

# Diabetes in children and young adults



**Vijayalakshmi Bhatia and Eesh Bhatia**

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## **Preface**

In the management of diabetes, the role of the patient and family is far greater than that of the medical team. All your daily activities have an impact on your diabetes control. It will not be possible for you to consult your diabetes team daily. Therefore you need to have plenty of knowledge regarding all aspects of diabetes, so that you can take good decisions at home. In this book, diabetes of childhood and adolescence has been described in detail.

It is possible to have a normal, active and satisfying life with diabetes. School, college, sports, employment, marriage are all perfectly feasible as long as you pay attention to your health.

We hope this booklet will help you gain some knowledge and give you the confidence to have a full and active life. We dedicate this first English edition of the book to Mrs. Nirmala Verghese, our first diabetes nurse educator at SGPGIMS.

Vijayalakshmi Bhatia  
Eesh Bhatia

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# 1

## Diabetes-An Introduction

### Summary

1. **Diabetes mellitus is a condition where the body is not able to make enough of the hormone insulin. When insulin production is insufficient, our body cannot utilize glucose (produced by digestion of food) to make energy. Therefore, glucose rises in the blood and spills out into urine also.**
2. **Diabetes is of two main types: insulin dependent and non insulin dependent.**
3. **Care regarding nutrition, medicines (insulin injection or tablets) and exercise are essential in the treatment of diabetes. Daily measurement of blood glucose at home is also necessary.**
4. **Good control of blood glucose is important. This will help in avoiding complications of diabetes and in leading a healthy life.**

Diabetes is seen commonly in India. Even if one has diabetes, one can lead a normal life, provided attention is given to diet, exercise and medicines. In this chapter we will discuss in brief the causes of diabetes, its symptoms and treatment.

### What is diabetes

Diabetes is a condition where the body is not able to produce enough of the hormone insulin. To know more about diabetes, we have to understand how the hormone insulin helps our body to convert food into energy. Our food which gets digested in the intestines is converted into glucose, which is absorbed into the blood. When glucose content increases in blood, it causes release of insulin from the pancreas, an organ which is situated in our abdomen, near the stomach. (Fig. 1A and 1B). Insulin enables transfer of glucose from the blood to the cells of the body, where it is converted into energy. Thus, insulin is a kind of key which opens the door to each cell and allows glucose to enter in. When insulin is insufficient, glucose is unable to enter the cells to give energy; its level rises in blood.

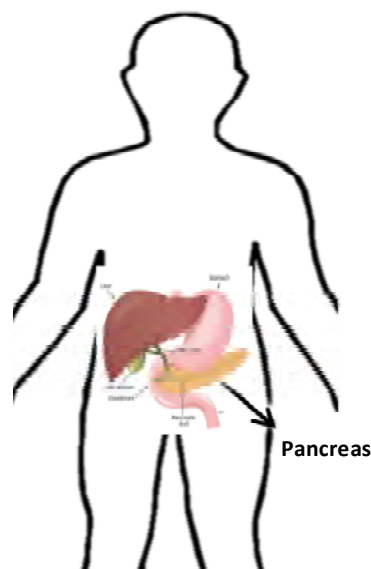


Fig. 1A:

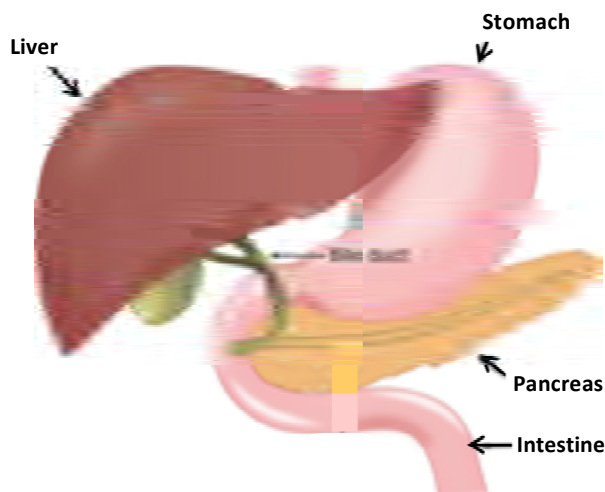


Fig. 1B:

**Fig 1A and B: The pancreas is an organ situated below the stomach. Insulin produced in the pancreas enters the blood and acts on tissues of the body such as liver, fat and muscle.**

### Consequences of increase in blood glucose:

1. Tiredness
2. Increased amounts of urine.
3. Excessive thirst

4. Weight loss
5. Increased hunger

### What are the different types of diabetes?

*Insulin dependent (Type 1) diabetes:* This type of diabetes starts at a young age. Daily doses of insulin injection are absolutely essential to reduce blood glucose and to keep you healthy, as the pancreas stops making insulin.

*Non-insulin dependent (Type 2) diabetes:* This is generally found in people above the age of 40 years, but is increasingly being seen in children and adolescents, especially in those who are overweight. In this condition, insulin is made by the pancreas but is unable to exert its action on the cells of the body. Control of body weight helps to control blood glucose. Treatment of type 2 diabetes is possible through tablets taken by mouth, but after some years insulin injection often becomes necessary in this type of diabetes also.

### Why does diabetes occur?

The exact cause of diabetes is still unknown. The following reasons may be partially responsible for the disease.

1. **Autoimmunity:** Our body has an army called the 'immune system', which protects us from infections like viruses and bacteria, on a daily basis. Sometimes, the immune system forgets to differentiate between the body's own organ and an outside invader like infections, and starts fighting against and destroying the body's own organ. When this "auto immunity" affects the insulin producing cells of the pancreas, one develops type 1 diabetes.
2. **Heredity:** If someone in your family has diabetes then the chances of your developing diabetes is higher. The possibility is 5-10% in type 1 and upto 30% in type 2 diabetes.
3. **Increased weight:** Type 2 diabetes is generally seen in people who are overweight. Hence, regulated diet and regular exercise is the easiest way to avoid getting this type of diabetes.
4. **Age:** Out of every 100 people between the age of 40-50 years, 5 to 7 develop type 2 diabetes, whereas out of every 100 people older than 60 years, 10-15 develop it. Therefore, every individual older than 40 years should get his or her blood sugar tested every 2-3 years. This is

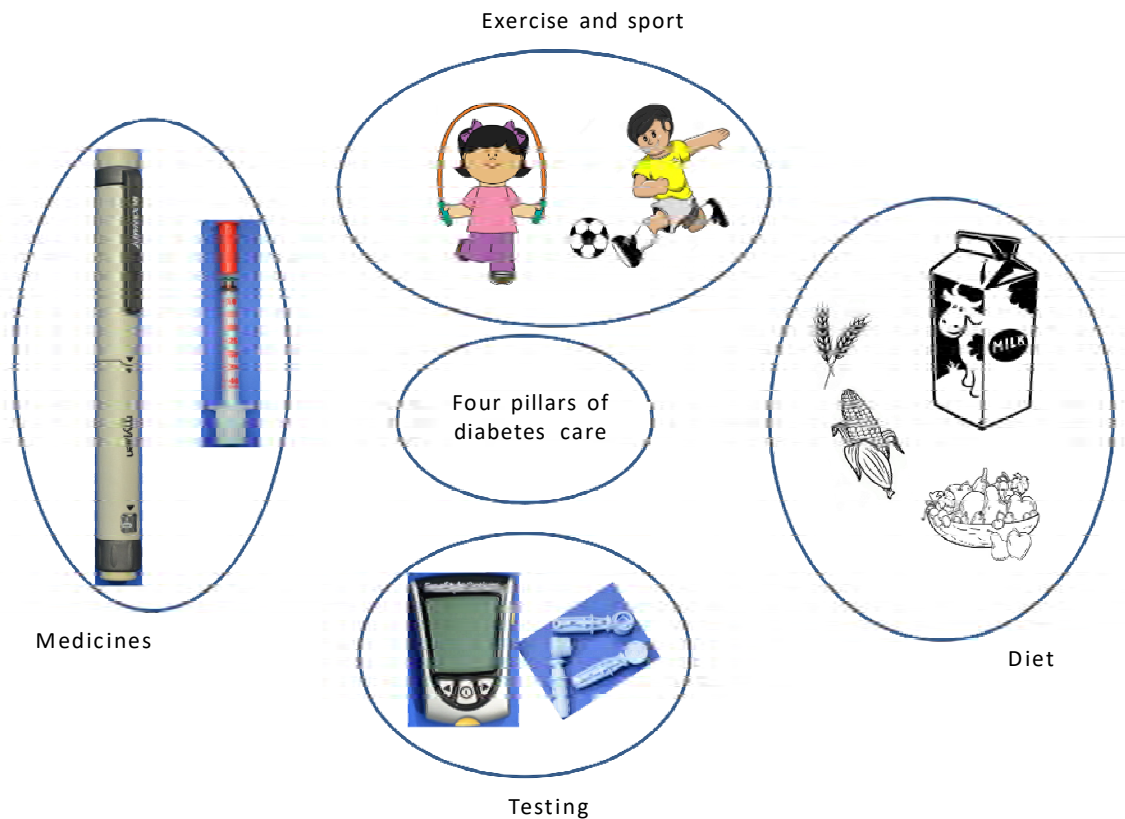


Fig. 2 The pillars of diabetes management

all the more urgent if you are overweight, have high blood pressure or have had a heart attack, or members of your family have diabetes.

