

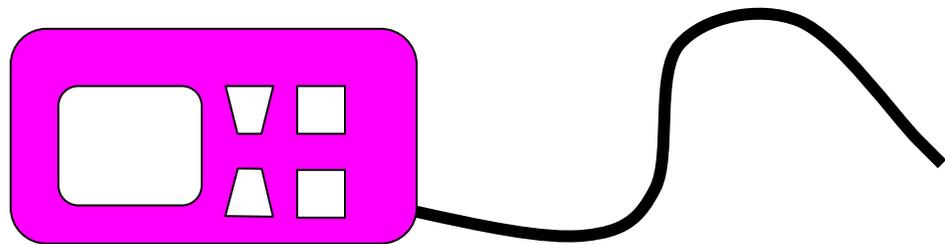


L'Hôpital de Montréal pour enfants
The Montreal Children's Hospital
Centre universitaire de santé McGill
McGill University Health Centre

Living well with your insulin pump!

Reference Manual

Montreal Children's Hospital
Pediatric Insulin Pump Centre



Anne Bossy, BSc(N), CDE
Evelyne Pytka, PDt, CDE
April 2012

\$8.00

Anne Bossy BSc(N), CDE
Evelyne Pytka PDt, CDE
4/22/2014

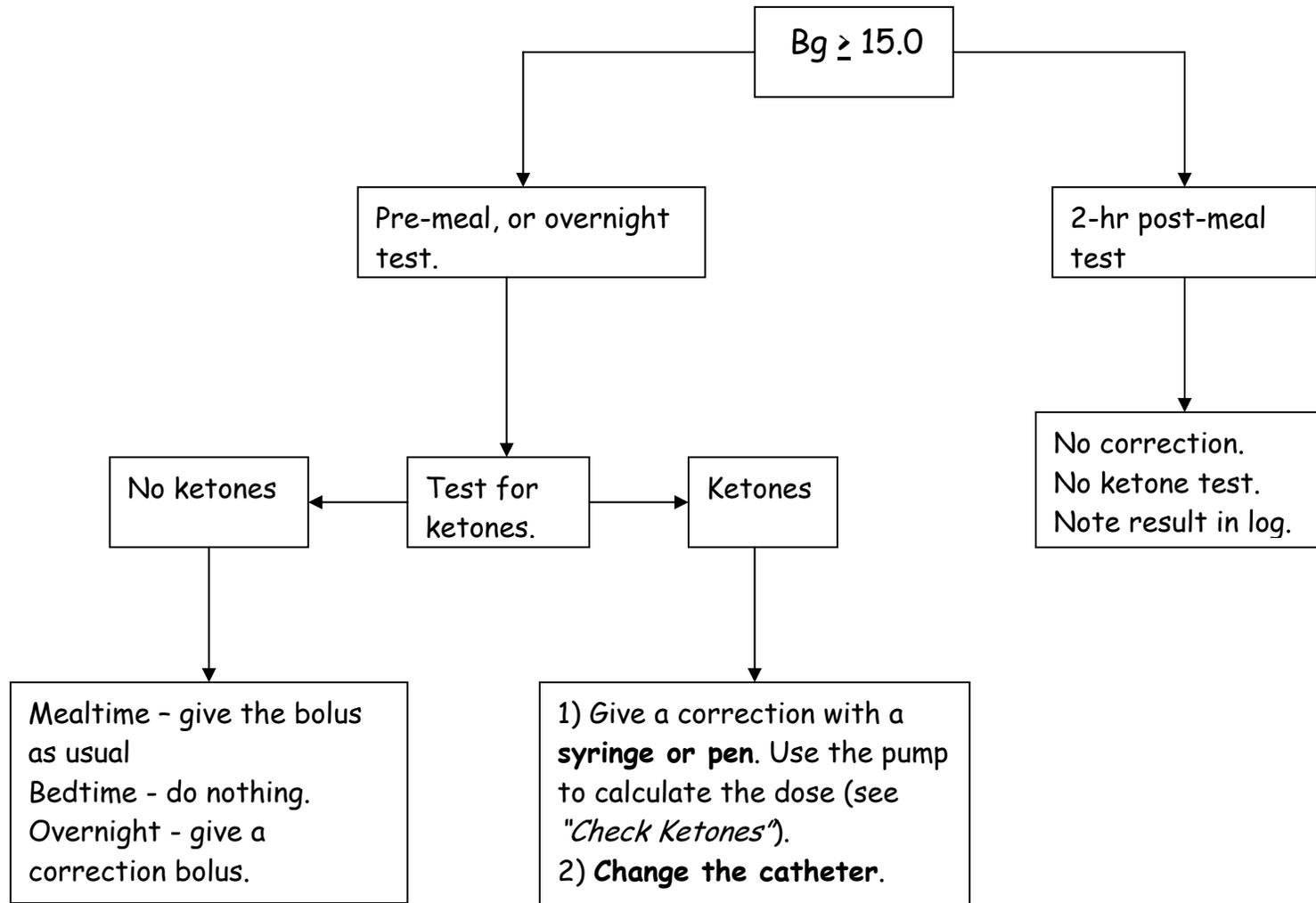


TABLE OF CONTENTS

	Page
Correction Bolus Protocol to Evaluate Basal Rates	3
Check Ketones!	4
Hypoglycemia Protocol for the Insulin Pump	5
Guidelines for Meals and Snacks during Insulin Pump Stabilization	6
Emergency Kit	7
Managing Sick Days on a Pump	8
Guidelines for Temporary Removal of the Insulin Pump	9
Ketones	11
How Can You or Your Child Get Ketones Using the Pump?	12
Basal Adjustment Guide	13
Testing Basal Rates and Boluses.....	14
Using "Advanced Bolus" Options	15
Appendix I: Annual Clinic Visit	18
Appendix II: Food Record.....	19
Appendix III: Travel List for Pumpers	20
Appendix IV: Managing Activity	21
Appendix V: Carb Factors for Various Foods	24
Appendix VI: Carb Counting Tips & Tricks when Eating Out.....	29
Notes.....	30



Correction bolus protocol to Evaluate Basal Rates:
Pump Start (first two or three weeks) & Prior to Clinic Visits





Bedtime test < ____ : take ____g carbs containing protein, with no bolus.

CHECK KETONES!

When blood sugars are 15 or over, or if nausea and vomiting.

**Ketones
0 – 0.6
(Negative)**

Troubleshoot!

- ▶ Leaks? Bubbles? Forgot to bolus?
- ▶ Give a correction bolus.
- ▶ Recheck in 2 hours.

