

## Diabetes Control

**Food, activity** and **insulin** influence your blood glucose levels. At times it may seem like a “juggling act” as you attempt to balance these three factors.

Home blood glucose monitoring is an important tool in your diabetes management. It provides you with information about your blood glucose levels, but alone will not improve your diabetes control. Action in the form of increasing or decreasing your food, activity or insulin is needed.

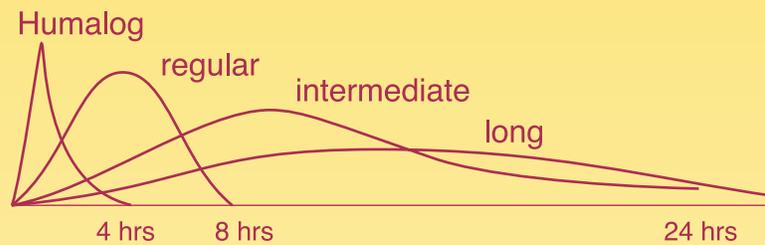
This booklet addresses the insulin variable in the “juggling act”. It provides you with guidelines for insulin adjustment, enabling you to make minor changes in your insulin dose. Your physician and diabetes educator play an important role in your diabetes management. Remember to keep in touch with them as you “juggle” for better control.

## Knowledge and Skills

Prior to making any insulin adjustments the following knowledge and skills are required:

- You need to monitor your blood glucose 1 - 4 times a day – before meals and at bedtime.
- Blood glucose results need to be recorded in a diabetes diary, along with insulin dose and comments (for example, delayed lunch, flu, extra snack, etc.).
- You need to set a target range for blood glucose control. Do this in consultation with your physician or diabetes educator. The Canadian Diabetes Association recommends a blood glucose range between 4 - 7 mmol/L before meals.
- You need to understand the action times of the insulin you take.

## Action Times of Insulin



**Note:** The action of insulin may vary from individual to individual

### Rapid Acting

**Humalog** (also known as insulin Lispro) is a rapid acting insulin. It begins to work 5 to 15 minutes after injection, peaks in one hour, and has a duration of 3 - 4 hours. Because of its rapid action and short duration, it "covers" the meal better, providing a good match between food and insulin. You should eat within 15 minutes of taking Humalog.

### Short Acting

**Regular** insulin (also known as R or Toronto) is a short acting insulin. It begins to work 1/2 hour after injection, peaks in 2 - 4 hours, and has a duration of 6 - 8 hours. It is recommended to take regular insulin 30 minutes before the meal.

### Intermediate Acting

**Intermediate acting** insulin begins to work 1 - 3 hours after injection, peaks in 6 - 12 hours, and has a duration of 18 - 24 hours. Examples of intermediate acting insulin are N (NPH) and L (Lente).

### Long Acting

**Long acting** insulin begins to work 4 - 6 hours after injection. Unlike short and intermediate acting insulin it has a minimal peak effect. Its duration of action is 24 - 28 hours. An example of long acting insulin is U (Ultralente).

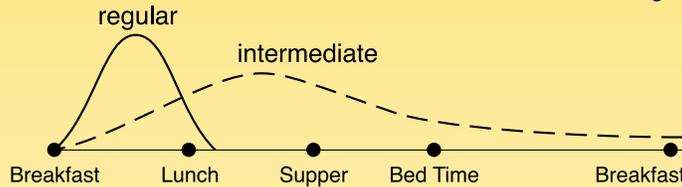
**Note:** Rapid & Short Acting insulins are clear. Intermediate & Long Acting insulins are cloudy

# Insulin Regimens

Some people with diabetes can be adequately controlled on one or two injections a day, while most will require three or four. Below are some of the more common insulin regimens.

