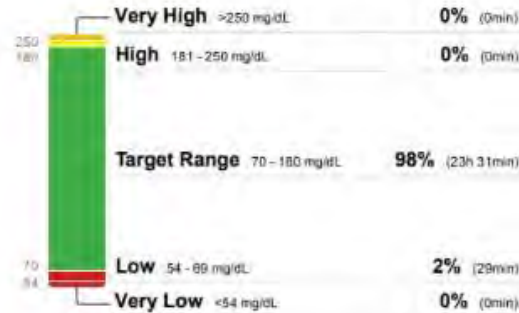
Average Glucose 101 mg/dL

Glucose Management Indicator (GMI) 5.7%

Glucose Variability 23.3%

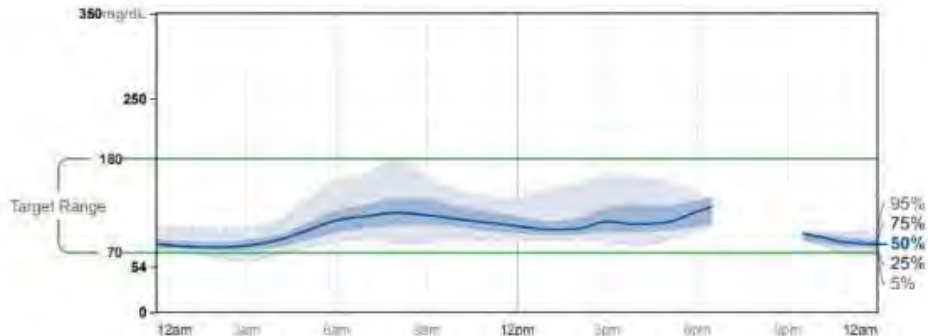
Defined as percent coefficient of variation (%CV); target $\leq 36\%$

TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%), and other percentiles shown as follows (mg/dL & cmg/dL):



2 months of Mounjaro

Medications:

- Mounjaro 2.5 mg weekly
- Jardiance 10 mg
- Lantus 5 units
 - Stopped 11/17/2023

Diet:

- B- Skip + green tea OR eggs + sausage + tea
- L- Skip
- D- 1-2 air fried chicken wings
- S- Limited; PB crackers, chips, nuts



Patient Concerns – Nov 2023

- Appetite became an issue
 - $\leq 75\%$ of estimated needs
- ~20% weight loss in 1 year
- Moderate Malnutrition₁₃
- Intervention:
 - ≥ 2 meals per day (w/protein source) + 2 protein supplements (unflavored protein powder – 18 gm/serving)
 - Goal ~60-65 gm protein per day (1.0-1.2 gm/kg)
 - Nutrient-dense snacks
 - Weight maintenance



GLP-1 / GIP Considerations

1. Decreased appetite → Calorie restriction → Malnutrition?
2. Lean Muscle maintenance
3. GI side effects
 - Nausea, vomiting, reflux, constipation, diarrhea





Decreased Appetite

- Small, frequent eating
 - 5-6 small meals
 - Eat every 2-3 hours
- Liquid between vs at meals
- Lack of hunger cues?
 - Set alarms
 - Bright sticky notes
 - Set foods out where visible (on counter / front of fridge)
- Nutrient-dense foods
 - Protein first (lean, fish, eggs)
 - Cottage cheese or Greek yogurt + fruit
 - Veggies + hummus
 - Apple + nut butter
 - Tuna/chicken salad + crackers
 - Eggs (hard boiled or scramble w/veggies)
 - Cheese + nuts
 - Protein shake