## Treatment of diabetes

To remain healthy it is necessary to keep the blood sugar as close to normal as possible, so that chances of diabetes related complications in the future are low. In order to attain this goal, proper attention must be given to the following :

1. **Food:** Healthy diet is essential in the treatment of diabetes. What should be eaten and in what quantities depends upon your height, weight and occupation. However the ideal diet for a person with diabetes is not different from a healthy diet for anyone, with a few additional precautions.
2. **Insulin:** When the body is not able to produce insulin, it becomes necessary to supply insulin as a medicine. This treatment is essential and life saving for people with type 1 diabetes; they are insulin dependent. Patients with type 2 diabetes will also often require insulin after a few years of diabetes.
3. **Tablets:** The pancreas can be activated to make more insulin or the insulin produced by the pancreas can be made more active, through administration of tablets. This is useful only for type 2 diabetes.
4. **Exercise:** Exercise is essential for everybody. Exercise keeps the body healthy and reduces overweight, and makes the insulin more effective.
5. **Tests:** To know about the control of diabetes, tests have to be done at regular intervals. Home blood sugar tests, glycosylated hemoglobin

(HbA1c), urine or blood ketones test, urine microalbumin, eye (retina) checkup, ECG, cholesterol (lipid profile) are some of the tests.

## Some frequently asked questions

1. Is there any cure for diabetes?

No, at present there is no medicine which will cure diabetes, but it is possible that patients of type 2 diabetes can keep a control over their condition without taking medicines, provided they regulate their weight and diet.

2. Is type 1 diabetes more dangerous than type 2 diabetes?

No, both categories of people can lead a normal life if they keep their blood glucose, blood pressure and other tests in a good range.

3. Have there been any new discoveries in the treatment of diabetes?

Nowadays, it is possible to operate upon a diabetic patient and transplant a new pancreas. The results of such a surgery are miraculous. In future it is possible that several diabetic patients may avail of this opportunity for cure. In addition, several instruments are being used for automatic measuring of glucose (CGMS, continuous glucose monitoring system) without multiple finger pricks and insulin pumps can deliver insulin very precisely at different rates in the 24 hour period, without multiple injections. The "artificial pancreas" is an instrument which connects the inputs from a CGMS to the insulin output of a pump. The pump thus delivers insulin at a rate in keeping with the current blood glucose (just like the human pancreas). It has recently been approved for marketing in some countries.



# 2

## Insulin Injection

### Summary

- In type 1 diabetes, it is essential to take insulin injections everyday.  
In type 2 diabetes also, the need for insulin may arise after some years.
- There are two types of insulin-one where the effect of insulin remains for a short time, this is taken with meals. The second type of insulin is effective for a long time after injection.
- Insulin is measured in terms of units. In India, we get insulin in two strengths-40 unit per ml and 100 unit/ml. For 40 unit/ml insulin, always use a 40 unit syringe.
- As far as possible, insulin should be kept in the refrigerator. If it is not possible then it may be kept in a shady place in a wet cloth or in water in an earthenware pot placed in wet sand.
- Insulin should not be injected in the same place repeatedly.
- Do not stop insulin during any illness. On the other hand, you may need to take it in increased doses.
- A single insulin syringe or needle should not be used more than 2-3 times. The needle becomes blunt and hence you may feel pain.

### Which individuals require insulin?

Those who have diabetes from childhood (insulin dependent or type 1 diabetes) should necessarily take insulin injection every day throughout life. People with type 2 diabetes may also require insulin after some years.

**Action of insulin** - There are two types of insulin – one which acts for a shorter time (eg. regular insulin) and the other which is long acting (eg. NPH insulin) (table 1). Regular insulin is the one which is also made in our pancreas. This looks clear like water and is taken 3-4 times a day before major meals and smaller snacks. (fig. 1) Long acting insulin NPH is taken twice a day. (fig. 2) It has a cloudy or milky appearance, and the bottle should be rolled between your palms to uniformly mix the contents, before injection.

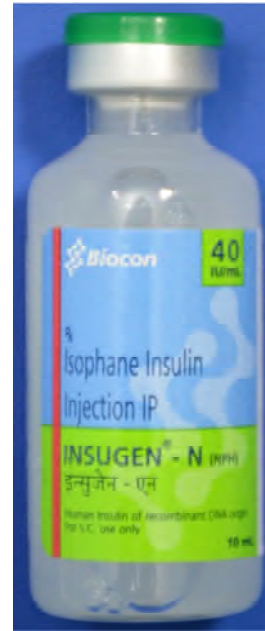
**Some newer insulins** - Lispro, aspart or glulisine insulin can be taken before meals, instead of regular insulin. These start acting faster than regular insulin and remain active also for a shorter duration. (fig. 3) Your doctor will advise you as to when it should be taken and which patient can take it. Similarly glargine or detemir can be used instead of NPH for long acting insulin. (tables 1, 2).

**Table 1: Types of insulin**

	<b>Rapid acting insulin (eg. aspart/ lispro/ glulisine)</b>	<b>Short acting (regular insulin)</b>	<b>Intermediate acting insulin (NPH insulin)</b>	<b>Long acting insulin (e.g. glargine/ detemir)</b>
Onset	15 min.	30 min.	½ –2 hours	--
Peak	1–1½ hours	2-3 hours	6-8 hours	--
Duration	3-4 hours	6-8 hours	12-16 hours	18-24 hours
Injection to be taken	15 min before meal	30 min. before meal	Morning and evening as per doctor's prescription	As per doctor's instructions
Expected action	Glucose control after food	Glucose control after food	Glucose control before food	Glucose control before food



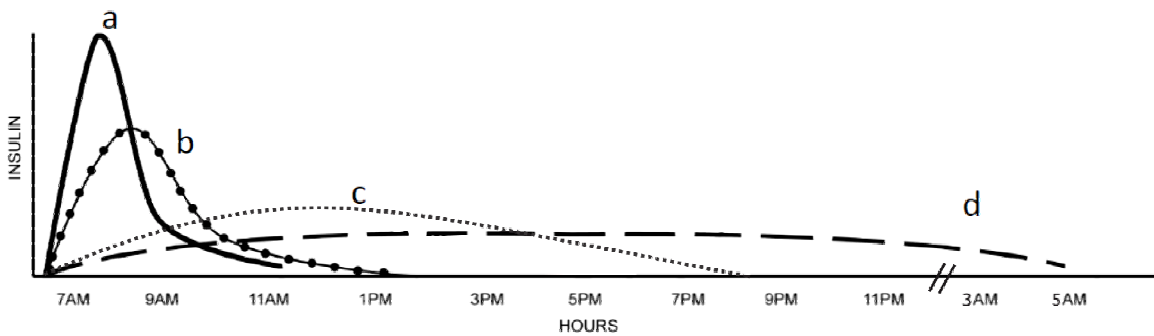
**Fig 1: Regular insulin:** This insulin is clear like water. It is the same as the insulin which is made in our body. It has a quick action, hence it is taken with meals. On the left is a 40 Units per ml bottle and on the right a 100 Units per ml bottle.



**Fig 2: NPH insulin:** This appears cloudy. It is made in the laboratory by adding some chemicals to natural insulin, making it have a long duration of action of 12 hours. Therefore, it is taken twice a day.

**Table 2: Some insulins available in India**

Company	Short acting	Intermediate acting	Premixed insulin	Rapid acting	Long acting or peakless
Novo Nordisk	Actrapid	Insulatard	Human Mixtard	Novorapid	Levemir
Eli Lilly	Huminsulin R	Huminsulin N	Huminsulin 30/70	Humalog	
Biocon	Insugen R	Insugen N	Insugen 30/70	-	Basalog
Shreya	Recosulin R	Recosulin N	Recosulin 30/70	-	
Aventis	Insuman R	Insuman N	Insuman 30/70	Apidra	Lantus
Wockhard	Wosulin R	Wosulin N	Wosulin 30/70		Glaritus



- a \_\_\_\_\_ Rapid acting: Insulin lispro / aspart / glulisine
- b ..... Early acting: Regular insulin
- c ..... Intermediate acting: NPH insulin
- d - - - - Long acting: Insulin glargine or detemir

**Fig 3: Action profile of various insulins:** rapid acting such as lispro, aspart and glulisine; short acting such as regular insulin; intermediate acting such as NPH insulin; long acting such as glargine or detemir.