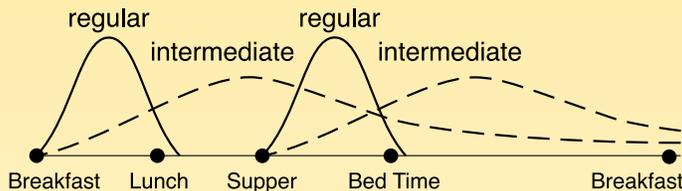
## One Injection - regular & intermediate acting insulin

- **Breakfast** blood glucose test reflects the tail end action of the intermediate acting insulin given the day before
- **Lunch** blood glucose test reflects the action of the regular insulin
- **Supper** blood glucose test reflects the action of the intermediate acting insulin
- **Bed time** blood glucose test reflects the action of the intermediate acting insulin



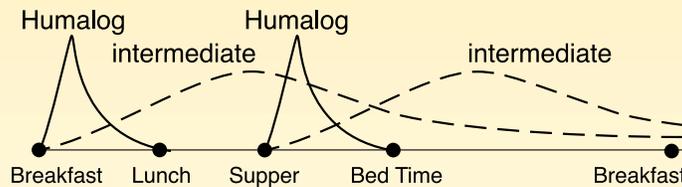
## Two Injections - regular & intermediate acting insulin

- **Breakfast** blood glucose test reflects the action of the intermediate acting insulin given the evening before
- **Lunch** blood glucose test reflects the action of the morning regular insulin
- **Supper** blood glucose test reflects the action of the morning intermediate acting insulin
- **Bed time** blood glucose test reflects the action of supper time regular insulin



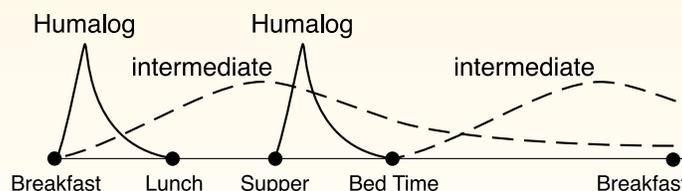
## Two Injections - Humalog & intermediate acting insulin

- **Breakfast** blood glucose test reflects the action of the intermediate acting insulin given the evening before
- **2 hrs after breakfast** blood glucose test reflects the action of the morning Humalog
- **Lunch & Supper** blood glucose test reflect the action of the morning intermediate acting insulin
- **2 hrs after supper** blood glucose test reflects the action of the supper time Humalog
- **Bed time** blood glucose test reflects the action of the morning and evening intermediate acting insulins



## Three or Four Injections - Humalog & intermediate acting insulin

- **Breakfast** blood glucose test reflects the action of the intermediate acting insulin given the evening before
- **2 hrs after breakfast** blood glucose test reflects the action of the morning Humalog of the morning intermediate acting insulin
- **Lunch & Supper** blood glucose tests reflect the action of the morning intermediate acting insulin
- **2 hrs after supper** blood glucose test reflects the action of the supper time Humalog
- **Bed time** blood glucose test reflects the action of the morning and evening intermediate acting insulins



**NOTE:**

Humalog may also be given at lunch

## Now... Insulin Adjustment!

### Important Points to Remember

- 1 Changes in your meal plan and activity will influence your blood glucose levels.
- 2 **Increasing** your insulin dose will **lower** your blood glucose level.  
**Decreasing** your insulin dose will **raise** your blood glucose level.

## Guidelines for Insulin Adjustment

- 1 Adjust the insulin that accounts for the high or low readings. For example, if your supper readings are higher than your lunch time readings, increase your morning intermediate acting insulin.
- 2 If insulin dose is:
  - less than 8 units, adjust by 1 unit.
  - between 8 - 20 units, adjust by 2 units.
  - greater than 20 units, adjust by no more than 10% (for example, if you are on 38 units of intermediate acting insulin in the morning, adjust by 4 units).
- 3 If you use Humalog, occasionally check your blood glucose **two hours after** the injection. If you are out of target at this time, adjust your dose of Humalog.
- 4 Only adjust one insulin at a time. (**Note:** There is an exception to this rule. See the example on page 8.)
- 5 First adjust for "insulin reactions". When lows are no longer occurring, then work on high readings.

## How to Adjust for Low Readings

If you feel as if you are having an “insulin reaction”, confirm it by doing a blood glucose test. This will rule out other situations such as anxiety which may give the same signs and symptoms of hypoglycemia.