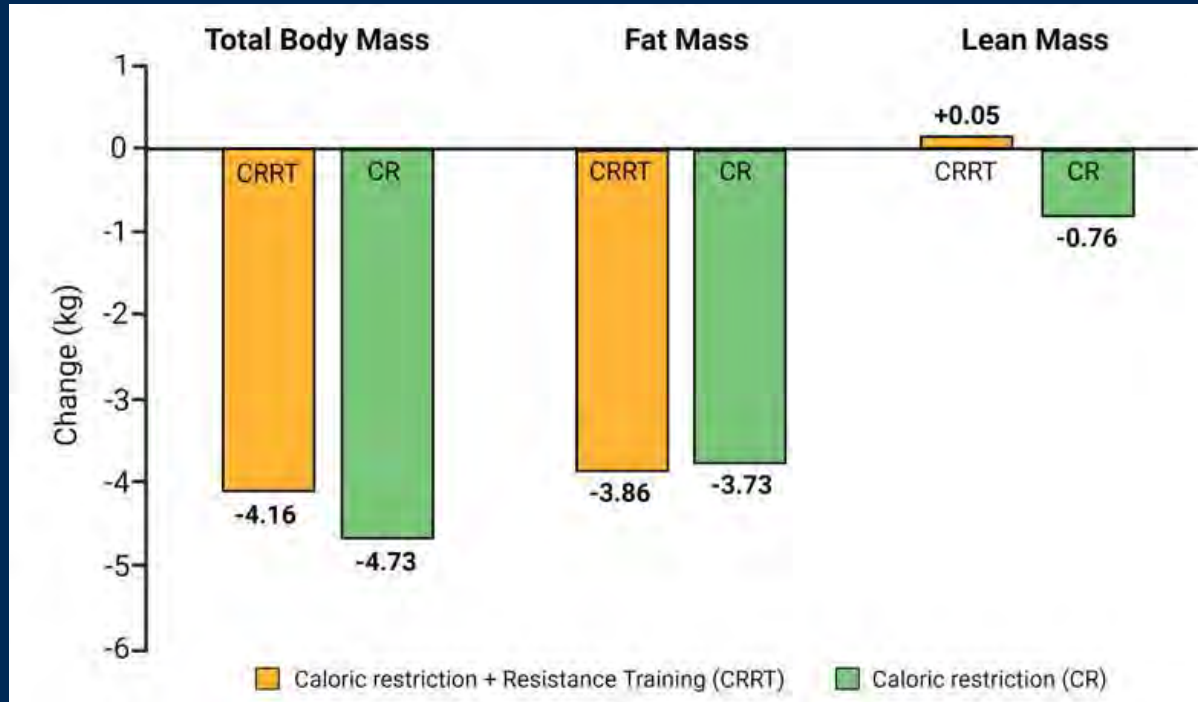
Maintenance of Lean Mass_{4,10}



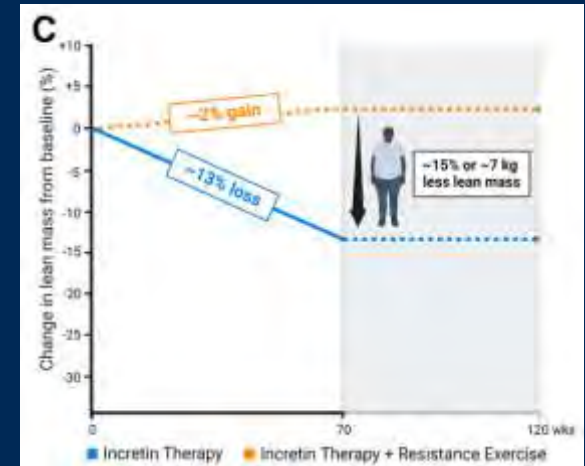
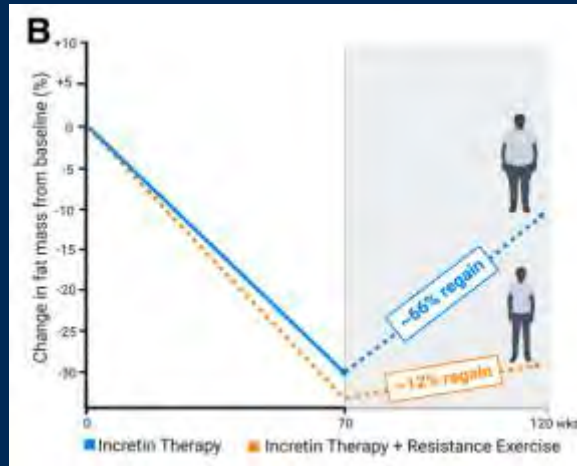
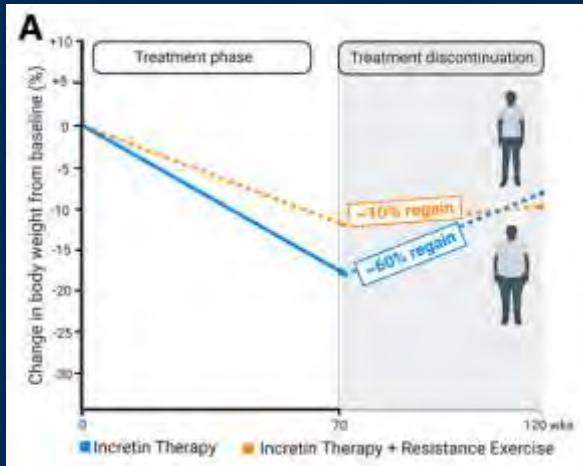
- Loss of fat & lean mass
- Why do we care?
 - Decrease functional capacity
 - Decrease resting energy expenditure -> **weight regain**
 - Decrease bone strength
 - Decrease metabolic health
- Protein
 - 0.8-1.5 gm/kg per day
 - Lean sources
 - Protein supplements
- Resistance exercise
 - Increase % fat loss
 - Decrease % lean mass loss



