Pediatric Nutrition Therapy for Diabetes Management

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Conflicts to disclose:

- I currently receive reimbursement from Dexcom (continuous glucose monitor company) for my time starting adult patients on the monitor.

- I personally developed this slide deck strictly for educational purposes and audiences.

  - It is without bias, branding or commercial influence and is evidence-based.

  - I will make no recommendations for off-label use of any drug, nutritional product or medical device.

Objectives
Participants will be able to:

- Understand the importance of screening for eating disorders related to diabetes.
- Describe the relationship between insulin and carbohydrate, fat and protein in the diet.

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Eating Disorders & Diabetes

▶ The misuse of insulin (usually omission) in such a manner to achieve weight loss.

   ▶ Form of purging or decreased food intake

▶ Who is at risk?

   ▶ 30%-40% of females with type 1 diabetes

   ▶ Females with T1DM are 2.5 times more likely than those without diabetes

   ▶ Prevalence increases with age

   ▶ More frequent DKA, increase risk of complications and higher mortality rate

Why the risk of eating disorders

▶ Main symptom of diabetes is weight loss.

▶ Use of insulin can lead to weight gain.

▶ Many numbers are used to manage diabetes: A1c, BG, grams of CHO, ICR, ISF, amount/frequency of exercise, weight.

▶ Restrictive diet is prescribed.

▶ Label reading is common.

▶ Shaming about food choices can take place.

▶ Psychological factors are associated with diagnosis of a long-term illness.

Warning Signs & Symptoms of Eating Disorder

- Feeling cold
- Loss of menstruation
- Thyroid dysfunction
- Low estradiol and testosterone
- Othostatic/unstable vital signs
- Poor sleep
- Weight scale anxiety
- Dieting, increased focus on food composition

- Growth delay, growth attenuation, delayed puberty
- Dry skin and/or hair loss, loss of hair
- Decline in school/work performance, social functioning, other psychosocial arenas
- Preoccupation with weight, poor body image
- Low self-esteem
- Depression or anxiety

Revised Diabetes Eating Problem Survey (DEPS-R)

- Losing weight is an important goal to me.
- When I overeat, I don't take enough insulin to cover the food.
- I avoid checking my blood sugar when I feel like it is out of range.
- I try to keep my blood sugar high so that I will lose weight.
- I try to eat to the point of spilling my ketones.
- I feel fat when I take all of my insulin.

Standards of Medical Care in Diabetes-2019

- ▶ Begin screening between 10 and 12 years of age.

- ▶ DEPS-R is recommended

- ▶ Presence of a mental health professional on the multidisciplinary team

- ▶ Psychosocial issues

  - ▶ Self-management difficulties

  - ▶ Suboptimal glycemic control

  - ▶ Reduced quality of life

  - ▶ Higher rates of acute and chronic complications

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Rapid Acting Insulin – Dosing before meals and snacks

Insulin	STARTS TO WORK IN (hours)	Peak Action (hours)	Duration of Action (hours)	MAXIMUM Duration (hours)
Rapid-Acting				
Lispro (Humalog)	15 TO 30 MINUTES	1 to 2 HOURS	3 to 6 HOURS	4 to 6 HOURS
Aspart (Novolog)	15 TO 30 MINUTES	1 to 2 HOURS	3 to 6 HOURS	4 to 6 HOURS
Glulisine (Apidra)	15 TO 30 MINUTES	1 to 2 HOURS	3 to 6 HOURS	4 to 6 HOURS

Estimation vs. Precision

Estimation	Measurement
2 slices Multigrain Bread = 30g	2 slices Multigrain Bread = 34g
Peanut Butter = 7g	2 Tbsp. Peanut Butter = 7g
All Fruit Jelly = 10g	1.5 tsp All Fruit Jelly = 15g
1 Apple = 15g	1 Apple (5.5 oz.) = 17g
Big Glass of 1% Milk = 13 g	Glass of 1% Milk (12 oz.)= 19.5g
TOTAL = 75 g	TOTAL = 92.5 g
Insulin: CHO = 1:10	Insulin: CHO = 1:10
7.5 units of insulin	9 units of insulin
Blood Glucose = TOO HIGH!	