If your blood glucose level is **3.5 mmol/L or less** you are indeed experiencing an “insulin reaction.” Treat it by having 10 gm of simple carbohydrate, 10 ml of sugar or 125 ml of juice (2 teaspoons of sugar or a half cup of juice). Usually there is an obvious reason for a low blood glucose reading — a delayed meal, missed portions of food, and/or extra activity. If you have two unexplainable “reactions” at the same time of day, you need to adjust your insulin.

You should **decrease** the insulin acting at the time of the “reactions”.

### Example →

Mary takes 5 units of regular insulin plus 15 units of intermediate acting insulin in the morning. For the past 4 days Mary’s lunch time readings have been between 4 and 6 mmol/L. On Saturday and Sunday Mary has an **unexplainable** “insulin reaction” before lunch. On Monday, Mary decreases her morning regular insulin by 1 unit.

## How to Adjust for High Readings

When adjusting for high readings, look for **trends**. Blood glucose readings should be higher than your target range for at least **3 consecutive days** before making an adjustment. **Increase** the insulin that accounts for the high reading and then **wait** 2 - 3 days to see if your adjustment worked.

## Examples

John takes 7 units of regular insulin plus 18 units of intermediate acting insulin in the morning; and 4 units of regular insulin plus 8 units of intermediate acting insulin before supper. His readings over the past few days are as follows:

DAY	DATE	7am	noon	6pm	10pm
MON	24/10	8.0	4.8	14.8	9.8
TUE	25/10	6.9	6.2	11.3	9.4
WED	26/10	7.1	7.6	15.9	11.2

← Example

John increases his morning intermediate acting insulin by 2 units. He then waits 2 - 3 days to determine the effectiveness of the increase.

If most of your readings are elevated and you are unable to detect any trends, attempt to correct your morning blood glucose readings. As your morning readings come down, the rest should follow.

Mr. Jones takes 30 units of intermediate acting insulin in the morning and 18 units of intermediate acting insulin before supper. Mr. Jones' readings are as follows:

DAY	DATE	7am	noon	6pm	10pm
MON	24/10	10.9	8.9	16.4	12.3
TUE	25/10	17.2	12.6	11.1	10.9
WED	26/10	15.8	13.2	12.7	14.5

← Example

Mr. Jones increases his supper time intermediate acting insulin by 2 units. He then waits 2-3 days before making further adjustments.

At times you may have to compensate for a successful adjustment. High readings followed by **normal** readings will require compensation.

Anne takes 10 units of Humalog plus 32 units of intermediate acting insulin in the morning, 8 units of Humalog before supper, and 12 units of intermediate acting insulin at bed time. Anne's readings over the past few days are as follows:

DAY	DATE	7am	noon	6pm	8pm
MON	24/10	4.8	4.8	12.9	4.2
TUE	25/10	5.2	8.9	14.5	6.9
WED	26/10	8.6	9.2	16.0	5.0
THUR	27/10	6.9	5.3	6.2	

### NOTE:

Anne's bed time readings have been normal, despite high readings at supper. If Anne takes her usual dose of Humalog before supper, she may drop too low at bed time.

Anne has increased her morning intermediate acting insulin by 3 units to account for the high readings at supper. This adjustment was successful as evidenced by the reading 6.2 mmol/L. To avoid an "insulin reaction", Anne decreases her supper time Humalog by 2 units. Note that guideline #4 (only adjust one insulin at a time) has been broken. In this situation safety is more important than guideline #4!

## Rebound

Often a high reading can occur following an “insulin reaction”. This is referred to as a rebound. In an attempt to prevent the blood glucose from dropping too low, the body releases hormones. These hormones cause a marked increase in the blood glucose level.

At times an “insulin reaction” may occur in the middle of the night. Clues are bad dreams, damp bed sheets, morning grumpiness and/or headache. If you suspect night time hypoglycemia, set your alarm for 2 or 3 a.m. and do a blood glucose test. You may need to do this for a few nights.

If high readings before breakfast are due to a rebound, a **decrease** in your evening intermediate acting insulin is required.

Mrs. Smith has had high morning readings over the past week. Although she has increased her evening intermediate acting insulin, high readings in the morning continue. She has also noticed restless nights and morning headaches.