Effects of Calorie Restriction Alone vs Calorie Restriction + Resistance Training₁₀



Discontinuation of Treatment - Hypothesis₁₀



GLUCOSE STATISTICS AND TARGETS

January 5, 2024 - January 18, 2024

14 Days

Time CGM Active:

81%

Ranges And Targets For

Type 1 or Type 2 Diabetes

Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 70-180 mg/dL	Greater than 70% (16h 45min)
Below 70 mg/dL	Less than 4% (58min)
Below 54 mg/dL	Less than 1% (14min)
Above 180 mg/dL	Less than 25% (6h)
Above 250 mg/dL	Less than 5% (1h 12min)

Each 5% increase in time in range (70-180 mg/dL) is clinically beneficial.

Average Glucose **103 mg/dL**

Glucose Management Indicator (GMI) **5.8%**

Glucose Variability **27.0%**

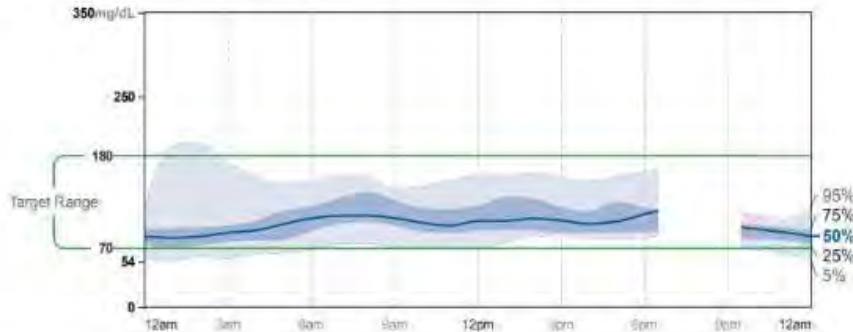
Defined as percent coefficient of variation (%CV); target 53%

TIME IN RANGES



AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



- Stopped December 2023
 - Malnutrition concerns
 - Poor energy
 - Suspected nutrient deficiency

1 month w/o Mounjaro

- Medications:
 - Jardiance only



Managing GI Side Effects₉

- Small portions
- Stop eating when satisfied (cut portions in ½)
- Choose low fat foods (avoid greasy)
- Avoid simple carbohydrates/sugary foods
- Avoid spicy foods
- Limit acidic foods/sauces (tomato sauce)
- Limit carbonation
- Avoid alcohol
- Gradually increase fiber (hydration)



