Fat and Protein Boluses

Leah Groppo, RD, MS, BC-ADM, CDCES

The plan

- How to bolus for
  - Fat
  - Protein
  - Mixed meals

First step

1

Get comfortable with carb counting

2

Assess if you are having prolonged high blood glucose post meal

3

Think about if your meals are higher in fat or protein

Carb counting

- **starches, fibers, added sugar, naturally occurring sugars**
  - All Grains
    - Breads, pasta, rice, tortillas, cereals
  - Starchy vegetables
    - Potatoes
    - Peas
    - Corn
    - Winter squash
  - Beans/lentils
  - Fruits
  - Dairy products
    - milk, yogurt and alternatives
  - Sugary foods
    - sweetened beverages, desserts including some sugar free foods, honey

Protein

- Amino acids are the building blocks of proteins
- Protein/fat sources like meat, fish
- Protein/carb sources like beans, lentils, quinoa, amaranth
- Amino acids can be used in the body to make glucose (it can be dose dependent or out of necessity)

Fat

- What are saturated fats
  - Animal sources
  - Dairy
  - Plant sources like coconut fat
- Unsaturated fats (poly and mono unsaturated)
  - Oils
  - Nuts and seeds

Where to find carb, fat and protein grams

- Nutrition fact labels
- Apps (myfitnesspal, fitbit, calorieking, Tidepool, Glooko, Carb Manager)
- Import recipes into apps
- Identify the foods with carbs, fats and protein and find them individually (time consuming)

What insulin dosing strategies are used for dietary fat and a combination of dietary fat and protein in type 1 diabetes?

Macronutrients

- Fat = 9 kcal per gram
- Protein = 4kcal per gram
- Carbohydrates = 4 kcal per gram
- 3 teaspoons in 1 tablespoon

Fat/Protein Unit

- FPU is defined as 100 kcal ingested from fat or protein, and it is thought to roughly approximate an insulin requirement equivalent to that of 10 g of ingested carbohydrate
- Important to extend the bolus
- Start with 2-2.5 hours
- Increase hypoglycemia

Lopez PE, Evans M, King BR, Jones TW, Bell K, McElduff P, Davis EA, Smart CE. A randomized comparison of three prandial insulin dosing algorithms for children and adolescents with Type 1 diabetes. Diabet Med. 2018 Oct;35(10):1440-1447. doi: 10.1111/dme.13703. Epub 2018 Jun 19. PMID: 29873107.

Diabetes Spectrum 2020 May; 33(2): 149-155.
https://doi.org/10.2337/ds20-0004

Protein

- 0.3 g/kg of body mass for protein only tends to not need extra insulin
- Example: 150 lb convert to kg
- Divide by 2.2
- =68 x .3 =20g

Protein Content of Foods

Meat, Poultry, Eggs:

Food (Cooked)	Serving Size	Calories	Protein (g)
Chicken, skinless	3 oz	141	28
Steak	3 oz	158	26
Turkey, roasted	3 oz	135	25
Lamb	3 oz	172	23
Pork	3 oz	122	22
Ham	3 oz	139	14
Egg, large	1 egg	71	6

Seafood:

Food (Cooked)	Serving Size (oz)	Calories	Protein (g)
Salmon	3	155	22
Tuna	3	99	22
Shrimp	3	101	20
Lobster	3	76	16
Scallops	3	75	14

Fat grams

- One fat serving is 45 calories, 5 grams of fat:
- 1 tsp oil, butter, margarine, or mayonnaise
- 1 Tbsp salad dressing or cream cheese
- 1 Tbsp reduced-fat mayonnaise or low-fat spread margarine
- 1.5 to 2 Tbsp reduced fat cream cheese or reduced-fat salad dressing
- 1 Tbsp seeds (pumpkin, sesame, sunflower)
- 16 pistachios
- 10 peanuts
- 6 almonds, cashews, or mixed nuts
- 4 pecans or walnut halves
- 2 Tbsp avocado
- 1.5 tsp natural peanut butter
- 8 to 10 olives
- 2 Tbsp half and half