Fig 4A: 40 Unit/ml insulin and 40 Unit/ml syringe (always use 40 Unit insulin with a 40 Unit syringe)



Fig 4B: 100 Unit/ml insulin and 100 Unit/ml syringe (always use 100 Unit insulin with a 100 Unit syringe). Shown here is also an insulin cartridge to be used with an insulin pen. Remember, the cartridge is always 100 Unit/ ml; in case it ever becomes necessary to use a cartridge with a syringe, use it with a 100 Unit syringe.

### How do we measure insulin? Insulin syringe

Insulin is measured in terms of units. Your doctor or nurse will be able to tell you how many units of insulin you require. In India, we get insulin in 2 strengths – 40 units per ml. and 100 units per ml (fig. 4 A, B) and the corresponding syringe is 40 or 100 unit/ml. You should always make sure that your insulin bottle as well as syringe contains the same measure indicator i.e. 40 unit insulin should be taken in a 40 unit syringe, and 100 U insulin with a 100 U syringe.

**Insulin pen :** Insulin injections can be taken by a pen instead of a syringe (fig.5). This pen resembles a big fountain pen. Many people prefer the pen to the syringes even though they are costlier, as they are easier to use and carry to school/work.

**Remember, the insulin in a cartridge which fits into the pen is of 100 U/ml type – never use it with a 40 U syringe.**



Fig 5: Insulin pens

### How do we draw up a dose of insulin?

1. Wipe the surface of the bottle with spirit and cotton. Wait for 2 minutes for the spirit to dry and disinfect the cap. Pierce the needle into the bottle and push in air (as much as at the units of insulin you will take).
2. Do not remove the needle from the bottle. Invert the bottle upside down and draw the plunger of the syringe downwards. Insulin will enter into the syringe. If there are air bubbles, tap the syringe while holding it upright, and expel the air.
3. Now the syringe is ready for injection.

### How to measure mixed injections (regular and NPH combined)

1. Wipe the top of both regular as well as milky white NPH bottles with spirit and cotton.
2. Turn the bottle of NPH upside down and roll the bottle in the palm of your hand to mix the insulin nicely.

3. Draw the plunger down, to fill the syringe with air. Pierce the needle into the NPH bottle and inject air into the bottle. Remove the needle from the bottle. Similarly, fill air into the bottle of regular insulin. Let the needle remain in the bottle.
4. Invert the regular insulin bottle. Draw the desired units of insulin into the syringe, and remove the air bubbles.
5. Now insert the needle in the milky white bottle (NPH).
6. Allow the plunger to slowly come up to the level of the total mixed dosage. Remove the needle from the bottle.

Now there is appropriate mixture of regular and NPH insulin and this mixture is ready for use.

### How should we give an insulin injection?

Insulin injection should be given 30 minutes before the meal (If you are using rapid insulin such as Humalog or Novorapid instead of regular insulin, then the injection should be taken 15 minutes before the meal). Injection may be given in the arm, thigh or abdomen or buttocks, as seen in figure 6. The site of injection should be rotated. Every new injection should be at a distance of 1 inch from the previous one. In this way if you have finished with one side of the arm and then the thigh, then you can start with the other side. Drawing a circle around the injection site with a

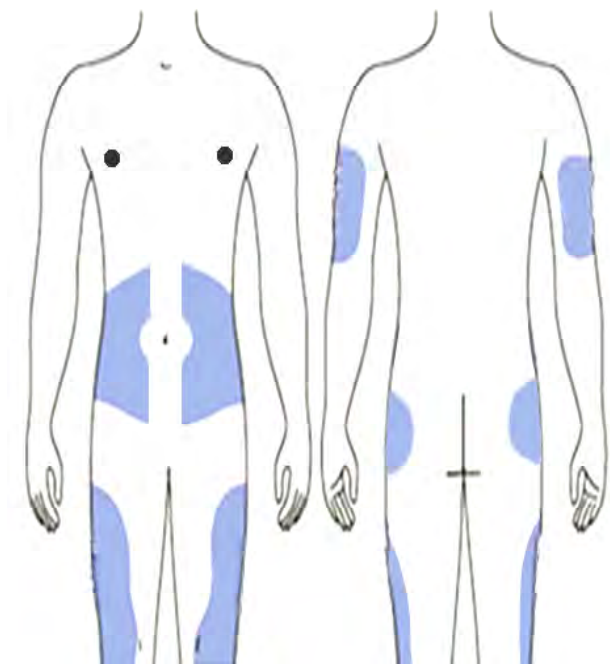


Fig. 6: Sites for insulin injection

ball point pen will help you choose a site 1" away for the next injection. If possible, do not take regular or rapid insulin in an exercising limb. Thus, you may prefer the abdomen for regular or rapid insulin and the thighs/buttocks/arms for NPH or glargine insulin.

### Precaution while giving the injection

1. Wipe the skin with cotton and spirit and allow it to dry. Never wipe the needle with spirit.
2. Hold the syringe like a pencil and pierce the needle directly into the skin. Slowly bring the plunger down.

Press the spot where the injection has been given with cotton and spirit. Slowly remove the needle. If you are using a pen, then remove the needle from the skin only ten seconds after delivering all the insulin, so that the medicine does not spill out. Sometimes a little drop of blood appears; do not worry, just press the spot with your finger for a minute. The correct method to give insulin is shown in figure 7.

### How do we store insulin?

When you are not using insulin, it should be stored in the refrigerator but remember never to store it in the freezer. If you do not have a refrigerator, then wrap the insulin in a damp cloth and keep it in a cool shady place away from the sun. It can also be kept in a clay pot filled with water.



Fig. 7: Procedure for insulin injection

Those who are using a pen should remember not to keep the pen in the refrigerator. Only extra insulin cartridges should be kept in the refrigerator. The pen with the cartridge in current use can be kept in the room during winter months (between October-February). During summer months these may be kept in a cool pack. To know more about a cool pack, please ask anyone from the diabetes team.

**Points to remember while buying insulin:**

1. Please make sure to check the expiry date.
2. U40 syringe should be bought with U40 insulin.
3. Check whether the shop keeper is taking out the insulin from the refrigerator or not.

One extra bottle of insulin should always be kept in the house, for an emergency in case of breakage of the vial in use. Extra bottles may be stored carefully in the refrigerator.

**What is an insulin pump?**

This is a new method to take insulin. A pump is like a small mobile phone in which a bottle of regular or rapid insulin is placed. A thin plastic tube carries the insulin from the bottle to the body just like the ordinary injection which you take. The only difference is that

the tube remains in the injection site, under the skin, and is changed once in three days. The pump can be programmed so that it releases a greater dose of insulin before meal time (bolus dose) and small continuous doses when it is not meal time (a continuous or “basal” rate). This continuous dose takes the place of NPH or glargine insulin which are the basal insulin taken by pen or syringe. The basal rate can be preset at different rates, like at a lower rate for a few hours during midnight (to avoid hypoglycemia) or at a higher rate to avoid the early morning rise in blood sugar experienced by many people. You can always take a bolus during snack time or meals, without having to use the needle again and again. You can keep better glucose control by using the pump. But for taking full advantage of the pump, you should test your blood glucose 4-7 times a day, and adjust your insulin dose according to the intended meal intake. At the moment, the cost of the pump and tube are a bit high. Please contact our team if you want to know more about this.

**Please remember**

Insulin injection should be taken every day. Even during illness, do not stop taking insulin on your own. See chapter 7 for instructions on sick days.

# 3

## Diet and Diabetes

### Summary

1. To remain healthy, we need a balanced diet with sufficient amounts of carbohydrate, fat and protein, rich in vitamins and minerals.
2. Your daily diet with respect to quality as well as quantity should remain as constant as possible. With the help of the information given below you can bring variety to your daily diet.
3. Sweet items like sugar, honey, chocolate, sweets, toffees, beverages with sugar etc. should not be taken often. Sugar can sometimes be substituted with artificial sweeteners like aspartame or sucralose.
4. Fatty and oily food like poorie, parathe, dalmoth and other fried food, egg yolk, butter, ghee, cream and fatty meat should be taken in limited quantities. Ground nut, mustard, sunflower oils are some examples of unsaturated healthier fats.
5. Some bevarages like tea or coffee without sugar, lemon juice, or soda without sugar, home made vegetable soup, raw vegetables like cucumber, 'mooli' and 'kakdi' can be consumed at any time and in any quantity.
6. People using some types of insulin may need to take snacks in addition to the three major meals. Some extra carbohydrate should be taken before doing any exercise.
7. Never skip a meal; your blood sugar level will fall dangerously.