Case Study #2

Diabetes Management during Pregnancy

Pregnancy be like:



Patient - SK

- 35 y/o female with Type 1 Diabetes since the age of 13
 - H/o miscarriages and hormone level imbalances
 - Body image concerns as worried about gaining weight and maintaining figure
- Hemoglobin A1Cs' consistently in the 8.2-9.0 range
 - Currently on injections, had been on insulin pump years ago
 - Terrified of low BS readings
- Notified on 10/30/23 of positive pregnancy test
 - Met with provider and diabetes educator on 11/9/2023



Diabetes and Pregnancy₃

- Had actively been trying to get pregnant and maintain the pregnancy for past few years.
 - Met with Reproductive Endocrinologist and other specialists
 - Declined to meet with diabetes education for preconception planning.

Pre-Conception Considerations:

- Healthy weight Healthy diet
- Active lifestyle
- Blood glucose control (goal A1C <6.5% pre-conception, goal of <6.0% during pregnancy)



CGM reports at appt on 11/9/23

- **Medications:** Tresiba 26 units. Novolog 1u:12-13 grams for meals and 1u:15g for HS snack. SS:1u:50>120 and at HS >200.
- **Insulin Dose Changes:**
- Tresiba 28 units. Novolog 1u:11grams at meals.
- **Interventions:**
- Referral for Treat to stability program with first appt in 2 weeks per request of patient.
- Aware of BS targets during pregnancy
- Introduce idea of pump therapy



Two Weeks Later:

- Treats lows when BS <90
- Big concerns on upcoming weight gain
- Takes < insulin at meals due to fear of lows.
- BS are then high and overtreats with her sliding scale.-Refused changes
- Education provided on what to expect during the remainder of her pregnancy.
- Pump readiness completed.



1 month post pump start:

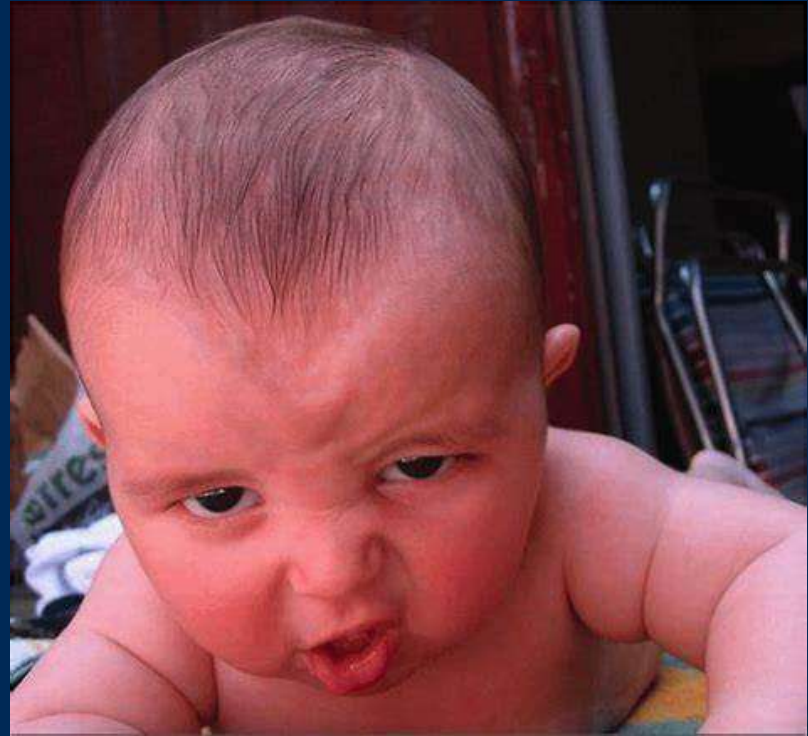


- Currently 16.5 weeks pregnant
- Improvements in BS control
- **Interventions:**
- Appts every 1-2 weeks with CDCES/provider.
- BS review and continuing education.
- Fasting BS not at target, manual mode at night.
- Continue to work with the patient to meet her comfort level but also optimize BS control



