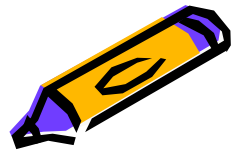
Insulin Adustment based on patterns

OSMH Paeds Diabetes Team

March 2022



Target Ranges

Fasting or Before meals 4.0 to 8.0 mmol/L

2 Hour After Eating 5.0 to 10.0 mmol/L

HbA1C

3month average of sugars

Target = 7.5%

(Non-diabetic 4.3-6.1%)

Ask Yourself These Questions

- Are blood sugars outside target range?
- Are they too high or too low?
- Is it a one time high/low or a pattern?
- Which insulin has the most effect at this time?
- Does the insulin dose need to be increased, decreased or the insulin type or timing changed?
- What would be the recommended adjustment?

Which Blood Glucose Value Reflects Which Insulin?

before breakfast	**Bed time snack bolus or bedtime basal insulin**
before lunch	**Breakfast bolus insulin**
before supper	**Lunch bolus insulin**
bedtime	**Supper bolus insulin**
2-hour after meal	**Meal time bolus insulin**
during the night	**Supper bolus or bedtime basal insulin**

Insulin Adjustment

Adjusting the usual insulin dose in response to a pattern of highs or lows.

The pattern for highs is based on a 3 day pattern at the same time of day.

The pattern for lows is based on a 2 day pattern at the same time of day or multiple lows in a day.

Tips on Insulin Adjustment

- Change one insulin at a time.
- Try to get morning blood sugar reading in target first.
- Adjust the insulin that accounts for the lows first then address the high readings.
- Allow at least 4 days to evaluate adjustments for high sugars before making another adjustment. For lows wait 1 to 2 days and decrease again.

Adjusting night-time basal

Breakfast
9.8
14.2
10.5
13.9

Here we see the last 3 numbers are above target range. It is the basal insulin that affects our morning numbers, if there has been no rapid given at bed snack. Therefore, we will increase basal by 1 unit or 10%. Evaluate for 4 days and increase again by 1 unit or 10%, if numbers are still above target. Stop at the effective dose.

Action of basal insulin

- Basal insulin is very stable and has no peak action.
- If we go to bed, with no snack, at a number of 8.8 mmol/L. We should wake up between 10.8 and 6.8 mmol/L. Our sugar should not fluctuate out of that range.
- If our blood sugar drops from an 8.8 mmol/L to a below target at breakfast, then the basal is too high.
- Basal insulin should never bring us from an above target to an in-target at breakfast.

Insulin to Carb Ratio (ICR)

- An ICR bolus is the amount of Rapid insulin given at a meal to cover food to be eaten. If the ratio is correct, the blood sugar at the next meal, **when no additional food has been eaten**, should be in target.
- If the result at the next meal, is above or below target, **when no additional food has been eaten**, the ratio is incorrect.

Insulin to Carb Ratio (ICR)

- This evaluation can only be done if the blood sugar is **in target** before the meal you are investigating.

- Ratios are adjusted by 1- 2 grams for tight ratios e.g. 1:10 to 1:9 or 1:8 and up to 5 grams for wider ratios e.g. 1:25 to 1:30.

Insulin to Carb Ratio (ICR)

- If lows (below target #'s) are occurring after the bolus, the ratio needs to be widened. The ratio number would therefore be increased, resulting in less insulin.
  - Eg. 1:8 would be increased to 1:10.
  - The larger the carb ratio the less the insulin.

Insulin to Carb Ratio (ICR)

- If highs (above target #'s) are occurring after the bolus, the ratio needs to be tightened. The ratio number would therefore be decreased, resulting is more insulin
  - Eg. 1:35 would be decreased to 1:30.
  - The smaller the carb ratio the more the insulin.

Correction/Sensitivity Ratio (ISF)

- Correction/sensitivity ratios **can only be adjusted once the proper carb ratio is determined.**
- This ratio is a bolus of Rapid insulin taken to lower above target blood sugar levels. Most boluses are given with main meals.
- Based on 3 day pattern for highs at same time of day. Based on 2 day pattern for lows or multiple /day.

ISF CALCULATION

- An ISF of 1:3 means, when used as a correction:
  - One unit of Rapid insulin will drop the blood glucose 3 mmol/L
- Formula to determine correction dose:
  - (blood glucose – target blood glucose) ÷ ISF = correction dose
  - E.g. (14.0 – 7.0) ÷ 3 = 2 units
  - Add this dose to the food bolus to lower blood glucose to target by the next meal.

ISF Ratio

- *If you need to use the correction frequently at the same time of day, this may indicate that you need to tighten your ICR ratio at the previous meal. Or snacks may need to be covered.*

ISF Adjustments

- Ratios are safely adjusted by 0.2 mmol to 2.0 mmol.
- If high sugars are not corrected to target at next meal the ratio would be tightened.
- If low sugars are happening, ratios would be widened.
- If ratios are tight, use the 0.2 mmol suggestion. Eg 1:2.0 changes to 1:1.8 for correcting highs and 1:2.2 for lows.
- If ratios are wide, use the 2.0 mmol suggestion. Eg 1:13 changes to 1:11 for correcting highs and 1:15 for lows.
- Continue adjusting every 3-4 days until highs or lows are prevented

Exercise

- Increases cell sensitivity for immediate and prolonged benefit.
- Increases risk of low blood sugar during activity, immediately after, and up to 24 hours in some people.

Exercise

- Test- before, during and after to determine physiologic response. Include overnight testing if exercise was of high intensity/long duration or unplanned.

- Hydrate - about 250 ml (1 cup) for every 30 minutes, type of fluid will depend on duration, intensity and blood sugars. If blood sugars are above target use low carb or water. If below target use carb fluids.

Dehydration can lead to hyperglycemia.

Exercise

- Rapid Insulin

For activity lasting 30-90 minutes

  - Decrease meal bolus prior to activity by 20-50%
  - Reduction depends on duration, intensity, type and competition
  - Several attempts maybe needed to find the right reduction
  - Start with lower reduction e.g. 20% and increase as needed

Exercise

- Basal insulin by injection or pump-
- For activity lasting longer than 90 minutes
  - Am and afternoon activities may require a 30-50% decrease.
  - For aerobic activity on a pump decrease 60 to 90 mins before activity and continue 90 mins after. May continue until next morning for nighttime lows.
  - Evening basal reduction by pen- to prevent nocturnal hypo no more than 50% and typically 10-30% .

Sick Day Management(SDM)/High Blood Sugars (see SDM module)

- Do not stop insulin
- Test blood glucose and ketones every 4hrs around the clock
- For impending hypoglycemia use mini-dose Glucagon
- Be familiar with insulin adjustment based on ketone levels
- Vomiting and/or diarrhea twice in 4 hours call Diabetes Team in day 705-327-9111 nights and weekends
- DKA is preventable