Insulin Dosing for Fat and Protein in Type 1 Diabetes
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Disclosure
No relevant Conflict of Interest

Carbohydrate to Insulin Ratio, circa 1935

The Current Approach:
Food Insulin Dose Calculation

\[
\text{Carbohydrate quantity} \times \frac{\text{Insulin-to-Carb ratio}}{} = \frac{\text{Insulin dose}}{}
\]

This dosing formula - which is incorporated in current insulin bolus calculators - has never been scientifically validated

Does this approach work in practice?

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\]

Assumes that accuracy in carb counting is a realistic goal for most patients

Is this a realistic goal?

Assumes that carbs are the only dietary ingredient that affects insulin requirements

Is there any scientific validity to carb-based insulin dosing?
Carbohydrate Counting (In)accuracy

Free Fatty Acids induce Insulin Resistance

Dietary Fat Delays Gastric Emptying and Glucose Absorption in T1D Adolescents

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Use of Closed Loop to Examine Effect of Dietary Fat on Glucose Control and Insulin Requirements
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Effect of Protein only - WITHOUT Carbohydrate and Fat on Glucose Concentrations

Effect of Protein WITH Carbohydrate on Glucose Concentrations

Optimized Mealtime Insulin Dosing for Protein and Fat in Type 1 Diabetes

Marked Inter-individual Differences in Fat Sensitivity

Optimized Dose for High Fat/High Protein meal:

- **DOSE:** +65 ± 10% (Range: 17 ~ 124%)
- **DURATION:** 2 ± 0.1 hr (Range: 2 ~ 3 hr)
- **SPLIT:** 30/70% (Range: 10/90% to 50/50%)

Marked inter-individual variability
Where to Start with Dosing Recommendations for Higher Fat Meals:

1. Calculate insulin dose based on CIR & Carb content of meal, then add +30%
2. Deliver over 2-3 hours
3. Distribution of bolus, dependent on Carb type
   If Pizza or Pasta (GI 50 or less): start with 30% initially
4. Consider dose reduction if exercise preceding higher fat meal, or alcohol with meal
5. RE-EVALUATE, RE-EVALUATE, RE-EVALUATE

Unanswered Questions:

- What are the predictors of inter-individual differences in fat sensitivity?
- Is there a fat threshold or dose-response effect?
- Does fat type matter?
- Does carb quantity and/or type matter?

CONCLUSION:

Need to Shift from Carb-based to Meal-centric Paradigm for Insulin Bolusing

BUT...

"Carbohydrate counting is a challenging aspect to diabetes self-management, and requiring that fat and protein intake also be quantitated and incorporated in insulin dosing decisions will create an additional burden that few patients will be able to accomplish."

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