Post-Delivery:

- Delivered at 37 weeks
- A1C at time of delivery was 5.9-6.
- Baby was 8 lbs and healthy.-No NICU visits.
- Had to work with the patient and meet her on her level.
- Patient is enjoying motherhood and continues to work on optimizing BS control



Importance of Nutrition

- Handle extra demands on mom
 - Hormonal changes
 - Support growth of tissues, including fat mass, breast tissue, placenta and uterus
- Support the growth and development of the baby
- **Goal:** Consume a healthy, well-balanced diet of protein, fruit, vegetables, healthy fats, and whole grains



Weight Gain_{5,15}

- Joslin Diabetes Center calorie estimates:
 - Underweight: 30 kcal/kg first trimester; 36-40 kcal/kg second/third trimester
 - Normal: 30 kcal/kg first trimester; 36 kcal/kg second trimester; 36-38 kcal/kg third trimester
 - Overweight/Obese: 24 kcal/kg throughout pregnancy

Pre-Pregnancy BMI	Rate of gain in 2nd & 3rd trimester (lb/week)	Total gain for single (lbs)	Total gain for twins (lbs)
< 18.5	1.0-1.3	28-40	50-62
18.5-24.9	0.8-1.0	25-35	37-54
25-29.9	0.5-0.7	15-25	31-50
>= 30	0.4-0.6	11-20	25-42

Macronutrient Needs^{8,11,12}

- **Protein** --> Baby's growth (muscle, tissue, hormones, etc.)
 - 10-35% of total calories
 - Increased to 1.1 grams/kg --> RDA = 71 grams per day
 - Choose lean sources
- **Fat** --> Energy and helps build the placenta and fetal organs
 - 20-35% of total calories
 - Choose healthy fats --> Omega-3 (brain/eye development)
 - 8-12 oz seafood per week (low mercury options)
- **Carbohydrates** --> Energy and glucose for the brain
 - 45-65% of total calories
 - RDA = 175 grams per day
 - ~28 grams fiber recommended



Micronutrients_{8,11,12}

- **Prenatal vitamin**
 - Check ingredient list – gummies may not contain iron
- **Folate / Folic Acid**
 - Prevent neural tube defects
 - Pre-conception: 400 mcg per day
 - Pregnancy: 600-1000 mcg per day
- **Iron**
 - Increased blood volume to supply oxygen to the baby
 - 27 mg per day
- **Calcium / Vitamin D**
 - Strong bone and teeth development
 - Calcium: 1000 mg per day (adults) / 1300 mg per day (\leq 18 years)
 - Vitamin D: 600 IU per day
- **Iodine**
 - Essential for fetal brain development
 - 220 mcg per day (pregnant) / 290 mcg per day (breast feeding)



Diabetes Specifics

- Primary nutrient of concern = **Carbohydrates**
- **Goal:** Achieve appropriate glycemic control, prevent ketosis, and provide adequate nutrition for mother and fetal development.
 - Increased insulin resistance with increased gestational age
- Complications of poor glycemic control:
 - **Mom:** pre-eclampsia, complicated delivery (c-section)
 - **Baby:** large baby, complicated delivery (c-section, shoulder displacement), pre-term delivery (breathing issues), low blood sugars