### What are the components of our diet?

Let us find out what constitutes our food. Food is generally comprised of one or more of the following components-carbohydrate, protein, fat, vitamins and minerals. The presence of these components in appropriate quantities in the food makes it a balanced diet. Protein is used for building and repair of the body, while carbohydrate and fat produce energy, which is either utilized by the body immediately or stored in

the form of fat and glycogen for future use. Energy from food is measured in calories. Calories from carbohydrates are available in the blood immediately, while calories from protein and fat take several hours to be absorbed into the blood. Examples of food rich in carbohydrate, fat or protein are given below in tables 1, 2 and 3.

**Table 1: Food containing carbohydrates:** (fig. 1)

Cereals - Wheat, rice, jawar, maize, bajra, millet, suji, maida etc.
Dal - All dals, rajma, chole, lobhiya, dry matar etc.
Veg and fruits - all.                      Milk & milk products

### Special instructions regarding food

Generally insulin is secreted from the pancreas according to the quantity of food consumed. But in a person with diabetes insulin is being provided by an injection and not the pancreas. Hence, insulin secretion cannot be automatically increased or shut off. Therefore, the following precautions should be observed by people with diabetes.

#### 1. Do not skip a meal

If you do not take food on time, your blood glucose will fall (because of the action of insulin or tablets), which may lead to a serious condition.

#### 2. Quantity and components of food

Your daily quantity of food consumed should ideally not vary too much. In addition, one should try to be consistent regarding quantity of food taken in the morning, afternoon and night. This is because your doctor has fixed your insulin or tablet dose according to your intake of food. If you change your food habits or quality of food taken daily, it will affect your blood sugar. Different food items have different quantities of carbohydrate, proteins and fats. For example: the energy derived from one paratha is not same as that from one chapatti. Similarly, there is more protein in dal, whereas in a roti of the same total calories, the carbohydrate component is greater.



Fig. 1: Examples of carbohydrates : cereal, fruit, vegetables

Table 2: Food rich in protein (fig. 2)

Protein + Carbohydrate + Fat	Protein + Fat	Protein + Carbohydrate
Milk	Egg	All dals
Curd	Chicken, partridge, (teetar), turkey	Food containing soya
	Mutton, kidney, liver	All grains (they have less protein)
	Fish	
	Paneer	
	Cheese	



Fig. 2: Examples of proteins: milk, paneer, cheese, curd (dahi), meat, fish, egg, dals

Table 3: Food rich in fats (fig. 3)

<u>Saturated Fat</u>	<u>Unsaturated Fat *</u>	<u>Trans Fat</u>
Mutton, liver, kidney, Egg yolk Ghee Butter Vanaspati ghee Coconut oil	Oil such as mustard oil, soyabean, sunflower oil, groundnut oil, corn and olive oils. (all oils except coconut oil) Fish Dry fruit	Vanaspati ghee All fried food purchased in the shop: samosa, pakora, burger, tikki, french fries, namkeen, biscuit, cakes, pastry etc. Oil which is repeatedly heated for deep frying.

\*Unsaturated fats are better for health. Saturated fat and trans fats should be used sparingly



**Fig. 3: Examples of fats – butter, oil, nuts**

This does not mean that you must take the same food day after day and month after month. If you learn enough about different food items, you can always exchange one food item with another. You can have one big slice of bread or 1/2 of a 150 ml. katori of rice instead of one 20 gm flour chapatti. Or one glass of curd (dahi) instead of a glass of milk, but not a banana, because these two foods contain different components. Fat, protein as well as carbohydrates are present in milk whereas a banana contains only carbohydrate.

A list of such information is given in this chapter and in the Appendix.

Our dieticians will also teach you this information. Occasional variations in the quantity and quality of a meal should be accompanied by appropriate alterations in the insulin dose before that meal.

### 3. Glycemic index

Low glycemic index foods are those which raise the blood glucose slowly and thus help in good blood

**Table 4-A Examples of low, moderate and high glycemic index foods**

<i>Use more</i>		<i>Use less</i>
<p><b><u>Low Glycemic Index (GI) Foods</u></b>            * Grain: missi roti (aata-besan-jau mixed) aata roti, idli            Dals : chana, choley, all dal            * Green vegetables            * Fruit : orange, mausmi, peach, apple and guava</p>	<p><b><u>Moderate GI Foods</u></b>            * Grain : rice, poha, noodles, pasta            * Fruit : mango, less ripened banana, papaya            * Vegetables : potato, sweet potato, green peas</p>	<p><b><u>High GI foods</u></b>            * Sugar, gur, honey, sugarcane juice, cold drinks            * Fruit : water melon, melon, cheeku, ripe bananas , dates            * Grain : cornflakes, maida products including maida noodles, white bread, cake.</p>

**Table 4-B: Food which can be taken at any time and any number of times**

<p>There are a number of items which fill the stomach but on digestion do not produce much glucose or calories, so when ever you are hungry and it is not yet time for your meal or snack, then you can take such items without a danger of high blood sugar :</p> <ul style="list-style-type: none"> <li>● Tea or coffee with less milk and no sugar.</li> <li>● Lime juice (lemonade) without sugar.</li> <li>● Soda water, lime soda.</li> <li>● Dilute mattha or chach (butter milk) without sugar.</li> <li>● Pickles which contain no oil or very little oil.</li> <li>● Raw green vegetables like cucumber, kakdi, mooli, salad leaves etc.</li> <li>● Vegetable soup (home made)</li> <li>● One cup laiyya (50 Cal.)</li> </ul>
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**Table-5A : Carbohydrate counting - cereal list**

Each item below contains 15 gm carbohydrate, 2 gm protein and 70 kilo calories.			
Roti (20 gm wheat)*	1		
Bread (4.5" width)	1	Monaco/Mariegold biscuit	3
Bread (3" width)	2	#Potato (80 gm uncooked)	¾ cup
Bread (3.8" width)	1½	#Arvi	¾ cup
Cooked Rice (20 gm uncooked)	½ cup	#Sweet potato	¾ cup
		#Green peas	¾ cup
Maggi noodles (20 gm uncooked)	½ cup		
Maize	1 large		
Cornflakes (20 gm)	¾ cup		
Dalia (20 gm uncooked)	¾ cup		
Oats (20 gm uncooked)	¾ cup		
Upma (20 gm suji)	¾ cup		
Idli	1 medium		

Unless mentioned otherwise, all measures are of cooked items. 1 cup means 150 ml, an ordinary tea cup.

\*This item provides 17 gm carbohydrate, 3 gm protein and 85 kilo calories.

#Though these are vegetables, they are included in the cereal list due to their higher carbohydrate content.

**Table-5B: Carbohydrate counting - milk list**

Each item below contains 9 gm carbohydrate, 6.5 gm protein, 8 gm fat and 130 kilo calories.	
Cow milk (without cream)	1 glass
Toned milk	1 glass
Curd (made from cow milk)	1 glass
Butter milk (mattha)	4 glass
One glass equals 200 ml.	
Buffalo milk is not appropriate as it contains excess fat.	

**Table 5C: Carbohydrate counting - dal list**

Each portion provides 15 gm carbohydrate, 6 gm protein and 80 kilo calories	
All pulses (rajma, lobhiya, peas, chana) (25g raw, 1 cup cooked)	
Unless mentioned otherwise, all measures are of cooked items, One cup implies cup of 150 ml	

**Table-5D : Carbohydrate counting - vegetables list**

Each portion provides 5 gm carbohydrate, 2 gm protein and 30 kilocalories			
Cabbage	¾ cup	Lady's finger (okra, bhindi)	½ cup
Carrot	¾ cup	Pumpkin (kaddoo)	½ cup
Cauliflower	1 cup	Green gourd (lauki)	½ cup
Egg plant	½ cup	Spinach	½ cup
Flat beans	¾ cup	Tomato	1 medium
Capsicum	¾ cup	Bitter gourd	½ cup
Cooking oil is counted separately. Vegetables such as potato, peas, sweet potato are counted as cereals as they are rich in carbohydrate. 1 cup means 150 ml.			

**Table-5E : Carbohydrate counting - fruit list**

Each exchange provides 10 gram carbohydrate and 40 kilo calories			
Apple	1 small	Guava	1 medium
Orange	1 medium	Peach	2 small
Mosami	1 medium	Plum	4-5
Papaya	1/3 medium	Mango	1 small
Raisin (kismis)	20	Pear	1 medium
Rasbhari	8 - 10	Banana (less ripe)	½ (half of 8" fruit)
Grapes	12 - 15 (30 gm)		
Watermelon*(tarbooz)	1 cup		
Melon* (kharbooja)	¼ medium		
Pineapple	1 cup		
Dates have the highest glycemic index, so they should preferably not be consumed. (1 cup = 150 ml.)			
*These fruit should not be consumed in excess as they have high glycemic index, i.e. they raise the blood sugar very fast.			

glucose control. Complex carbohydrates and foods which have protein, fat and fibre included, are low in glycemic index. Table 4A contains a list of low glycemic index foods. You will see that this table contains items made with sugar in the "High GI Foods" column. It is best to restrict the intake of these items.