Insulin to Carbohydrate Ratio (ICR) of 1:35
1 unit of insulin for every 35 grams of carbohydrate consumed

Sandwich (2 slices bread, deli meat, mustard)	44 grams
1 c. broccoli (raw)	8 grams
1 c. cubed honeydew melon	15 grams
Infused water to drink	0 grams

Total grams of carbohydrate *67 grams*

$$\frac{\text{Total grams of carbohydrate}}{\text{Insulin to carbohydrate ratio}} = \text{Units of Insulin to be dosed}$$

$$\frac{67 \text{ grams of carbohydrate}}{35 \text{ }_{ICR}} = 1.97 \text{ or } 2 \text{ Units of Insulin}$$

Impact of fat on blood glucose

- High fat meals can greatly increase blood glucose concentrations.
  - Insulin resistance
  - Delayed gastric emptying
- Increased need for more insulin.

Impact of fat on blood glucose

- Calculate dose:
  - Count grams of carbohydrate for meal
  - Use ICR to calculate dose
  - Consider adding 30% *cautiously*

Impact of fat on blood glucose

▶ Dosing by injection (MDI):

  ▶ Administer calculated dose before meal

  ▶ Administer additional dose (30%) 1 hour after meal.

Start of meal:

$$\frac{47 \text{ grams of carbohydrate}}{9 \text{ }_{ICR}} = \text{5.2 units of insulin}$$

1 hour after meal: + 30% more = 1.56 units of additional insulin

Impact of fat on blood glucose
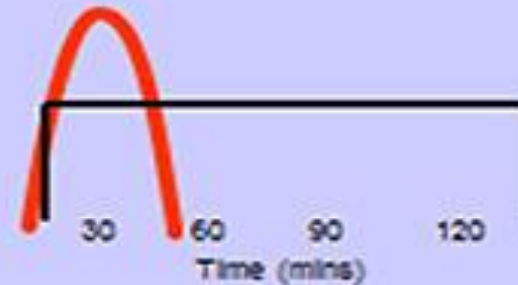

Dual Wave Bolus

Normal Bolus
Whole bolus delivered now

Square Wave Bolus
Bolus delivered over time

30   60   90   120
Time (mins)

⭐ **Dual Wave** (normal + square)
Percentage of bolus now and percentage over time duration

30   60   90   120
Time (mins)

Impact of fat on blood glucose

- Dosing by insulin pump:
  - Consider using a "dual wave" bolus feature by:
    - delivering 50% of the bolus before the meal
    - then the remaining 50% extended over 2-3 hours time
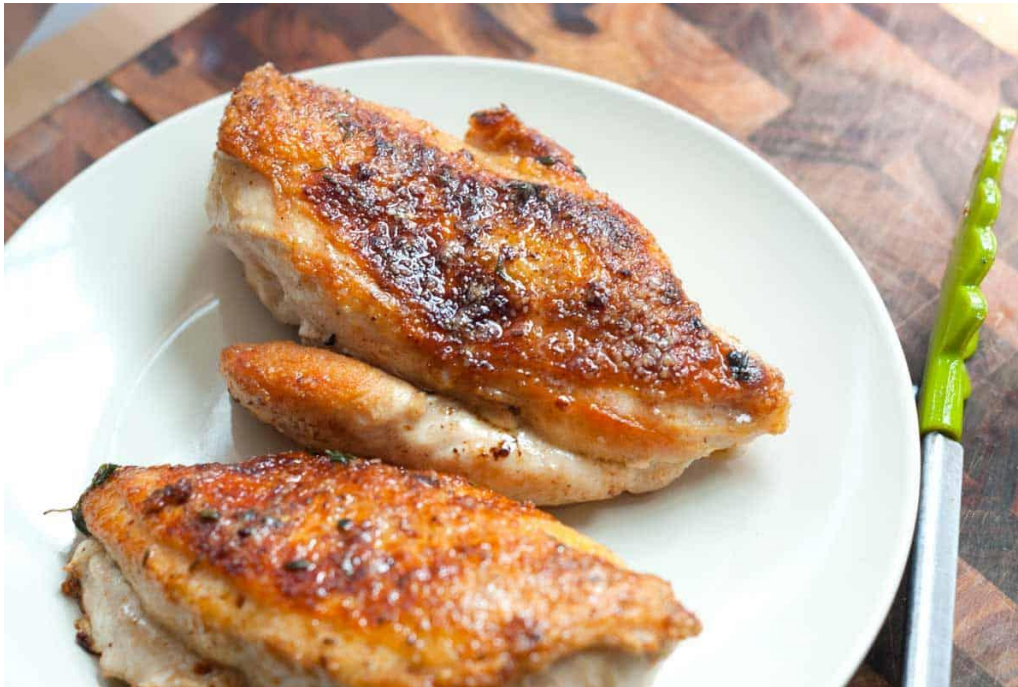
Impact of fat on blood glucose