Mrs. Smith calls her physician and is instructed to do a blood glucose reading at 3 a.m. Night time hypoglycemia is confirmed and Mrs. Smith **decreases** her evening intermediate acting insulin.

← **Example**

## Adjusting for Special Occasions

There will be “special” occasions (for example, your birthday dinner) when you eat extra food containing carbohydrate. As you know, extra carbohydrate will result in an increase in your blood glucose level. To prevent this blood glucose rise, you can take **extra** Humalog or regular insulin **before** the meal. Most **adults** require 1 unit of extra insulin for every 10 - 15 grams of extra carbohydrate.

Your meal plan is an important factor in your diabetes management. Taking extra insulin for extra carbohydrate can result in weight gain.

← **Remember**

## Adjusting for Exercise and Activity

Exercise and activity can cause your blood glucose levels to drop. This drop can occur during or several hours after exercise. To compensate for the effects of exercise, you may need to take extra food (in the form of simple and complex carbohydrate) before, during and/or after exercise.

You can also decrease your insulin in anticipation of increased activity. The insulin that is having the greatest effect at the time of exercise is decreased (for example, morning intermediate acting insulin is decreased for an afternoon golf game). The insulin is decreased by:

- **10%** for light exercise/activity.
- **20%** for moderate exercise/activity.
- **30 - 40%** for vigorous exercise/activity.

If you use **Humalog** and strenuous or prolonged exercise is planned within two hours of the injection, consider reducing your usual dose of Humalog by as much as 50%. This will help prevent low blood glucose during its peak action.

Blood glucose monitoring will determine if you are successful in achieving the balance between food, exercise and insulin. Monitor your blood glucose **before**, **during** and **after** various forms of exercise and activity. Once the balance is determined, such frequent testing can be reduced.

If you have decreased your insulin for anticipated exercise which has been cancelled, do not fret. Do a blood glucose test—you may require a few extra units of Humalog or regular insulin at that time.

## Adjusting for Illness

An illness, such as a bad cold or the flu, will often result in a rise in blood glucose levels. When you are ill, it is important to test your blood glucose every 4 hours. It is also very important to test your urine for ketones—the presence of ketones means a serious situation.

**Always take your insulin**, even if you are vomiting. If you use Humalog and you are nauseated, your injection can be given after you have eaten.

 **Remember**

Elevated blood glucose and ketones in your urine indicate a need for more insulin. If you use Humalog, give an extra dose every 3 to 4 hours. If you use regular insulin give an extra dose every 4 to 6 hours. The amount depends upon your blood glucose level and the presence of ketones. One suggested program is as follows:

Blood Glucose	Urine Ketones	Extra Humalog or Regular
13-16 mmol/L	negative-small	zero
13-16 mmol/L	moderate-large	10% of total daily dose
16.1-22 mmol/L	negative-small	10% of total daily dose
16.1-22 mmol/L	moderate-large	15% of total daily dose
22.1 or more	negative-small	15% of total daily dose
22.1 or more	moderate-large	20% of total daily dose

Mr. Morgan is ill with the flu. He has been testing his blood glucose and urine for ketones every 4 hours. At lunch time his blood glucose is 17.8 mmol/L and urinary ketones moderate. Mr. Morgan's total daily insulin dose is 40 units.

He gives himself 6 units of Humalog (15% of 40) and continues to monitor his blood glucose and urine for ketones.

 **Example**

## Other Important Points to Remember When You Are Ill:

- If blood glucose levels are high and ketones present, vigorous activity may cause your blood glucose level to rise even further. Be good to yourself — get some rest!
- Drink as much fluid as possible. If your blood glucose level is below 15 mmol/L, have both sugar free and sweet beverages. If your blood glucose is 15 mmol/L or more have sugar free fluids.
- If you are vomiting and unable to keep food and fluids down phone your physician, diabetes education centre, or report to the hospital emergency room. You may need to be admitted to hospital to avoid dehydration and diabetic ketoacidosis.
- If your blood glucose remains above 15 mmol/L or your ketones remain greater than small despite taking extra Humalog or regular insulin, call your physician or diabetes education centre.