Some further guidelines on when to count

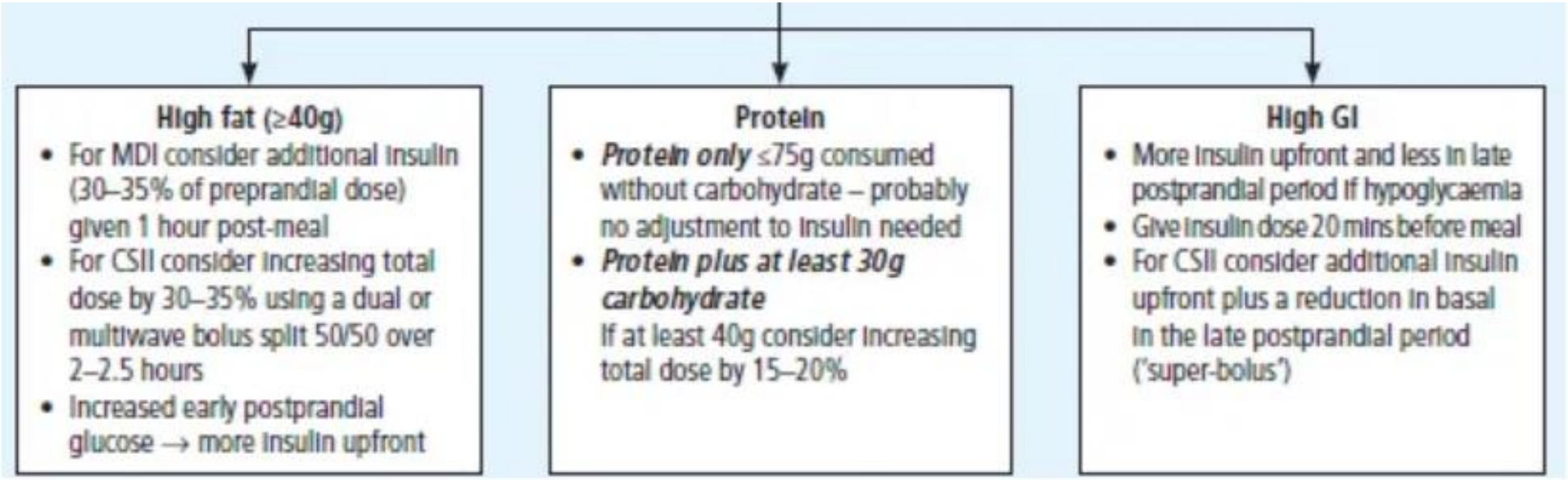

Figure 1. Nutritional intervention to improve postprandial glycaemia. (Adapted from Bell KJ, et al. Diabetes Care 2015;38:1008–15)12

Fat Protein Unit broken down

*Warsaw/Pankowska Equation
Insulin to carb ratio: 1:10
Carbs in our pizza 39g
39/10 = 3.9 units of insulin

Calories from fat and protein 395 kcal
FPU 100 kcal is 1 unit

Fat 31 x 9 = 279 kcal
Protein 29 x 4 = 116 kcal

TOTAL kcal = 395/100 kcal = 3.95 (ADDED for protein and fat) 7.85 units
Extend over 2.5-3.5 hours
My favorite way
OR 1.35 or 35% extra =52.65g OR 5.26 units

Start with 50% split but you might need more like 30-40% plus the remainder

Nutrition Facts

Serving Size: 1 slice

Amount Per Serving	
Calories 550	Calories from Fat 279
	% Daily Value*
Total Fat 31g	**48%**
Saturated Fat 14g	**70%**
Trans Fat 0g	
Cholesterol 85mg	**28%**
Sodium 1500mg	**63%**
Total Carbohydrates 39g	**13%**
Dietary Fiber 3g	**12%**
Sugars 3g	
Protein 29g	
Vitamin A	2%
Vitamin C	8%
Calcium	15%
Iron	10%

* Percent Daily Values are based on a 2000 calorie diet.

PIZZA MY HEART

Pepperoni Pizza Slice

Pizza My Heart

Why does fat affect blood glucose?

- Fat
  - Dietary fat and free fatty acids (FFAs) are known to impair insulin sensitivity
  - Enhance hepatic glucose production gluconeogenesis)
  - Delay gastric emptying
- Protein
  - Gluconeogenesis from amino acids
  - Increase glucagon secretion

Things to be aware of

- More risk for hypoglycemia in the first few hours
- Count fat if it is over 40g ideally
  - most from outside the home will meet this recommendation
- Some studies showed counting fat at 20g
- Protein plus carbs has an additive affect (2 hours)
  - 75g in isolation or you can use the .3 per kg formula
  - 12.5g of protein may have a blood glucose rising affect with carbs 30g carbs

Low carb diet

Think about your FPU or adding 30-35% on meals for higher fat and protein foods

Depending on the carbs think about not prebolusing

Think about premeal bg as well

Take home message

- Experiment to see what works for you!
- Try first at home
- Avoid trying post a busy exercise day
- Try one meal
- Identify a meal that has been causing you unexplainable high blood glucose
- Anytime you make a change it may take more thought and time
- Try making a change at dinner
  - More impact
  - Overnight blood glucose

Experiment!

- Try the different calculations
- Try different preboluses
- Try different insulin percentages
- Try different alarm ranges (maybe you are on MDI)
- Blood glucose are variable

Thank you