- ▶ Glucose still 15 or over?
- ▶ Check ketones.

▶ 0.6 or less?

▶ 0.7 or more?

▶ Go to  or 

- ▶ Change catheter and infusion set.
- ▶ Give a correction bolus.
- ▶ Recheck in 2 hours.

- ▶ If the glucose stays high without ketones, call the Pump Centre for help.

**Ketones
0.7 – 1.4
(Medium)**

- ▶ Use your pump to calculate a correction dose.

- ▶ Multiply the dose by 1.5.

- ▶ Inject the dose, using a syringe or insulin pen.

- ▶ Change catheter and infusion set.
- ▶ Recheck in 2 hours.

- ▶ If ketones are still present, call the Pump Centre or Doctor on call.

**Ketones
1.5 or higher
(Strong)**

“Starvation Ketones”:

- ▶ occur with normal or low blood sugars.
- ▶ are not harmful.
- ▶ will resolve once the child can eat.

Call the Pump Centre or Doctor on call if you need help or support.

A blood ketone test is more reliable than a urine test.



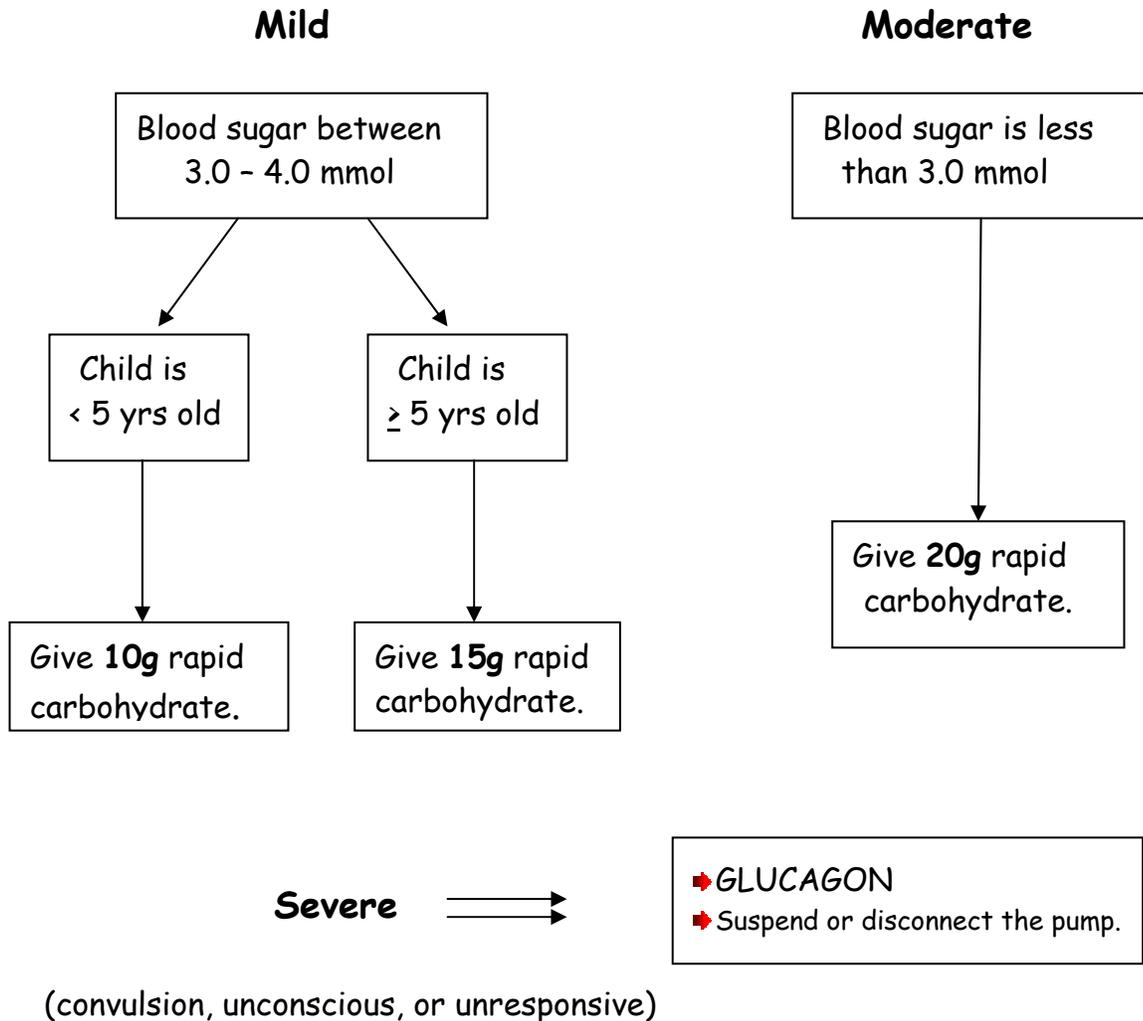
L'Hôpital de Montréal pour enfants
The Montreal Children's Hospital
Centre universitaire de santé McGill
McGill University Health Centre

Anne Bossy BSc(N), CDE
Evelyne Pytka PDt, CDE
514-412-4400 x 23084/5
Dr on call x 53333



HYPOGLYCEMIA PROTOCOL FOR THE INSULIN PUMP

The 2008 Clinical Practice Guidelines from the Canadian Diabetes Association recommends:



Always **RECHECK** the blood sugar 15 minutes after treatment, to verify that it has risen above 4.0 mmol.

There is no need to give a snack afterwards, unless the child is engaged in sports or activity.



Guidelines for Meals and Snacks During Insulin Pump Stabilization

Purpose: To help adjust basal rates and boluses (carb and correction) as efficiently as possible.

During this time, your child should eat three meals and carbohydrate-free (<3 g), low-calorie snacks (i.e. low in fat, protein and carbohydrate).

1. **Meals:** Please be sure that meals contain known amounts of carbohydrate (use food labels, measuring cups/spoons and a digital scale). Restaurant meals are difficult to calculate precisely, so it is best to eat at home until basal rates and boluses are established.

Because large amounts of fat and protein may also affect blood sugars, please avoid the following foods **until your child's basal rates and boluses are established:**

- Pizza
- Deep-fried foods (e.g. French fries, poutine, etc.)
- Portions of meat, fish, eggs, cheese, poultry that are **larger than usual**
- Chocolate
- Ice cream
- Nuts (other than peanut butter on toast or in a sandwich)

These foods will be re-introduced once the basic settings of your child's pump are set.

Remember that there is no limit on the amount of carbohydrate at a meal. Please allow your child to eat for his/her appetite and remember that the rules of healthy eating apply to the entire family!