#### 4. Fibre

Fibre-containing food takes time to digest and therefore blood glucose rises slowly after these are eaten. In other words, these are low glycemic index foods. Examples of fibrous food are fresh green leafy vegetable, fruit, unrefined grains, and dals with the skin intact. These foods also serve to improve lipid profile (cholesterol and other fats in the blood) and keep away constipation.

#### 5. Carbohydrate counting

The carbohydrate present in food is digested very fast and gets assimilated in the blood in the form of glucose. The carbohydrate present in your food is mainly responsible for rapid increase or decrease of blood glucose. Thus, if we suddenly remove the carbohydrate in your meal or make it considerably less and if you take the same daily dose of insulin, there are chances of hypoglycemia. For example, suppose meat or fish has been cooked for dinner, and you eat more of it and try to compensate by taking less of rice and roti, then there are chances of fall in blood sugar as meat, fish, eggs, chicken do not contain carbohydrates at all. The dietician can teach you how to count carbohydrates. Knowledge of this will help to control blood sugar. Please read list 5A to 5E and know more about carbohydrate counting by reading Appendix-A.

## 6. Avoid sugar and fats

Sweet substances like sugar, honey, sugar containing drinks like Coca Cola, Limca and sweets and toffees raise blood sugar immediately. So you should avoid such items as far as possible. Instead of sugar there are certain sweeteners which do not affect blood glucose. Aspartame (Sugar Free Gold or Equal) and sucralose (Sugar Free Natura) can be used in moderation, in place of sugar, in any food like kheer, custard, sweets, ice creams, dalia, lemonade, tea etc.

## 7. Some information about fats

Increase in fat content in the blood (hyperlipidemia/hypercholesterolemia) can lead to high blood pressure and heart disease. Diabetes itself predisposes to heart problems. So one should avoid consuming excess fatty foods. Some variety of fats are more harmful like ghee, vanaspati, cream, egg yolk and coconut oil. These should preferably not be taken in large quantity. Sunflower oil, corn oil, mustard til or

ground nut oil should be used instead. Fish or chicken can be had instead of red meat. Minimum fat should be used while cooking meat. Cows milk contains less fat than buffalo milk. Instead of fried egg, boiled egg white will reduce the fat content of the meal. Oil which is left over in the kadhai and is repeatedly used for deep frying is converted into trans fat, a variety of very harmful fat. Another source of transfat is vanaspati ghee, which is used in bakery products and ready made namkeens. Please read tables 3 and 6.

**Exercise:** It is essential to exercise every day. Exercise helps to keep blood sugar under control and prevent high blood pressure, heart ailments and hyperlipidemia. During exercise, glucose is used up to produce energy, so blood glucose may decrease. If you are taking insulin, please take some carbohydrate snack immediately before the exercise, to prevent hypoglycemia. Please see chapter-6 for details on exercise related precautions.

### Table-6 Fat exchange

Each exchange contains 5 gm fat 0 gm carbohydrate and 45 calories

Oil (sunflower, safflower, corn, til, groundnut or mustard oil)	1 tsf (5 ml)
Butter	1 tsf
Cream	2 tsf
Ghee	1 tsf
Dry fruit (these are rich in fat content, therefore they are included in the fat exchange table)	
Walnut	6 small
Peanut (groundnut)	10 whole
Cashew nut	6 whole
Almond	10 whole

All these nuts provide protein and carbohydrate also and if eaten in large quantities, they should be counted for carbohydrate and protein also.

### Table-7 Meat exchange

Each exchange contains 7 gm protein 5 gm fat and 0 gm carbohydrate and 70 calories

Paneer	25 gm (1"x1"x1")
Mutton	30 gm
Fish	30 gm
Chicken	30 gm
Cheese	30 gm
Egg	1 medium

Due to the high cholesterol content, the yellow of the egg should be consumed not more than 2 or 3 times a week; chicken and fish are to be preferred over mutton, kidney, liver due to their lower fat content. Before cooking, the yellow fat portions from mutton can be cut away. Use minimum oil to cook the meat.

Unless mentioned otherwise, all measures of 1 cup are equal to 150 ml.

**Table 8: Examples of foods with high fat and carbohydrate content**

<b>Fast Foods and Biscuits</b>	<b>Calorie</b>	<b>Carbohydrate (g)</b>	<b>Fat (g)</b>
Veg burger without cheese (1 piece)	370	61	16
Veg burger with cheese (1 piece)	495	66	22
Pizza (large, 1 piece)	272	33	10
Samosa (medium, 1 piece)	250	27	12
Kachauri 1 big	200	25	09
Aaloo tikki chat	280	22	20
Chowmein (1 cup)	340	48	15
Cooked Maggi Noodles (75 gm raw, 1 cup cooked at home with plenty of vegetable)	305	45	11
Rasgulla 1 pc 50 gm	120	26	01
Gulab jamun (1 piece / 50 gm)	142	16	08
Ice cream 1 cup (100 gm.)	200	24	11
Bhujiya packet (10 gm.)	57	04	04
Nutrchoice Fibre biscuit (8 gm 1 pc.)	37	05	1.7
Rusk 8 gm 1 pc	30	06	0.5

1 cup = 150 ml.

# 4

## Hypoglycemia

### Summary

- 1- **Your blood glucose may fall if there is a mismatch between insulin injection, (or tablets for diabetes) exercise and meals (decreased quantity of food, excessive exercise or increased dose of insulin).**
- 2- **The initial symptoms are hunger, weakness, tremors, sweating, irritability and anxiety. Blood glucose below 70 mg% brings on these symptoms.**
- 3- **Hypoglycemia (hypo) should be treated immediately. Take some glucose or sugar and rest for some time. After ten minutes of rest check blood sugar again to make sure it is normal, take some food.**
- 4- **If immediate treatment is not given, it may result in fits or unconsciousness. If such a situation arises, then one of the family members should give a glucagon injection or if this is not available, then a doctor should be called to give glucose injection.**
- 5- **Meals should be taken on time to avoid hypoglycemia. A snack before exercise is useful. Always keep glucose (or sugar or candy) with you. A diabetes ID card must always be kept in your bag or wallet.**

### Why does glucose level in the blood fall?

The dosage of insulin or tablets used in the treatment of diabetes is adjusted according to the quantity of food and exercise. If the balance between food, exercise and insulin is disturbed then the blood glucose falls.

### What are the causes of hypoglycemia?

#### 1. Less food

Missing a meal, or decreasing carbohydrate content of the meal, or delaying the meal after having taken insulin, can lead to hypoglycemia.

#### 2. Excess insulin

Another reason for hypoglycemia is a mistakenly high dose of insulin. This can occur if the insulin strength is not matched to the proper syringe, i.e. 100 U/ml of insulin should be used with 100 U/ml.

syringe. Remember, cartridges always contain U100 insulin; never use cartridge insulin with a U40 syringe. Tablets for diabetes if taken in inappropriate quantities, may also lead to low blood glucose.

### 3. Exercise

During exercise, muscles consume plenty of glucose. This effect can remain for 8 - 10 hours or more after the exercise is over (till the muscles replenish their energy stores) i.e. well into the night or early next morning. It is prevented by adjusting insulin dose and food intake.

**Blood glucose below 70 mg/dl. is defined as hypoglycemia**

### Symptoms of hypoglycemia

#### *Initial symptoms:*

- Trembling
- Weakness
- Irritability
- Hunger
- Sweating
- Anxiety

***Subsequent symptoms:*** (when effects of hypoglycemia disturb brain function)

1. Decrease in concentration during work
2. Headache
3. Double vision or darkness in front of the eyes
4. Extraordinary behavior like anger
5. Inability to walk steadily

If treatment is not given immediately, it can lead to unconsciousness or fits.

### Treatment

1. If it is possible to measure blood glucose, do so immediately.
2. If blood glucose is below 70 mg or if there is no facility to measure blood glucose, then immediately eat glucose powder or sugar : 15 gm (3 tea spoon) for adults and 10 gm (2 tea spoon) for children. If you do not have glucose or sugar with you, 3-4 pieces of candy or 150

ml. unsweetened juice (or 100 ml of sweetened juice) will also help.

