

Health Care Professional Education

Blood Glucose Monitoring and Insulin Dose Adjustment

Basic Level -2



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INITIATE - MONITOR - TITRATE



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Insulin therapy without self monitoring and dose adjustment in a person living with T1D is like driving a car blindfolded.



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Basic thoughts on monitoring and dose adjustment

Who needs to know how to adjust insulin doses?

1. Clinician
2. Educator
3. Caregiver
4. Person Living with T1D

ANSWER-ALL OF THE ABOVE !!



Insulin requirements in a person living with Type1Diabetes change within a day, day to day and also over years ,specially in a growing child or stage of life ,e.g. Pregnancy

Monitoring serves two purposes:

- To know whether the blood sugar levels are in the required range
- To calculate the insulin dose required on a regular basis ,e.g. Before meals or correction measures in case blood sugar level is High or low.
- There are multiple factors that can influence the dose requirement.



Monitoring of Blood Glucose Levels



Use a glucometer and strips (Self Monitoring of Blood Glucose-SMBG)



Use a sensor that does Continuous Glucose Monitoring (CGMS)



Tips on Glucometer choices

- Focus on a cost effective supply of strips
- Always use a glucometer with a memory [A record is essential for dose titrations and cross checking the written logs]
- Connected meters offer an advantage [An app on phone would keep all records, show patterns with space for logging]

Cost differences are not much...
check it out!



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105 $\frac{\text{mg}}{\text{dL}}$

SMBG-

How many times a day and when?



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Early days when doses are being set : All pre and post meals plus bed time.

Once the requirement and dose adjustment is understood: All premeal and Bedtime.

In limited resource setting care :

- 3-4 sugar checks everyday [Fasting/Premeal/Bedtime]
- Pre and post meals once a week.

The patterns can be designed keeping in mind where we expect most variability or a suspicion of **hypoglycaemia**.





A school goer goes for sports every evening at 6 pm for an hour. Here predinner and bed time sugar levels would need special attention.



A student stays up at night studying for exams would need a focus on post dinner, bedtime and fasting blood sugars.

EXAMPLES



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Maintaining a Log

A log of date , time, meal, activity, BSL and insulin dose taken is essential. This can be done on paper or digitally .

The log helps in identifying patterns and insulin dose adjustments.





The log also helps identify other factors such as

A higher requirement seen in morning due to insulin resistance



Insulin requirement changes in the different phases of menstrual cycle.

EXAMPLES



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A collection of medical supplies including two insulin syringes, a teal calculator, and a pen, arranged on a light surface. The syringes are in the foreground, and the calculator and pen are in the background.

Basic thoughts on Insulin Dose calculation

- ✓ Basal –bolus insulin therapy has started.
- ✓ A meal pattern has been planned
- ✓ A monitoring plan is in place

Now we are ready to be able to adjust bolus doses as per the carbohydrate intake and blood sugar levels.

This will have to be done as per the skill set of the person living with T1D and their care giver.

The idea is to go step by step with education and encouragement till self dose adjustment is possible .





Learning basics and using them



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- 1. Step 1: calculate TDD – divide to 60% bolus/ 40% basal approximately**
- 2. Step 2: calculate ICR & ISF [use formula/calculator]**
- 3. Step 3: make a meal plan counted for carbohydrate in each meal**
- 4. Step 4: use ICR to calculate bolus dose for each meal**
- 5. Step 5: use ISF to create a correction bolus scale**
- 6. Step 6: Prandial dose plus correction dose = total dose**
- 7. Step 6: monitoring and logging to be used for further modification**



ICR & ISF : Two ratios every T1D care team must know.

ICR

Insulin-to-carbohydrate ratios estimate how many grams of carbohydrates are covered with 1 unit of short-acting or rapid-acting insulin. This is used to calculate how much insulin to take for a specific meal.

This will be different for different people

ISF

The insulin sensitivity factor is also called a correction factor. It estimates the amount of glucose reduction with 1 unit of bolus insulin. This is used to calculate how much insulin you need to take to bring your glucose level down to a pre-determined target range.

As with the ICR, the ISF is different for different people.



Calculation of ICR & ICF

How to calculate insulin sensitivity factor (ISF):

1800/TDD (for BG in mg/dl) or 100/TDD (for BG in mmol/l)

For example, if the TDD is 20 units:

ISF is $1800/20 = 90$ (mg/dl) or $100/20 = 5$ (mmol/l)

- ▶ So, 1 unit of insulin lowers blood glucose by 90mg/dl or 5mmol/L

How to calculate insulin/carbohydrate ratio (ICR):

500/TDD or 250-330/TDD (often used instead for young children) rule

For example, if the TDD is 20 units, the ratio is $500/20 = 25$.

- ▶ That is, 1 unit of insulin should be given with 25 grams of carbohydrates (CHO)

Simply use any of the online available calculator apps!

Or

The insulin dose calculators can use TDD to Calculate ICR & ISF

They are FREE!

Can be used by the educator or you to make individualised scale for the first time.



Learn carb counting basics

To be able to make a basic meal plan effective it is essential that the HCP learns some very basic carb counting or outsources to someone who does.

Macronutrient recognition and **basic counting** can be learnt easily.

Example :

A 25 gm raw flour Roti is 15 grams of carbohydrate

A 20 gm raw rice when cooked gives 15 grams of CHO



Basic scale for fixed Meal Patterns

In a newly detected person with T1D

1. Make a carb counted meal plan [give measured options /exchanges]
2. Calculate TDD as per weight
3. Calculate ICR & ICF
4. Give a dose prescription with a scale to adjust as per glucose level.



Basic scale for fixed Meal Patterns

TDD 25 | ISF 72 | ICR 18

Meals of 30 gm carbohydrate in each meal .

Inj Rapid insulin before breakfast ,lunch, evening snack and dinner.

Inj Glargine 10 units at 9pm.

- **70-140 :2U**
- **140-210 :3U**
- **210 -280 :4U**

With observation of pre and post meal levels this scale can be modified over time as TDD and ICR will change



What we have learnt is very basic first level of dose adjustment for fixed CHO meals. Yet it gives good results and can be used long term for those with low learning skills and as a first step for others to move on to advanced care. If the person living with T1D learns to carb count, the meal flexibility can add value to quality of life.



Insulin dosing is dependent on many factors

- Age
- Weight
- Stage of puberty
- Duration and phase of diabetes
- Nutritional intake and distribution
- Exercise patterns
- Daily routine
 - Results of BG monitoring and glycated hemoglobin
 - Intercurrent illness
- Menstrual cycles



Advanced learning .

What we need to know as we go along:

1. Dawn phenomenon
2. Somogyi effect
3. Advanced carb counting
4. Fat and protein counting
5. Variations in insulin sensitivity for time of the day
6. Factoring in of activity and other influencers

Goal is to empower a person living with T1D with self dose adjustment skills for freedom in day to day life, accurate control and hence complication free life.





**Its like riding a bicycle-You struggle and stumble but once you get a hang of it
you never forget .**



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The discipline of monitoring and self dose adjustment gives not just better control but freedom and better quality of life. Look out for more learning !



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