2. **Snacks:** Your child may eat snacks that have little or no carbohydrate (≤ 3 g) and a small amount of protein (1 oz or 30 g of weight, or < 7 g protein on the food label) or fat (<5 g) to avoid any effect that these nutrients may have on blood sugars. Any foods that have <30 calories are acceptable.

Examples of low carbohydrate/low energy snacks:

- "light" *Jell-O™*
- *Crystal Light™* popsicles
- Tossed salad (lettuce), cucumber, celery or 125 ml (1/2 c) free vegetables (broccoli, cauliflower, zucchini, etc) with 15 mL (1 Tbsp) dip or salad dressing
- Sugar-free gum
- *Crystal Light™* or other diet drinks



Pumpers' Emergency Kit

Make sure you or your child has access to the following, in case of problems with the pump or catheter:

Infusion sets



Reservoirs



Batteries



Alcohol swabs

IV Prep or other brand

Tegaderm or other brand

Emla cream or patch



Insulin syringes or pens

Rapid insulin - at school, keep an unopened vial or cartridge of rapid insulin in a refrigerator

Extra Glucometer and strips (for blood sugar and ketones)



Glucose tablets or juice

** Keep long-acting insulin (N/NPH/Levemir/Lantus) at home in case of pump malfunction or loss (see "Temporary Removal of Pump protocol).



MANAGING SICK DAYS ON A PUMP

1. Never omit insulin. Do not disconnect or stop insulin pump unless patient is receiving insulin by injection.
2. Increase frequency of blood glucose and urine ketone monitoring to every 2 to 4 hours throughout the entire day and night.
3. If hyperglycemia develops during illness, increase the basal rate by 20% to 50% for 4 - 6 hour blocks until the illness resolves and blood sugars are back in range.
*** for diarrhea, the basals may need to be *reduced*.
4. Adjust boluses to carbohydrates intake. Increase boluses by 20-50% as needed to return blood sugars to their targets range if elevated after eating.
*** for diarrhea, the bolus may need to be *reduced*.
5. Increase fluid intake as needed to help prevent dehydration and clear ketones.
6. Examine infusion site as a possible source of occult infection and cause of hyperglycaemia and ketosis.
7. Check pump and infusion device.
8. Call the health care team if the patient has persistent nausea or vomiting for more than 4 hours, if symptoms of diabetic ketoacidosis develop (chest or abdominal pain, deep breathing) or if questions or concerns arise.

Starvation ketones:

- Occur with normal or low blood sugars, usually with “gastro” or “stomach flu”.
- Are not harmful.
- Will resolve once the child can eat.

Call the Pump Centre or Doctor on call if you need help or support.



Guidelines for Temporary Removal of the Insulin Pump

Why remove your pump?

- 1) the pump is broken and a new one won't arrive for a few days
- 2) the pump is lost or stolen
- 3) you need to be admitted to the hospital and will be unable to operate your pump
- 4) you want to take a "pump break" (eg. while at the beach)

When off the pump, it is best to stick as close as possible to a "basal-bolus" routine. The following are **guidelines only** for calculating an insulin dose. Extra blood sugar testing will be needed including overnight, to assess how it's working for you or your child. Please let your doctor or nurse know when you need to go back on injections, so that we can help you with the "fine-tuning". *These guidelines are dependent on your knowing your pump's settings, ie. basal rates, meal bolus ratio's, and correction factors (insulin sensitivity factors).*

ALWAYS KEEP RECORDS OF YOUR CURRENT PUMP SETTINGS. Insulin pumps are machines that can break or malfunction. Don't rely on your doctor or nurse to have all your data up-to-date.

- 1) **Short term off pump** (less than 24 hrs): Rapid-acting insulin (Novorapid or Humalog) will need to be given approximately every 3 - 4 hours.

Combine:

- 3 - 4 hours of basal insulin
- a pre-meal bolus for carbs
- a correction bolus if needed

Example: AT 8AM - the blood sugar reading is 14.8

- breakfast is 40 grams
- carb ratio is 1/15g
- correction factor (insulin sensitivity factor) is 4.0
- the basal rate is 0.60 units/hr until noon

- 4 hours of basal: $4 \times 0.60 = 2.4$ units
- breakfast food bolus: $40/15 = 2.7$ units
- correction bolus: $\frac{14.8 - 6.0}{4.0} = 2.2$ units

4.0

Total dose: $2.4 + 2.7 + 2.2 = 7.3$ units, rounded off to 7.0



2) Long term off pump (24 hrs or more): There are 3 options -

- Give long-acting insulin (Lantus or Levemir) as basal, and rapid insulin for boluses
- Give intermediate-acting insulin (NPH or N) ** call the doctor on-call for this dose
- Give rapid-acting insulin every 4 hours including overnight, as per the "short term" example

Using Lantus or Levemir

Calculate the total daily **basal** amount of insulin and give as a single dose of Lantus or Levemir. It can be given as soon as convenient. Then continue every 24 hours thereafter.

Note:

- These insulins cannot be mixed with other insulins in a syringe
- Take rapid insulin for meal, snack and correction boluses
- The carb ratio's and correction factors remain the same as for the pump
- Children who are too young to give their own insulin may need to have a parent go to school to give the lunchtime dose.

Example: the basal rate is 0.50 units from midnight to 6AM, and 0.40 units for the rest of the day until midnight. The total basal is 10.2 units. The dose of Lantus or Levemir will be rounded off to 10.0 units, given once every 24 hours until the insulin pump is resumed.

Note:

- Since Lantus and Levemir are basal insulins, you cannot have a basal rate running when you restart the pump or severe hypoglycemia may result!
- Restart your basal approximately 18 hours after the last Levemir dose; 22 hours after the last Lantus dose.
- If you want to re-start the pump earlier, set the basal rate at 0.00 units/hr until all the Lantus or Levemir has worn off.

Important things to remember:

- Extra blood sugar checks will be needed to see how your adjustments are working, especially after the first injection of Lantus or Levemir.
- Insulin may need to be decreased for activity
- Check for ketones when the blood sugar is over 15.0
- Be sure to double-check all the settings on the pump and the battery before reconnecting.
- Always keep an unopened vial of long-acting or intermediate-acting insulin at home, and take it with you when travelling.

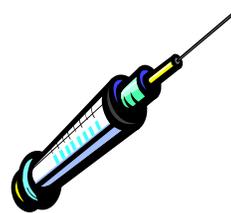


KETONES

Ketone testing should always be done when you are sick. Ketones should also be tested if the blood sugar is 15.0 mmol or over, even if you feel well. Using a Precision Xtra or NovaMax Plus glucometer is preferable and will give the most precise results, but a urine test can also be done.