3. Stop all work and take rest for 10 minutes. After 10 minutes please test your blood glucose again. It should be above 100 mg/dl. Even if it is above 70 mg/dl the next step is have a snack consisting of 15 gm carbohydrate (eg. 1 roti or 1 cup milk, 1 large slice of bread, a large fruit or 3 biscuits), so that hypoglycemia does not recur. If it is your meal time, take your usual insulin dose but eat your meal (instead of the snack) but immediately instead of leaving the usual gap of few minutes. If blood glucose has not risen above 70mg/dl, take sugar or glucose again. In spite of this if there is no improvement please consult a doctor immediately.
4. If there is severe hypoglycemia you may not be able to take care of yourself. Somebody in the family can help you take glucose or sugar. In case of fits or unconsciousness, no water or food should be given. Glucagon injection should be given. It will take 5-10 minutes for the injection to take effect. After regaining consciousness, you must eat some food. Glucagon injection may produce vomiting; the child should be made to lie on his or her side so that no vomitus goes into the windpipe.
5. Glucagon comes in a 1 mg. vial. Children below 12 years can be given 0.5 mg and those above 12 years can be given 1 mg. It is given just like an insulin injection.
6. If after giving sugar or after the glucagon injection no improvement is seen or if you are confused whether you are giving proper

treatment, then immediately call in the doctor, who can give intravenous glucose injection.

### **What to do if you don't have glucagon and your patient is not in a state to eat or drink?**

You can make a paste of glucose, resembling toothpaste, by adding about 5 to 8 drops of water into 10-15 gm (2-3 tsf) glucose powder. Take small quantities of the paste on your finger, pull open the lower lip of the patient, and apply in small frequent quantities, till all the paste has been applied over several minutes. At the same time, call a nearby doctor to come and give intravenous glucose. Once the patient regains consciousness, give a snack or meal. Buy a new glucagon without delay.

### **Points to remember**

1. When you are away from home, always remember to take your Hypo Kit (with some glucose or powdered sugar, candy, some biscuits or other snack, and your glucometer with lancet and strips; glucagon inj). Treatment of hypoglycemia must be done in the early stages.
2. Always keep a diabetes identity card with you. The card should contain your name, address, telephone number, doctor's name, dosage of insulin and names of other medicines. The other side of the card should contain the warning given in picture. (figure 1)
3. In an unconscious state, liquid or eatables should not be forced into your mouth. If glucagon is not available, the caregiver should make a paste of glucose (like toothpaste) and apply the paste little by little on the inside of the patient's lips.

#### *I have diabetes*

If I become unconscious or my behavior is not normal, it may be due to diabetes or medicines given for diabetes.

If I am able to swallow then please give me a glass of juice or 3 tea spoons of sugar.

If in 10 minutes I do not regain consciousness then please call a doctor or take me to the doctor, to be given intravenous glucose.

If I am unconscious and am unable to swallow then do not give anything in my mouth. Please call in the doctor immediately or take me to the hospital.

Name :
Address :
Phone No. :
Family phone No.:
My medication :
My doctor :
My hospital :

**Fig. 1 : Diabetes Identity Card**

# 5

## Monitoring Diabetes Control

### Summary

1. It is important to keep blood glucose under control, to avoid complications of diabetes.
2. It is possible to measure glucose at home itself. We have to test blood glucose because symptoms will appear only when the blood sugar has been very high for a longer time. Blood glucose should ideally be 70-130 mg/dl before food, and 90-180 mg/dl 2 hours after food.
3. Those who take insulin should measure their glucose at least 4-5 times in a day (before breakfast and dinner and lunch, and 2 hours after meals) and once in a week at night (1-2 or 3 a.m.). Every blood glucose reading should be made use of for improvement in glucose control. If you are not using insulin then you may test 4 times a day (before and 2 hours after breakfast and dinner) on 2 days of the week. In addition, if there are signs of low blood sugar, or any other problem, you should test immediately.
4. Blood glucose results should be written in a diary. Changes in patterns of blood glucose over the longer term provide clues for adjustment of insulin or tablets.

### Why is it necessary to test blood glucose?

Keeping blood glucose under control will help minimize diabetes related complications. This is applicable both for people using insulin and those using tablets. There are a number of ways to test glucose. Some tests can be done at home by yourself and some can be done only in the laboratory. Measuring blood glucose at home is very necessary for good control of diabetes, because you can take immediate remedial action if blood sugar is too high or low.

### What are the symptoms of high blood glucose?

These include increased urination, excessive thirst, loss of weight and feeling of weakness. Remember that these symptoms appear where the glucose level rises too high. So you should not wait until that time to increase the dose of insulin or tablets.

### Testing blood glucose at home

When you test your blood glucose at home, you can do so at different times of the day and night, so that it is easy for you or the doctor/nurse to adjust the dosage of insulin or tablets. It is more important for people who take insulin injections to measure glucose at home because of the frequent fluctuation in blood glucose.

For measuring glucose, you should prick your finger and place one drop of blood on the strip provided, (the lancet used for pricking should not be used more than twice as it will become blunt and painful) (a lancet is less painful than a normal needle) (Fig. 1). Do get your meter checked out by the diabetes team during every visit to the clinic.

**Ketones in urine or blood** - When there is too little insulin in the body, or when you are sick or have fever, then the body converts fat into ketones. If ketones are found in urine or blood then the condition can become serious. To prevent any serious problems, you should immediately consult the doctor.

### When to measure ketones?

1. If glucose in the blood becomes more than 250 mg% persistently.
2. During fever or any other illness.
3. Early morning for pregnant women.

In order to measure ketones you use a strip called Ketodiastix (Fig. 2). When dipped in urine, the colour of the box on the strip turns purple in the presence of ketones. The following is the way to use Ketodiastix:

1. Collect urine in a bottle.
2. Dip the strip in the urine, remove it and tap it on the side of the bottle or tube.
3. After 40 seconds compare the colour of the box at the end of the strip to the colour code on the bottle, and write it in the diary.

**Ketones in blood** - If you have a blood glucose testing machine at home you may be able to use the same



for ketones testing (ask your diabetes nurse if your machine is suitable for ketone measurement). You prick your finger the same way as you do for blood glucose, but use a ketone strip instead of glucose strip. Keep 3-4 blood ketone strips at home always.

**Time of measurement:** If you are using insulin then you should measure glucose every day before breakfast, lunch and dinner and at bed time. These are the most useful times to check, as the insulin dose for that intended meal can be increased if pre-meal glucose is high or if the meal is going to be larger than usual. If bedtime glucose is below 120 mg, then an extra snack can be taken to prevent midnight hypoglycemia. Pre-meal (before meal) glucose generally reflects the action of your long acting insulin. To know the effectiveness of your meal insulin, you have to test 2 hours after your meal. Ideally you must do this every day, however, you may not be able to do all of these daily due to various reasons. Do discuss how to solve these difficulties, with your diabetes care team. During fever or any other illness blood glucose should be tested every 4-6 hours as there are chances of increase in blood glucose and development of ketones.

If you are using tablets, then test before and 2 hour after breakfast and dinner, twice a week. Please keep a diary with details of glucose levels.

*Please see Appendix-B for details of adjustment of insulin doses in relation to quantity of food and blood glucose reading.*

**Other tests:** Hemoglobin A1c (HbA1c) is a test done in the hospital. It is an indication of the average blood sugar maintained in the last three months. In our hospital, the normal value of HbA1c in a person without diabetes is 4.3 to 5.6%. It should be your effort to keep your HbA1c below 7% (Note : different guidelines may apply to some situations; you should be individually guided by your diabetes care team).

**Points to remember while purchasing a glucometer:**

1. Do remember to take a receipt/warranty card
2. Make sure these strips are available in your town easily.
3. Test the meter at the shop itself to make sure it is working correctly.
4. Look at the cost of the strips rather than the cost of the meter. The strips are a recurring expenditure whereas the meter is a one time expenditure.

**Table 1: Ideal results of blood glucose test**

Before breakfast, lunch and dinner	70-130 mg.
2 hours after breakfast or lunch	90-180 mg.
Bed time	80-140 mg.
Mid night (1-3 a.m.)	80-160 mg.
HbA1c	Below 7.0%

**Continuous Glucose Monitoring System (CGMS)**

CGMS is a system by which glucose in the tissue fluid beneath the skin is measured every 5–20 min. throughout the 24 hour period. Since the tissue fluid glucose reflects blood glucose very closely, this instrument can help us get an idea of 24 hours blood glucose values. The sensor of the CGMS is a small filament which is inserted into the skin quite painlessly once in a few days (5 days for some instruments and 14 days for some other instruments). The tissue fluid glucose measured by the filament is transmitted to and stored by a reader or recorder electronically. Thus without multiple finger pricks you can get an idea of blood glucose during the entire day and night. This is a useful tool to help you achieve excellent blood glucose control. However, in some CGMS instruments, the results may be less accurate than the finger prick test. Please do ask your diabetes team for more details of CGMS before deciding to use it.