- Be aware:
  - Monitor glucose levels up to 5 hours after meal and adjust as indicated
    - More than 3 hours post-meal hypoglycemia, increase duration of time of bolus
    - Less than 2 hours post-meal hypoglycemia, reduce amount given upfront in "dual wave"

Impact of protein on blood glucose

▶ Carbohydrates were consistent at 30 grams

▶ Low-fat (3 grams or less)

▶ Protein in drink was 12.5 grams to 75 grams

▶ Conclusion:

  ▶ Decreased glucose excursions 0-60 minutes postprandial.

  ▶ Increased blood glucose levels 2 to 5 hours postprandial.

Impact of protein on blood glucose

▶ High-protein (75 g), low-fat (3g or less) and low to moderate carbohydrate containing meal

Impact of protein on blood glucose

- For pump users and dosing by injection:
  - Deliver the dose at the beginning of the meal.
- Be aware:
  - Hypoglycemia occurring within first 60 minutes of high-protein, low to moderate carbohydrate meal.
  - Delayed hyperglycemia.

Impact of fat & protein on blood glucose
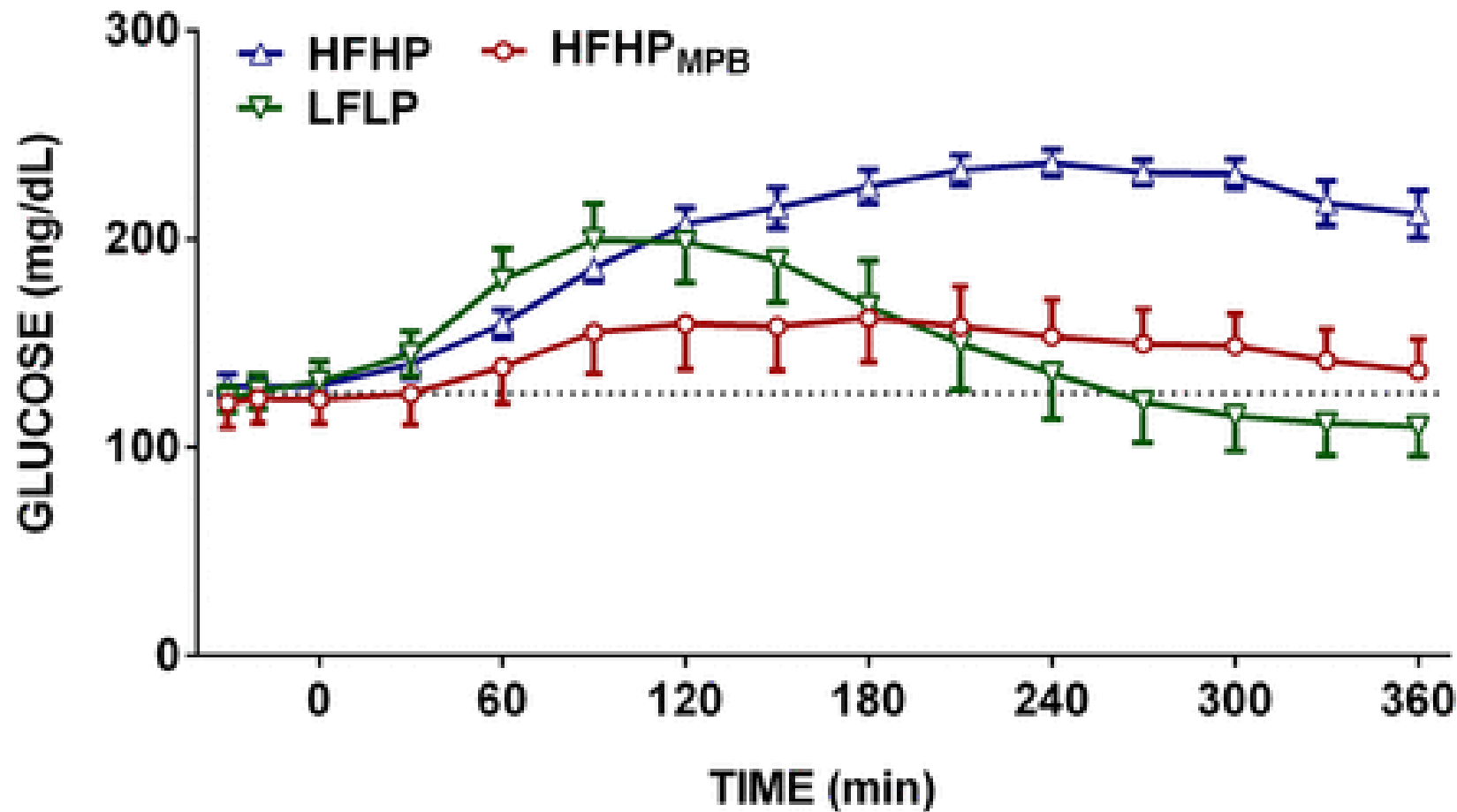
Bell KJ, Toschi E, Steil GM, Wolpert, HA. Optimized Mealtime Insulin Dosing for Fat and Protein in Type 1 Diabetes: Application of a Model-Based Approach to Derive Insulin Doses for Open-Loop Diabetes Management. *Diabetes Care*, 2016; 39 (9) 1631-1634.