If ketones are not present, give your usual correction using your insulin pump, and recheck the blood sugar in 2 hours. If the blood sugar has not started to decrease, check for ketones again and change your catheter and tubing. Give another correction and recheck in two hours.

***If ketones are present,
a dose of rapid insulin must be given
immediately by syringe or insulin pen.***



Check with your clinic about the dose protocol for ketones, and when you should contact the Endocrinologist on-call for help.

Symptoms of ketones include nausea and vomiting.

If someone with diabetes is experiencing these symptoms, ***a ketone check should be done immediately even if the blood sugar is normal.***

Ketones mean that the body does not have enough insulin. If left untreated, ketones can result in diabetic ketoacidosis (DKA), coma, brain damage, and/or death.



HOW CAN YOU OR YOUR CHILD GET KETONES USING THE PUMP?

1) A blocked catheter:

- make sure to change your catheter every two to three days.
- If possible, change your catheter before giving a bolus (meal or correction) and check your blood sugar 2 hours later to make sure it's working.
- never do your catheter change just before bed - if it blocks, you might not realize it until the next morning when it's too late.
- always check your blood sugars a *minimum* of 4 times per day!

2) Air in the line:

- check the tubing for air bubbles regularly.
- keep your opened insulin vial at room temperature; this will cause less bubble formation in the reservoir and tubing.
- make sure all connections are appropriately tightened.
- don't forget to PRIME or FILL CANULA after a new catheter insertion.

3) Illness:

- colds, fever, sore throat, gastro, etc. will often cause ketones.
- check for ketones early in order to get treatment started as soon as possible, even if your blood sugars are not elevated.
- broken bones, sprains, or other physical stressors can bring on ketones too.

4) Your insulin has degraded:

- it has passed its expiry date.
- the bottle has been opened more than one month.
- it has been exposed to summer heat or winter cold.
- The insulin has been in the pump reservoir too long (ie more than a week)

5) Human error:

- **forgetting to give your meal boluses!**
- leaving the pump disconnected for too long without checking your blood sugar.



BASAL RATE ADJUSTMENT GUIDE

I RULES

1) Certain factors will affect blood glucose levels and cause unreliable results, so pick the right day to evaluate you or your child's basals. Make sure that **NONE** of the following have occurred within the last 12 hours:

- **Moderate or intense exercise unless it is part of the daily routine, that is, done EVERY DAY (e.g. recess at school).**
- **Hypoglycemia**
- **Illness**
- **High protein/fat meals (e.g. restaurant meals), or where the carbohydrate content is unclear**
- **Alcoholic beverages**



- 2) Basal testing must begin **4 hours after the last bolus**, so that only basal insulin is present.
- 3) Begin your basal test only if the glucose is between 5.0 – 9.5 mmol/L.
- 4) Do **NOT** give any correction boluses during basal checks unless the glucose rises to 15.0 or over. If this occurs, follow the hyperglycemia/ketone protocol and abandon the basal check until another day.
- 5) If hypoglycemia occurs during a basal test, treat the low and stop the test.
- 6) Basal checks should be done at least 3 times over the same period to verify if an observed trend is consistent.

II Overnight basal check schedule:

- See "RULES".
- Eat a regular supper, not too high in fat and protein, and where the carb content is known.
- Do **NOT** take a bedtime snack.

Test:

- 1) Bedtime
- 2) 4 hours after the supper bolus (if this is after bedtime)
- 3) Midnight
- 4) 3am
- 5) 6am

III Daytime basal check schedules:

- See "RULES".

	Basal Check Period	Last Meal	Begin testing every 2 hours (testing period)
1	Morning	---	6:00 to 10:00, then eat breakfast
2	Mid-day (lunch)	Bkft at 6:00	10:00 to 14:00, then eat lunch
3	Late afternoon (supper)	Lunch at 11:00	15:00 to 19:00, then eat supper
4	Evening	Supper at 16:00	20:00 to midnight

IV How to make your adjustments:

- Compare the results of your blood sugar tests over the 4 hour basal testing period.
- A good basal rate will sustain the blood sugar within 1.7 to 2 mmol over the 4 hour testing period.
- If the readings increase or decrease by more than that amount, adjust the basal rate up or down by 0.025 to 0.100 units/hr (depending on age) over that period.
- Start the new basal at or near the time you began the basal check.
- Do another basal check over the same period to evaluate your change.

Good luck, and call Anne or Evelyne if you need assistance!



Testing Basal Rates and Boluses

1. Testing basal rates

If your child is old enough, skipping or delaying a meal will allow you to determine if the basal rates are adequate. This is the time to allow your child to sleep late. Please continue to test the blood sugar every 2 hours during this time. A basal rate that is set correctly will allow your child to sleep in, delay or miss a meal with running the risk of a low or high blood sugar.

Children who are unable to delay or skip a meal, may have a **low-carbohydrate/low energy snack** (≤ 3 g carbohydrate; < 7 g protein; < 5 g fat; < 30 calories).

Please do not try to test basal rates for more than one mealtime per day.

2. Testing meal boluses (insulin to carb ratios)

Test meal/carb boluses at a meal where the pre-meal blood sugar level is in target (i.e. there is no correction bolus required). Eat a meal with **known carbohydrate quantities**. Frozen meals (e.g. Michelina dinner) work well. Test the blood sugar 2 and 4 hours after the meal.

Because ratios can vary at different times of the day, you will need to try this at each meal.

A meal bolus should return the blood sugar to target range within 4 hour if the ratio is corrects.

3. Testing correction boluses

This is best done at a time when there will be no meal or snack within 4 hours, and when basal rates are well established. Correct the high blood sugar using the bolus calculator program in the pump, or according to **correction formula**:

(Actual blood sugar - target blood sugar) / sensitivity factor

Target blood sugar _____

Sensitivity factor _____

A correction bolus should return the blood sugar to target range within 4 hours.