**Table 2. Blood glucose measuring instruments and strips available in India**

Company	Meter	Memory	Strips	Advantage	Disadvantage
Roche	Accuchek Performa	Result storage in memory	50/pack		Strips are costly
Roche	Accucheck Active	200-result memory	25 or 50/pack		Strips are costly. Needs slightly larger drop of blood. Older technology
Bayer	Contour TS		25/pack	No coding required	The strips are costly.
Abbott	Freestyle Optium Neo	1000 results memory	Individual foil wrapped strips.	Large easy-to-read display. Cheaper. Individually wrapped strips, can use for blood ketone strips also. No coding required.	
Life scan	One Touch Ultra	150-results memory	25 or 50/pack		Strips are costly
Life scan	One Touch Horizon	Only one reading is stored	10 or 25/pack		Strips are costly. Only 1 reading in memory.
Convergent	Elegance	450 results memory	25/pack	Strips are cheaper; no coding is required	
Pulsatom Health care	Pulsatom		Individual foil wrapped strips	Strips are cheaper, individually wrapped.	
Dr. Morepen	GlucoOne				



**Fig. 1: Urine ketone test strips**



**Fig. 2: Blood glucose test strips, meter, lancets and pricker**

## Diabetes and Exercise

### Summary

1. It is necessary to do daily exercise to maintain good health. Exercise reduces blood glucose and helps in preventing overweight.
2. You should do only such exercise which you like and which is based on your physical endurance and way of life. For children, their play is their exercise.
3. Please consult your doctor before starting a vigorous exercise program. This precaution is essential for people who are above 40 years of age or those who have diabetes for more than 10 years.
4. Blood glucose may decrease due to exercise; prior to exercise you should take some extra carbohydrate containing food, which will prevent hypoglycemia.

For good health it is essential to exercise every day. Exercise helps in strengthening the muscles, and keeping the heart in good condition. If you have diabetes then there are other benefits of exercise too. Regular exercise helps the body to utilize the glucose well. In this way, the glucose level in the blood decreases and it is easier to balance blood sugar. Exercise also helps in reducing the fat in the blood, which reduces the risk of high blood pressure, heart disease and stroke. Exercise also helps in reducing overweight.

### Which exercise is suitable for you or your child with diabetes?

You should do only those exercises which suit you and your way of life. Daily exercise of 30-60 minutes will be good for you. If this is not possible then at least 5 days in a week is a must. You should do such exercises which will involve increased use of energy. As for children their play is their exercise. Definitely if given space and friends, they would play. In addition, if you have the facility please encourage the child to excel in a certain game. Taking part in competitive sports is not prohibited. On the other hand, it will help in physical and mental development.

Running, tennis, swimming, football, hockey, badminton, cycling, skipping, volley ball etc. and such other games are all good. Doing yoga also (should

learn from a yoga teacher) makes the body active.

These were examples of aerobic exercises. The second category, i.e. anaerobic or resistance exercises, include sit-ups and push-ups and weight lifting etc. (Fig. 1). A combination of aerobic and anaerobic exercise is ideal.

### Precaution

1. If you are not used to doing exercise then you should begin the exercise program gradually
2. During summer months, you should drink sufficient water.
3. You should not do any exercise during illness/fever.
4. When blood glucose remains above 250 mg. for a prolonged time or insulin is not being given for any reason, or ketones are present in urine or blood, then exercise should be avoided, as it may cause an emergency situation.
5. The effect of exercise on lowering blood glucose can continue for many hours after the exercise has stopped, leading to a possibility of hypoglycemia at night.
6. Take the Hypo Kit with you while going for play/exercise. Your friends should know about management of hypoglycemia.
7. If during exercise you experience pain in the chest, arms, face, neck or back, or you become breathless, then you should immediately stop the exercise and consult your doctor.

### Precautions for insulin dependent people

1. Blood glucose may fall because of exercise. To prevent such a situation you should eat a snack made of low glycemic index carbohydrate before exercise. (Table 1).
2. In the be, you should measure blood glucose both before and after the exercise. This will indicate whether the extra food eaten beforehand or the adjustment in insulin was sufficient to avoid hypoglycemia.



Fig. 1: Examples of aerobic exercises: walking, running, swimming, skipping rope, football



Fig. 2: Examples of anaerobic exercises: pushups, pullups, lifting weights/dumbbell, body building

**Table 1. Guidance before exercise/play based on blood sugar test result**

Less than 90 mg%	Take 10 to 20 gm. carbohydrate, check blood sugar in 10 to 15 min., if it is more than 90 mg then you may go to play.
90 mg% - 125 mg %	Take 10 gm. carbohydrate and then go to play
125 mg% - 250 mg%	You may go to play without eating anything extra
250 mg% and above	Please check ketones and do not go to play if ketone is present. Contact your diabetes team. Take extra insulin as per instructions. If ketone is negative, you may play when the sugar normalizes.

3. Try not to play at the time of maximum effect of insulin. While taking rapid acting insulin (Humalog, Novorapid), the effect is greatest after an hour. If you are taking regular insulin (Actrapid, Insugen R, Huminsulin R) there the greatest effect is after 2-3 hours. If you have to play during such a time, then decrease that particular quick acting insulin dose by 25-50%. If you have not been able to your dose, then take 10-20 gm quick acting carbohydrate (table 2,3).
4. Remember- For every half hour of moderately vigorous play/exercise beyond the first half hour, you should take 10-20 gms. (1 gm) per kg body weight of high glycemic index carbohydrate snack. Please see table 2.
5. Try to remember to take the insulin injection in an area of the body which will not be exercising. Insulin enters the blood faster from an exercising limb and hence there may be greater reduction in blood glucose. To prevent this, if you are using

**Table 2. Examples of 15 gm carbohydrate exchanges which raise blood glucose quickly**

Food Stuff	Quantity of carbohydrate
Bread 1 piece 3.8"	15 gm.
¾ of big banana	13-15 gm.
Biscuit 3 piece (Parle G)	15 gm.
Juice 100 ml. (half of small pack)	15 gm.

your legs while exercising like running or jogging, insulin can be taken in the arm or abdomen. If both arms and legs are used during exercise like swimming or playing hockey, then the injection before the exercise may be given in the abdomen.

6. After exercise is finished, take 15-30 gm. carbohydrate to replenish glycogen stores and avoid late hypoglycemia. You may even need to decrease dinner time insulin by 10-20%.
7. If you are playing an unaccustomed amount, then test blood glucose often during the game.

**Table 3: Grams of carbohydrate to be taken every half hour, during prolonged exercise**

	<b>Body weight 20 kg</b>	<b>Body weight 40 kg</b>	<b>Body weight 60 kg</b>
Cycling at 10 km. per hr	8 gm.	12 gm.	18 gm.
Walking at 4 km per hr	8 gm.	12 gm.	15 gm.
Walking at 6 km per hr	12 gm.	15 gm.	18 gm.
Running at 8 km per hr	18 gm.	30 gm.	45 gm.
Basketball, football	15 gm.	30 gm.	45 gm.

## Precautions during Illness

### Summary

1. **During any illness the need for insulin increases. Fever, cold, diarrhea, surgery, toothache or some stressful conditions - all these increase the need for insulin.**
2. **If during illness, you do not increase the dose of insulin, blood glucose will increase and may cause ketoacidosis. Do not forget to take insulin even if you are not able to take adequate food. The diabetes care team will teach you how to avoid hypoglycemia during such a circumstance.**
3. **During illness check your blood glucose every 4-6 hours. If ketones are found in the urine or blood, and blood glucose is more than 250 mg. then you require extra regular or rapid insulin.**
4. **During illness drink more water. And take rest.**
5. **Even if you are not using insulin you should follow the above instructions. You might require insulin for a few days, but only your doctor will be able to advise you on this.**
6. **When you are ill and are confused as to what should be done, please consult the doctor as soon as possible.**

Any type of disease, surgery or stress (including ordinary ailments like cold, diarrhea, fever, toothache) can increase insulin requirement. When insulin is insufficient, blood glucose increases, there is excessive urination and there will be loss of fluid from the body. Subsequently, the body fat will be broken down to form ketones and in this condition of ketoacidosis, the patient can become unconscious. To prevent such a situation, people with diabetes should follow certain instructions at time of illness.

Even if you are not using insulin on a daily basis (in type 2 diabetes), you may need insulin during illness. Please follow the instructions for extra insulin. If blood glucose remains more than 250 mg/dl despite extra insulin, then you should consult the doctor. In such a condition you may require insulin for a few days.

### Instructions during illness

1. When you are ill you should take rest. You may take help from any member of your family for

taking injections, measuring blood glucose and eating food.