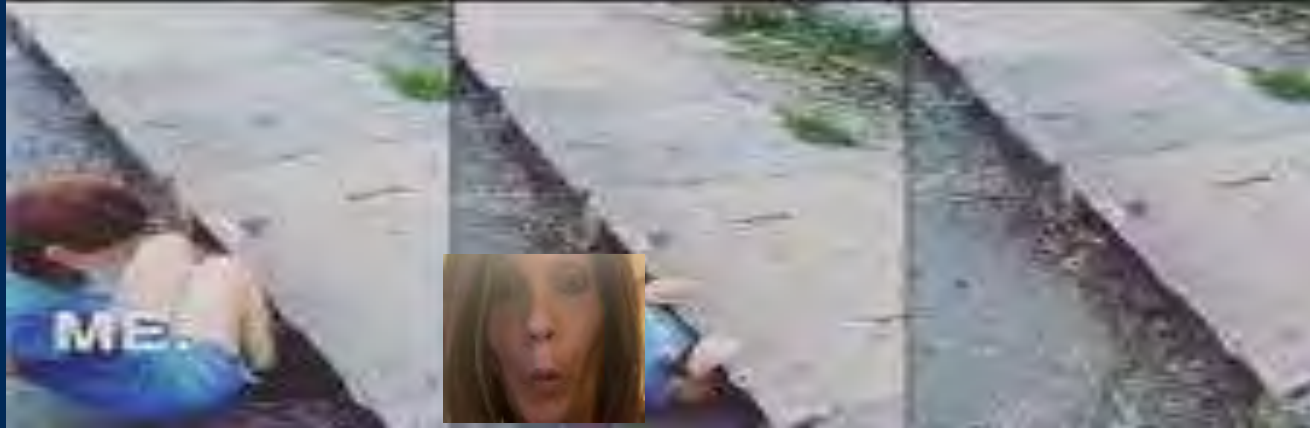
Carbohydrate Distribution

- Carbohydrate Starting Line:
 - Breakfast: 30-45 grams --> Insulin resistance greatest in the morning
 - Lunch: 45-60 grams
 - Dinner: 45-60 grams
 - Snacks: 15-30 grams --> may not be needed
 - **INDIVIDUALIZED**
- **KEY** – When eating carbohydrates, pair with a protein or healthy fat source to better manage blood sugar trends



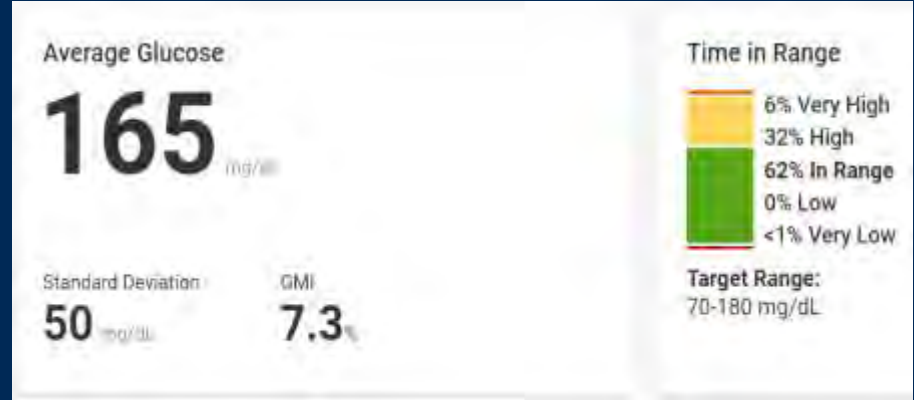
Case Study #3

New Tech → New Carb Management

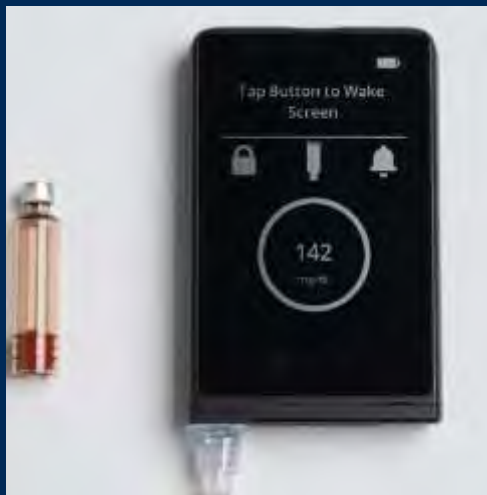


Patient - DO

- 25 y/o male. Diagnosed with type 1 diabetes at 15 years old.
- Medical: hereditary multiple exostosis, autism, ADD/ADHD.
- Complex family history-Lives with grandmother
- Suppose to take 4-5 shots per day, noncompliance
- Unable to proceed with pump due to complexity and carb counting
- Inpen-3/29/21-able to track the missing insulin shots and how much patient was injecting with meals and snacks.
- Fluctating BS with A1C ranges from 6.8-8.0.