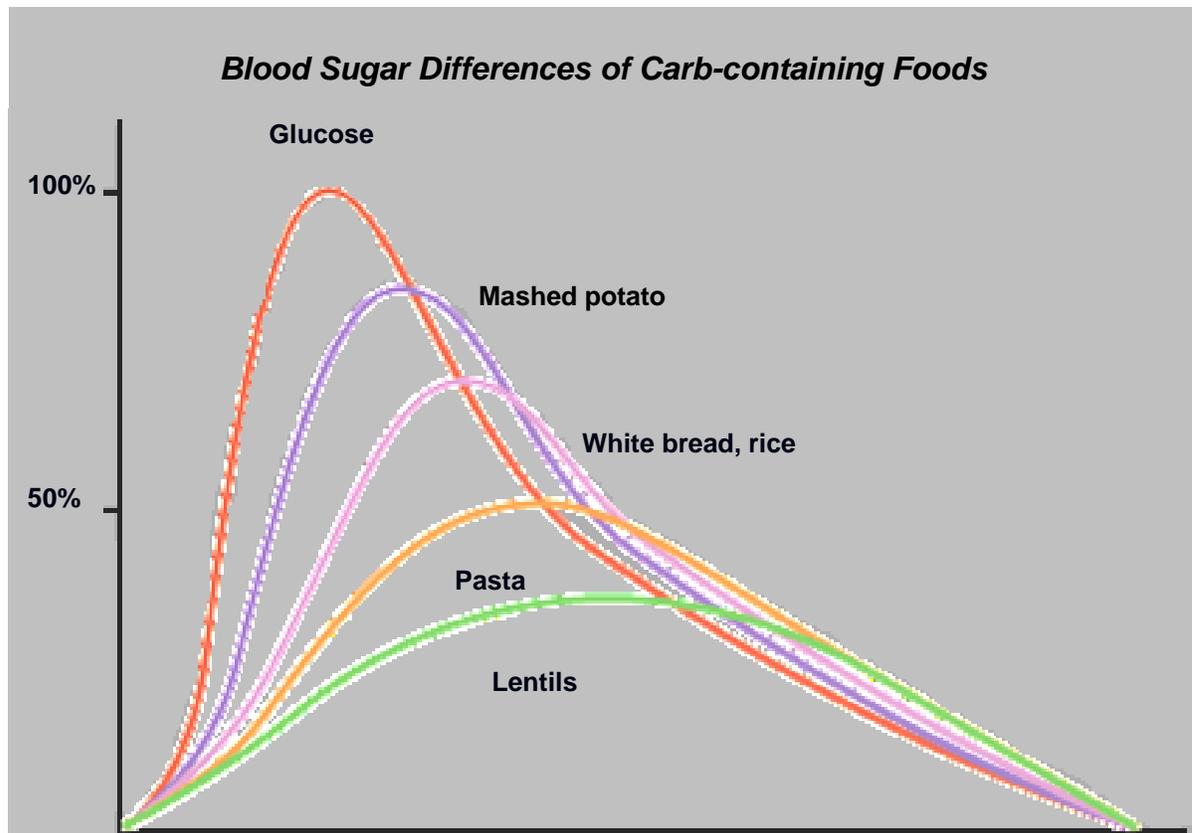
Using "Advanced Bolus" Options

Once your basal rates and ratios are established, many pumpers find that certain foods cause unusual blood sugars. This can happen even if you count your carbs correctly.

Some foods raise the blood sugar quickly, while others raise it more slowly. If the blood sugar rises slower than your insulin peaks, this can cause a low blood sugar 1-2 hours after the meal, and then a high blood sugar many hours later. These foods are called "slow carbs."

"Fast carbs" cause the blood sugar to rise faster than your insulin peaks.

The graph below shows the differences in blood sugar increase between different carbohydrate foods.



Reference: DiabSurf

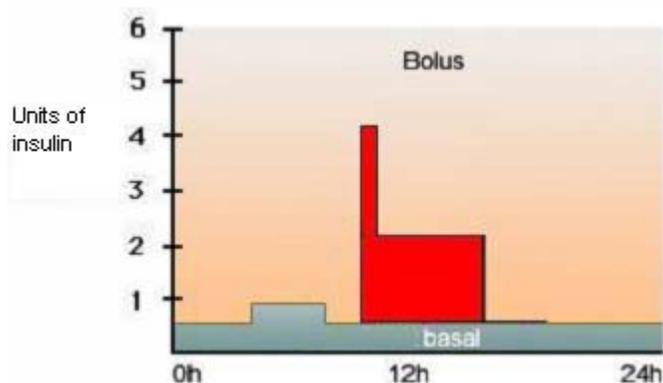
Slow carbs

1. High fat foods such as pastries, chocolate, pizza, ice cream; fried foods such as french fries, poutine.
2. Foods that are less processed, less cooked or high in certain fibres (low glycemic index) such as "al dente" pasta, legumes (chick peas, lentils, etc) old-fashioned (not instant) oats.

You can control your blood sugars after eating slow carbs by using a combination-type bolus. Depending on the make of pump you are using, this may be called a *dual wave*, *combination*, *combo* or *multi-wave bolus*.

If you notice that some foods cause a low blood sugar 1-2 hours after eating, or very high readings several hours after your meal, you may want to try this type of bolus.

A good way to start, is to calculate your bolus for the amount of carbohydrate, and program your pump to give 50% (half) of this amount immediately, and extending the remaining 50% over 2 hours. Test your blood sugar every 2 hours. Six hours after the start of your bolus (4 hours after all the insulin is delivered) your blood sugar should be back in your target.



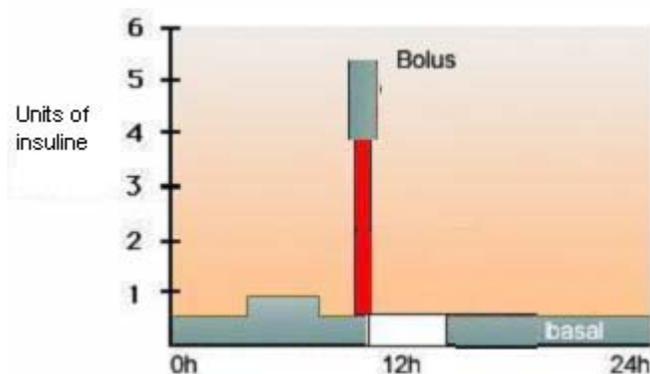
You may need to try different percentages as well as different times to extend the second part of your bolus. Keeping good notes will help you and your diabetes team decide what works best.



Fast carbs

1. Low fat, low fibre, processed foods such as bagels, white rice, breakfast cereals. These foods are often a big problem in the morning, when most people are more "resistant" to the action of their insulin. These foods cause a very high blood sugar 2 hours after you eat but your blood sugar may return to target before the next test.

You can control your blood sugars after eating fast carbs by using a "super bolus". **This bolus is not found in your pump menu.**



Program a temporary basal rate of 0% for 1 or 2 hours.

Give a meal bolus for the CHO grams + correction bolus (if needed) + the insulin missing from the basal rate.