Impact of fat & protein on blood glucose

- What was concluded:
  - Excursions can last 3 to 5 hours or more
  - Despite particular algorithms used plus carbohydrate counting, hyperglycemia still occurred.
  - Individualization is important

Impact of fat & protein on blood glucose

▶ High fat (>40 grams), high protein (>25 grams)

Impact of fat & protein on blood glucose

- Count grams of carbohydrate for meal
- Use ICR to calculate dose
- Consider adding 15-40% *cautiously*

Impact of fat & protein on blood glucose

▶ Dosing by injection (MDI):

　▶ Administer calculated dose using ICR before meal

　▶ Administer additional dose (15-40%) 60 to 90 minutes after meal.

Start of meal:

$$\frac{71 \text{ grams of carbohydrate}}{9 \text{ ICR}} = 7.9 \text{ units of insulin}$$

1.5 hours after meal:

+ 40% more = 3.15 units of additional insulin

Impact of protein on blood glucose

https://myglu.org/articles/5-diabetes-meal-time-tips-from-medtronic
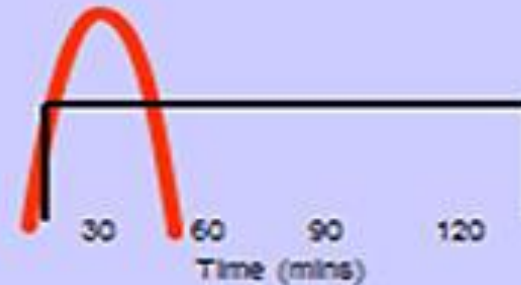
Impact of protein on blood glucose

- Dosing by insulin pump:
  - Consider using "dual wave" bolus feature by:
    - Delivering 30% of the bolus before the meal
    - Then the remaining 70% extended over 2.5 hours time
    - May need additional insulin over 2 to 5 hours

Impact of protein on blood glucose

- Be aware:
  - Monitor blood glucose to adjust per individual response
  - If resulting hyperglycemia >3 hours post-meal, then consider extending time of remaining 70%

Recommendation from the American Diabetes Association (2019):

▶ "Individualized medical nutrition therapy is recommended for children and adolescents with type 1 diabetes as an essential component of the overall treatment plan."

Team of Diabetes Educators

► Play an integral role in overall diabetes management.

► Persons with diabetes should be engaged with their healthcare team

  ► Nutrition Education

  ► Self-Management

  ► Treatment Planning

References

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Questions?

Thank you!