iLet Beta Bionic



- The system learns you after the first 48 hours
- You **HAVE** to wear with a CGM – Dexcom G6 or Dexcom G7
- You have to announce your meals (breakfast, lunch, dinner – there are currently no options for snacks)
 - Usual for you
 - Less
 - More

• Modifiable settings with AUTOMATION

- CGM target
 - Lower (110 mg/dL)
 - Usual (120 mg/dL)
 - Higher (130 mg/dL)



No more:

- Carb Counting*
- Carb Ratios
- Correction Factors
- Pre-set Basal Rates

or any of the other settings that might be overwhelming about other Insulin delivery devices.

The iLet needs only one number - your weight.

*User must be carb aware

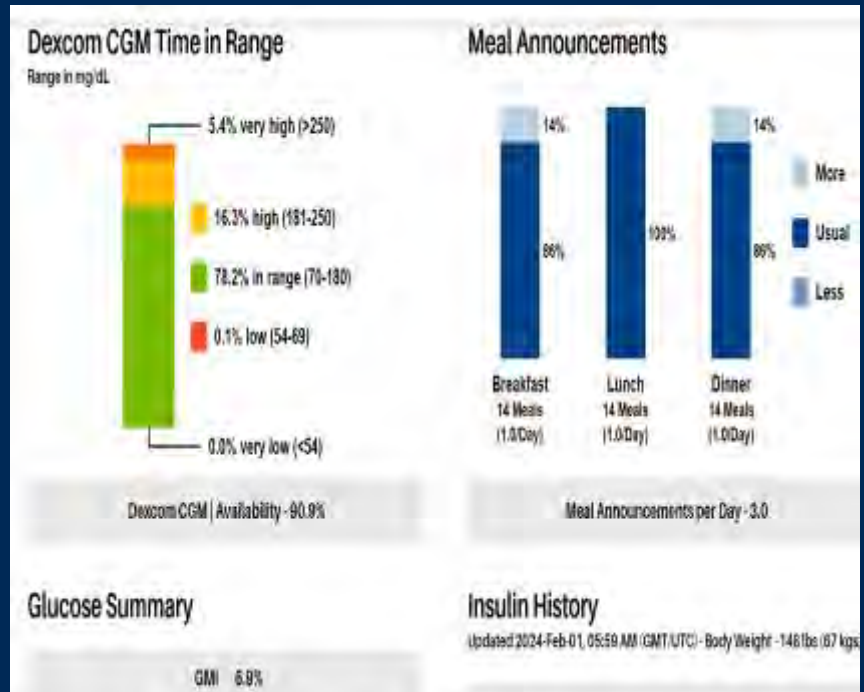


Pump Training:

- Initial training was on a Tuesday afternoon for 3 hours.
- Parents, grandmother and uncle were available to observe and go thru the training.
- Touchpoints daily via onechart and/or phone for 2 weeks.
- Came back 2 days later for first site change and review of pump data.
- In person visit weekly for the next 3 weeks to review more advance features of the pump-more or less for meal announcements. Monthly touch points.






Post Pump: 2 weeks and 1 month



Meal Announcements

- Carb awareness education vs Carb counting
- Most closed-loop systems require an insulin to carb ratio. (Concerns on fix doses)
- Benefits of Ilet: Snacks

Carb Amount	Example
"Usual for me" Carb Amount	 This is the usual amount of carbs you would typically eat for that meal.
"More" Carb Amount	  This is around 50% more carbs than your "Usual for me" meal (1.5 times as many carbs as your "Usual for me" meal).
"Less" Carb Amount	 This is about half as many carbs as your "Usual for me" meal (50% of your "Usual for me" meal)
DO NOT ANNOUNCE	 If the meal or snack you are eating has less than one quarter (25%) of the carbs in your "Usual for me" meal, you do not need to announce.



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QUESTIONS?