Test your blood sugar every 2 hours. Your blood sugar should be back in your target 4 hours after the start of your bolus.

Example :
meal bolus = 4 units
basal = 1.0 units/h
Temporary rate = 0% X 2 hours

$$\text{Super bolus} = 4 \text{ units} + (2 \times 1.0 \text{ u of basal}) = 6 \text{ units}$$

You may need to try different temporary rates and different lengths of time. Testing every 2 hours, and keeping good notes will help you and your diabetes team decide what works best.

Appendix I: ANNUAL CLINIC VISIT

WHY:

- Once per year, we need to update you on new protocols and pump strategies.
- To accomplish more during your clinic time, and avoid being sent home with more testing and follow-up for missing information.
- To take the “guesswork” out of adjusting your child’s insulin.

WHAT TO BRING WITH YOU:

1. Besides your usual log, at least three days of extra testing following the same schedule you used at your child’s pump start:

12:00a 3:00a breakfast / 2h after lunch / 2h after supper / 2h after bedtime

For those 3 days -

- No snacks (if possible).
 - No correction boluses at bedtime or overnight unless blood glucose is > 15.0
 - Please note any exercise.
 - If you choose to download your readings via computer, make sure you send them to your doctor at least 3 days before your clinic visit.
2. A **3-day food record using the form that follows (Appendix II)** that includes -
 - All foods eaten including non-carbohydrate foods
 - The portion size or amount eaten (weight, mL or pieces) and carbohydrate amount that you calculate
 - All blood sugar tests, insulin doses and any comments
 - If a low blood sugar occurred, please also include information on the treatment

ARRIVE AT 8:30 am FOR THE ANNUAL BLOOD TESTS. Your child may be asked to arrive fasting. He/she may eat after the blood test.

MORNING SCHEDULE:

1. Blood test (apply Emla at home if necessary).
 2. Review with the nurse and dietician.
 3. Clinic visit with your doctor.
- **Expect to be in clinic all morning.**
 - **You will receive a phone call a few days prior, to remind you of the Annual Visit.**



- **Please contact the nurse Anne (23084) or nutritionist Evelyne (23085) if you have questions, or if you wish to reschedule your Annual Review on a non-clinic day.**



Appendix II: Bilan alimentaire / Food record Nom/ Name _____

Date Date	Repas & heure Meal & time	Glycémie Glucose	Insuline Insulin	Nourriture Food	Quantité Portion	Glucides Carb	Commentaires (activités, maladie, etc) Comments (activity, illness, etc.)



--	--	--	--	--	--	--	--



APPENDIX III : TRAVEL LIST FOR PUMPERS

- Pack DOUBLE what you think you will need for the length of your vacation.
- Keep supplies in separate carry-on bags in case one is lost or stolen.
- Do not pack insulin in a bag that will go into the baggage compartment of the plane, it will freeze.
- Never expose your pump to X-rays and other scans. It can be removed safely for about an hour. Always check your blood sugar before pump removal, and after re-attaching.
- Disconnect any remote devices (meters, glucose sensor, etc.).

<p><u>Pump supplies:</u></p> <ul style="list-style-type: none"> • Rapid insulin in a small cooler or "Frio" bag. • Infusion sets • Reservoirs • 2 glucometers; strips • Batteries (for pump and glucometer) • Emla cream • Alcohol swabs • IV Prep (if used) • IV 3000 or Tegaderm transparent tape 	<p><u>Pump malfunction or lost/stolen:</u></p> <ul style="list-style-type: none"> • Long-acting insulin (Lantus, Levemir) ** refer to "Guidelines for Temporary Removal of the Insulin Pump" • Insulin syringes or pens • Check with your pump rep if you can borrow a spare pump during your vacation.
<p><u>Hypoglycemia:</u></p> <ul style="list-style-type: none"> • Glucose tablets • Juice boxes • Small snacks • Glucagon 	<p><u>Hyperglycemia and/or Illness:</u></p> <ul style="list-style-type: none"> • Precision Xtra or NovaMax Plus glucometer with ketone strips • Ketostix urine dips as back-up • Insulin syringes or pens • Gravol

OTHER THINGS TO REMEMBER:

- Travel letter for Customs
- Phone numbers:
 - your doctor and/or nurse
 - the on-call service



- your pharmacy

Appendix IV - Managing Activity

How Much Carbohydrate do you need to Prevent Hypoglycemia?

General Guidelines and Typical Carbohydrate Requirements for **One Hour** of Different Activities

Notice -- the more you weigh....the more you need to eat!

Activity	Grams of Carbohydrate per kg weight per hour	If you weigh :		
		20 kg (45 lbs)	45 kg (100 lbs)	68 kg (150 lbs)
		Suggested snacks in grams of Carbohydrate		
Badminton	0.4	10	20	30
Baseball	0.6	12	25	35
Basketball - moderate	0.8	15	35	55
- vigorous	1.3	30	60	90
Bowling	0.3	6	15	20
Bicycling				
Slow (8 km/h)	0.3	6	15	20
Moderate (15 km/h)	0.7	15	30	45
Fast (25 km/h)	1.0	20	45	70
Dancing -moderate	0.4	10	20	30
- vigorous	0.7	15	30	45
Disco dancing	0.6	12	25	35
Gardening/Yardwork				
Light	0.2	5	10	15
Raking leaves	0.4	10	20	30
Digging	0.6	12	25	40
Chopping wood	0.6	12	25	40
Digging ditches	0.7	15	30	45
Shoveling snow	0.7	15	30	45
Lawn mowing	0.3	6	15	20
Golfing with cart	0.2	5	10	15
Golfing with pull cart	0.3	6	15	20
Horseback riding - trot	0.4	8	20	30
House cleaning				



Mopping floors	0.3	6	15	20
Scrubbing floors	0.4	10	20	30

Activity	Grams of Carbohydrate per kg weight per hour	If you weigh :		
		20 kg (45 lbs)	45 kg (100 lbs)	68 kg (150 lbs)
		Suggested snacks in grams of Carbohydrate		
Ice skating - moderate	0.6	12	25	40
Jogging				
Slow (8 km/h)	0.7	15	30	45
Moderate(11 km/h)	1.1	20	50	75
Fast (14 km/h)	1.6	30	70	100
Racquetball-singles	1.3	25	60	90
Rock climbing	0.7	15	30	45
Roller skating	0.4	10	20	30
Skiing				
Downhill	0.8	15	35	50
Cross country	1.6	30	70	105
Water	1.0	20	45	70
Soccer	0.9	20	40	60
Softball	0.4	10	20	30
Squash	0.9	20	40	60
Swimming - slow	0.9	20	40	60
fast	1.5	35	70	100
playing in the pool	1.0	20	45	70
Tennis				
doubles	0.4	10	20	30
singles	0.6	12	25	40
Trampoline	0.6	12	25	40
Volleyball	0.4	10	20	30
Walking - Shopping	0.3	6	15	20
Moderate (5 km/h)	0.3	6	15	20
Fast (7 km/h)	0.6	12	30	40

References:

- 1) Colberg S. *Diabetic Athletes Handbook*, Champaign, IL: Human Kinetics, 2009
- 2) Scheiner G. *Think Like a Pancreas*, Cambridge, MA: Da Capo Press, 2004
- 3) University of California San Francisco Diabetes Teaching Centre; Snacks for Exercise
- 4) Walsh J, Roberts R. *Pumping Insulin*, 4th ed. San Diego, CA: Torrey Pines Press, 2006.
- 5) Langley S. *Sports Nutrition Workshop*, Dietitians of Canada; Montreal, 2009



6) Perkins B, Riddell M; Exercise and the insulin pump; *Can J Diab* 2006;30 (1) 72-79.



ACTIVITÉ ACTIVITY	GLUCIDES SUPPLÉMENTAIRES EXTRA CARBS	DÉBIT BASAL TEMPORAIRE TEMPORARY BASAL RATE	CHANGEMENT DE BOLUS REPAS MEAL BOLUS CHANGE



Appendix V : Carb Factors for Various Foods

Using A Digital Gram Scale And Carb Factors To Calculate Your Carbohydrate

What is a carb factor?

A carb factor represents the amount of carbohydrate found in 1 gram of a food. It corresponds to the amount of carbohydrate that is available to *raise* the blood glucose, and does not include fibre. This is another way of calculating the carbohydrate in the foods that you eat. This method is especially useful for people interested in more precise carbohydrate calculations, and is better for certain foods that are difficult to measure using a measuring cup.

How to use the carb factor

To use the carb factor, you will require a digital gram food scale that can weigh foods in 1 gram increments. After weighing your portion of a food, you should multiply its weight by the carb factor for that food to calculate the amount of carbohydrate in your serving.

Example:

A whole apple weighing 174 g

Carb factor = 0.11

Total carbohydrate in your apple = $174 \times 0.11 = 19 \text{ gm}$

Calculating the carb factor for your favourite recipes

You may wish to calculate the carb factor for your own recipes. This is especially useful for breads, cakes and combined dishes such as lasagna.

To calculate your carb factor, you will need to add up the total carbohydrate for the entire recipe using food tables such as the *Nutrient Value of Some Common Foods*. Remember to subtract all dietary fibre. Once the food is cooked, you will need to weigh the cooked/baked product.

To calculate the carb factor for that food, divide the weight (in grams) into the total grams of carbohydrate (total carb \div total weight). The number should be less than 1. This is the carb factor for that food. You need only weigh your portion of this food and multiple the weight by its carb factor to calculate the carb content of your serving.

Example:

Banana bread recipe.

Total carbohydrate of all ingredients = 347 g

Total weight after baking = 630 g

Carb factor = $347 \div 630 = 0.55$



Carb Factors for Various Foods

Beverages		Grains and Cereals	
Soft drinks	0.10	Bagel	0.51
Chocolate milk	0.10	Bread, crumbs	0.67
Eggnog	0.14	French	0.49
Milk	0.05	Italian	0.47
Fruit Punch	0.13	Pita, white	0.54
Alcoholic beverages		Pita, whole wheat	0.48
Beer, de-alcoholized	0.13	Rye	0.43
Light	0.01	Sticks	0.65
Regular	0.03	White	0.52
Liquor	0.45	Whole wheat	0.39
Wine: sweet	0.14	Cornstarch	0.90
Cereal, cold, ready-to-eat		Flour, Wheat, all-purpose	0.73
All Bran	0.42	French Toast	0.29
Cheerios, regular	0.64	Kasha, (Buckwheat groats)	0.17
Corn Flakes	0.84	Matzo	0.81
Granola, Harvest Crunch	0.68	Muffin, English	0.43
Grape nuts	0.70	Muffins, commercial	0.45
Raisin Bran	0.68	Pancake, buttermilk mix	
Rice Krispies	0.85	Mix alone,	0.69
Shredded Wheat	0.69	Prepared	0.42
Special K	0.74	Rice, long or short grain, cooked	0.26
		Wild	0.20
Cereals, hot, cooked in water		Spaghetti: plain	0.26
Oatmeal, minute	0.10	With sauce	0.15
Cream of Wheat, quick	0.10	Tortellini, cheese	0.30
		Tortillas, corn	0.40
		Wheat	0.52

Prepared dishes			
Burrito, beef	0.24	Pizza, cheese, thin-crust	0.27
Lasagna, vegetarian	0.16	Stew, beef and vegetable	0.06
Meat	0.12	Salad, coleslaw	0.11
Macaroni and cheese	0.22	Salad, potato	0.12
Pie, chicken-pot	0.24	Shepherd's Pie (with corn; Pâté chinois)	0.12



Fruits			
Apple, cored, seeded, not peeled	0.13	Lemon	0.07
Fresh, whole	0.11	Lime	0.08
Applesauce, unsweetened	0.10	Mango, sliced, cubed	0.15
Apricots: fresh	0.09	Melon, cantaloupe, peeled, seeded	0.08
Canned, light syrup	0.15	With peel, seeded	0.06
Dried, uncooked	0.55	Honeydew, cubed, peeled	0.08
Banana, peeled	0.21	With peel, seeded	0.09
Whole, with peel	0.15	Orange, peeled	0.10
Blackberry, raw	0.04	Navel, including peel	0.07
Blueberries, raw	0.12	Tangerine/clementine, peeled	0.12
Cherries, Canned, in water	0.10	Tangerine/clementine, unpeeled	0.09
Fresh, sour, whole	0.10	Papaya, peeled, seeded	0.08
Fresh, sweet, whole	0.15	Peach, whole, fresh	0.07
Maraschino	0.39	Canned, in juice	0.10
Cranberries, raw	0.08	Canned, in water	0.05
Sauce, sweetened	0.38	Pear, whole, fresh	0.12
Dried, sweetened	0.77	Canned, in juice	0.11
Dates, dried and pitted	0.68	Pineapple: fresh, diced/sliced	0.11
Fig, fresh	0.16	Canned in water	0.08
Dried	0.54	Canned in juice or light syrup	0.15
Fruit cocktail, canned in water	0.08	Plum, fresh, whole	0.11
Packed in water		Prunes, dried	0.56
Grapefruit, peeled	0.07	Raisins	0.77
With peel	0.04	Raspberries	0.06
Grapes, seedless	0.17	Strawberries	0.05
With seeds	0.15	Watermelon, cubed	0.07
Kiwi	0.11		
Juice			
Apple: juice	0.12	Lemon, fresh	0.09
Cider	0.14	Lemonade, from frozen concentrate	0.10
Apricot, nectar	0.14	Orange: all types, unsweetened	0.10
Carrot	0.08	Canned, unsweetened	0.10
Cranberry, cocktail	0.14	Papaya	0.12
Grape: frozen, from concentrate	0.13	Pineapple, canned	0.14
Bottled	0.15	Prune	0.16
Grapefruit, fresh or canned, unsweetened.	0.09	Tomato	0.04
From frozen / with orange:	0.10	V-8	0.04



Vegetables and Legumes			
Artichoke, hearts	0.06	Corn, Cream style, canned	0.17
Asparagus	0.02	Cucumber	0.01
Avocado	0.02	Eggplant, cooked	0.06
Bamboo, sprouts	0.02	Lentils	0.16
Bean sprouts	0.06	Lettuce, romaine	0.01
Beans, black, kidney, cooked	0.13	Iceberg	0.02
Garbanzo (chick peas), cooked	0.23	Mushrooms, cooked	0.02
Green/string	0.05	Onion, raw	0.07
Lima, cooked	0.18	Parsnips, cooked	0.14
Navy, cooked	0.19	Peas, green	0.10
Pinto, cooked	0.17	Peppers, green, raw, seeded	0.03
Soy, cooked	0.04	Red, raw, seeded	0.05
Beets, boiled and drained	0.06	Potato, baked, flesh and peel	0.19
Broccoli	0.05	Boiled, peeled	0.19
Cabbage, raw	0.04	Hash brown	0.26
Cooked	0.03	French fried	0.28
Chinese, raw	0.02	Pumpkin, cooked, canned	0.05
Chinese, cooked	0.02	Radish	0.02
Brussels sprouts, cooked	0.04	Sauerkraut	0.02
Carrot, raw	0.06	Spinach	0.01
Carrot, cooked	0.06	Squash, summer, cooked	0.03
Cauliflower, raw	0.04	Winter, cooked	0.07
Cooked	0.01	Tomato, slices; cherry	0.03
Celery	0.01	Whole, raw	0.02
Corn, kernels, canned	0.16	Turnip, cooked	0.03
on the cob, cooked	0.09	Yams, peeled, boiled	0.24
Sauces and condiments			
Bacon bits, artificial	0.16	Sauce, chili	0.14
Ketchup	0.24	Soy	0.07
Pickles, sweet	0.31	Steak	0.14
Relish, sweet	0.34	Sweet and sour	0.25
Salsa, Mexican	0.05	Tartar	0.08
Sauce,		Tomato	0.06
BBQ	0.12	Tomato paste	0.14



Sweets			
Banana bread	0.53	Danish, cheese	0.36
Brownie	0.62	Fruit	0.46
Cake: Angel food	0.57	Donut, plain	0.48
Fruit	0.58	Iced	0.46
Sponge	0.61	Honey	0.82
Candies: caramel	0.76	Ice cream	
Fudge, chocolate with nuts	0.65	Plain	0.27
Hard	0.98	Cone alone (waffle)	0.76
Jelly beans	0.84	Jam	0.68
Lollypop	0.99	Pie: apple	0.32
Cookies: animal	0.72	Blueberry	0.34
Chocolate chip	0.70	Cherry	0.39
Chocolate chip, gourmet	0.61	Lemon meringue	0.46
Fig	0.66	Pecan	0.54
Gingersnap	0.75	Pumpkin	0.25
Oatmeal raisin	0.66	Sherbet	0.27
		Syrup, chocolate, thin	0.63

Snack foods			
Almonds, dry-roasted, unbalanced	0.07	Nuts, walnut	0.07
Banana chips	0.51	Mixed, dry-roasted	0.07
Cashews, dry-roasted	0.30	Pecans, dry-roasted	0.04
Chips: tortilla	0.56	Pistachios, in shell	0.22
Chips	0.50	Peanut, dry-roasted	0.14
Crackers:		Butter	0.14
Soda	0.75	Popcorn, microwave, low-fat	0.59
Graham	0.71	Pretzels, salted	0.77
Marshmallows	0.81	Sunflower seeds	0.13
Muffin, commercial	0.45		

Adapted by Evelyne Pytka PDt, CDE from:

-John Walsh; *Pumping Insulin*, 4th edition. 2006. Torrey Pines Press, San Diego CA

-Canadian Nutrient File, 2009; <http://webprod.hc-sc.gc.ca/cnf-fce/index-eng.jsp>

-USDA Agricultural Research Services 2010 <http://www.nal.usda.gov/fnic/foodcomp/search/>



Appendix VI: Carbohydrate Counting Tricks and Tips For Estimating carbs when you are eating out

- 🍎 Use your scale, measuring cups and measuring spoons to measure portion sizes and calculate your carbohydrate when you are home
- 🍎 Compare your calculated portion to different parts of your child's hand and your own hand to help you evaluate your carbs without measuring when you are not at home.
 - Use your **fist** to evaluate portions of foods such as
 - Pasta
 - Rice
 - Mashed potatoes
 - Muffins
 - Piece of fruit (apple, pear, etc.)
 - Use the **palm of your hand** to evaluate portions of protein (meat, fish, and poultry), slices of pizza and bread, etc.
 - Use the **tip of your thumb** to evaluate portions of jams, sauces, etc.
- 🍎 Practice using your hands to evaluate your foods at home. Use your scale, measuring cups and measuring spoons to check your calculations. You may wish to record your measures on the accompanying chart!
- 🍎 Other practical tips:
 - many restaurants have nutritional information available on-line and on-site
 - compare an unknown food with a similar food that you eat more often!





This manual was created by the clinicians of the Montreal Children's Hospital Pediatric Insulin Pump Centre, who are solely responsible for its content.

The production of this manual was made possible thanks to the assistance of Eli Lilly Canada. We wish to gratefully acknowledge and thank Eli Lilly Canada for their generous support which has enabled every family who begins insulin pump therapy at our clinic to obtain one copy of this manual without charge.

<http://www.lilly.ca/>

Additional printed copies may be obtained for \$8. To obtain a free electronic copy, visit the Insulin Pump Centre (under Departments) at our web site: <http://www.thechildren.com>