2. You should drink extra fluid ( 6-8 glasses). It is necessary to take some fluid every hour. Other than water, you can also have tea, lemonade (without sugar) or lemon soda. If there is nausea, pain in the stomach or vomiting and you are not able to eat anything you should go to hospital immediately. .
3. Keep up your daily diet. If you are unable to do that, then you can eat whatever is possible, in small frequent quantities. Dalia, khichri, bread with milk, kheer, ice-cream, custard, fruit, fruit juice, glucose biscuit etc. are some of the items which you can eat during illness every hour in small quantities.
4. Continue your insulin injection daily during illness, even if you are not able to eat regular meals. Take some of the sweet items mentioned above. If you are not able to eat even these, then discuss with the diabetes team how to regulate insulin dose and proceed to the nearest hospital.
5. Blood glucose should be strictly measured every 4-6 hours. If blood glucose exceeds 250 mg. then please measure ketones in the blood or urine. For measuring this, use a strip called Ketodiastix or Optium blood ketone strip. (if your blood glucose instrument is called 'Freestyle Optium'). If you do not have the strip you can get blood tested in a laboratory for ketones.  
  
If glucose is high and there are ketones in the urine/blood, then you need extra dose of insulin. If the ketone level is mild or moderate and you can have 24 hour contact with the diabetes team, then you can manage at home. If ketones are high, or rise from mild to moderate despite extra insulin dosing at home, then you must get admitted in hospital.
6. **Extra insulin:** Extra insulin should be taken only in the form of regular insulin (for eg. Actrapid, Insugen R, Huminsulin R or rapid acting insulin

(for eg. Humalog and Novorapid). During illness, calculation of each dose of extra insulin will be about 5-20 percent of your whole day's insulin dose. This extra amount of insulin is to be taken before meal or snack, in addition to the usual insulin taken at that time. Your extra dose of insulin will depend on the level of blood glucose and ketones. For eg:

If daily you take 6 unit regular and 12 unit NPH injection before breakfast, 8 unit regular in the afternoon and 4 unit regular and 6 NPH before dinner, then during illness 5% extra insulin will be calculated as follows :

$$6 + 12 + 8 + 4 + 6 = 36 \times 5/100 = 1.8 \text{ (or 2) units regular insulin.}$$

This means if blood sugar is high before breakfast then you will take 6 + 2 unit regular and 12 unit NPH. If it is before lunch, in the afternoon, then 8 + 2 unit regular should be taken and if before dinner, at night, 4 + 2 regular and 6 unit NPH should be taken.

After 4 to 6 hours of taking extra insulin, you should measure your blood glucose and ketones. If blood glucose is more than 250 mg/dl or if ketones are still present, then more of extra insulin (eg 10% or 20% of total daily dose) will have to be taken. If after all this, there is no improvement in your condition then consult your doctor. When blood glucose falls below 250 mg., then you may stop taking extra insulin.

More detailed instructions for taking extra insulin when there is only high blood sugar during illness, or when there is presence of ketones also, are given in Table 1.

When should you urgently go to the hospital :

1. If you have stomach ache or vomiting.
2. If you are unable to eat or drink anything.
3. If after taking extra insulin you don't get relief even after 6-12 hrs. and glucose is more than 250 mg. or ketones continue to be present.
4. If ketones rise from mild to moderate or moderate to large despite your efforts.
5. If you are confused as to what you should do

What should you do during illness if you are not using insulin :

1. Test your blood glucose 4 times a day.
2. Drink plenty of fluids.
3. Eat a full meal
4. You should continue to take your diabetes tablets, but should stop medicines like metformin, glycipbage, glycomet etc. Your doctor will be able to guide you as to what medicines to take instead.
5. If after measuring two/three times, blood glucose remains above 250 mg. then you may need insulin injection for a few days. Consult your doctor.

**Note:**

- (i) If on using a new vial or cartridge of insulin your blood sugar shoots up suddenly then perhaps the insulin has got spoilt in the shop itself. Try another new bottle of insulin.
- (ii) If you are using the insulin pump and you are getting high blood sugar and ketones which does not decrease even with extra insulin (bolus), then start using regular or rapid insulin by syringe or pen immediately. In addition, contact the pump technician and get the pump checked.

**Table 1: Extra insulin dose calculation during sick days**

Blood ketones	Urine ketones	Quantity of Additional Insulin		
		Blood sugar less than 180	Blood sugar 180-250	Blood sugar more than 250
Less than 0.6 m mol	0 or Trace	Normal dose	Normal dose	5% of total daily dose extra
0.6 to 1.0 m mol	Minimum	Normal dose (this is starvation ketone*)	5% extra	5-10% extra
1.0 to 1.5 m mol	Medium	Normal dose (this is starvation ketone*)	5-10% extra	10% extra
More than 1.5	Moderate to high	5% extra	10 % extra	10-20% extra

\*If there is poor intake during illness, you may have low blood sugar and "starvation ketones". The action to take is to eat extra carbohydrates and drink enough fluids.

**If you are unable to eat or are vomiting and your blood glucose is below 70 mg%, go immediately to the nearest hospital and get intravenous glucose.**



## Diabetic Ketoacidosis

### Summary

1. Generally diabetic ketoacidosis occurs in people with insulin dependent (type-1) diabetes.
2. Ketoacidosis is a serious condition which can lead to unconsciousness. When diabetes is under control then there is very little chance of getting ketoacidosis.
3. Ketoacidosis occurs when there is insulin deficiency in the body, either at the time of diagnosis of diabetes for the first time, or during ongoing treatment, if insulin injection is not being taken regularly or during other illness like fever.
4. In order to prevent ketoacidosis, blood or urine ketones should be measured, when blood glucose is continuously high and during fever/other illness. If ketones are present or blood glucose remains high, then you should phone your doctor or diabetes team immediately.

### Diabetic Ketoacidosis

Ketoacidosis is a very serious condition. This occurs when the body does not get enough insulin. If diabetes is under control, then chances of developing ketoacidosis are low.

#### When may ketoacidosis occur?

Ketoacidosis occurs when the required amount of insulin is not secreted in the body, or is not available from the treatment. Reasons for relative lack of insulin are as follows :

1. Infection, injury, surgery or any other stress (during stress, the body requires more than the usual amount of insulin).
2. Not taking the full dose of insulin or if your insulin is expired, or destroyed by heat.

3. Undertaking prolonged vigorous exercise on the background of inadequate insulin doses during the previous few days and/or prolonged high blood sugars.

**Remember : High glucose + ketones = danger**

### Symptoms of ketoacidosis

This begins slowly and often happens when the warning signs have been ignored for a few days. But in small children and young people symptoms may appear within a few hours. The following signs will be seen

1. Excessive urination and thirst
2. Nausea, abdominal pain and vomiting
3. Weakness, faintness
4. Fast breathing, drowsiness.
5. Finally, unconsciousness (coma)

### Prevention

The best way to prevent this is to take one's daily insulin doses regularly, and test blood glucose frequently. Ketones testing is important in the following circumstances.

1. If blood glucose is continuously above 250 mg.
2. During any illness or infection (like fever, diarrhea etc), surgery or stress of any kind.
3. High blood glucose with abdominal pain or vomiting

If glucose and ketones are both high, then follow instructions given in the previous chapter (chapter 7) regarding rules to be followed during illness or consult your doctor.

**Ketone testing:** Urine and blood ketones testing can be done at home through testing strips (Ketodiastix for urine ketone or Optium Freestyle blood ketone strips with Optium glucometer). Testing method has been given in chapter 5. (Monitoring Diabetes Control).



**Treatment:** Presence of ketones in blood or urine is an abnormal situation. You should immediately consult your doctor or follow the instructions written in chapter 7.

If ketones rise despite home treatment, this condition is very critical. You should try to get admitted in hospital immediately.

### **Can people who take diabetes tablets also become unconscious?**

Ketoacidosis generally happens in people with insulin dependent diabetes. But patients with type 2 diabetes on diet control and tablets can also become unconscious. In this condition glucose levels becomes very high but ketones are not produced. This happens often when there is an added stress like heart attack or infection. To prevent this condition, during such periods blood glucose should be monitored carefully. There may be a need to take insulin instead of tablets and it is better to get the doctor's advice.

## Long Term Complications of Diabetes

### Summary

1. Diabetes can affect the eyes, kidneys, nervous system and the heart. These complications occur only after 10-15 years after the onset of diabetes.
2. These complications are seen only in a few people and not everybody.
3. Complications can occur in both type 1 and type 2 diabetes.
4. By keeping blood glucose and blood pressure (BP) in good control, one can reduce the risk of complications.
5. Regular visits to your doctor are essential as it will help in preventing complications in the beginning itself.
6. Nowadays there are several measures for treating diabetes complications. The sooner it is diagnosed the easier it will be to treat it.

Diabetes can be associated with certain complications. Short term complications such as ketoacidosis and hypoglycemia can occur suddenly and have been discussed previously. Some complications may be encountered after some years from the onset of diabetes. Complications can occur in both types of diabetes, type 1 diabetes which is treated with insulin, and type 2 which may be controlled by oral pills initially. Complications are seen only in a few individuals. There are many people who, even after 25 to 50 years of diabetes are free from complications. By proper control of blood sugar and blood pressure, one can avoid complications.

### A. Diabetes and your eyes

Diabetes can affect the retina in your eyes. It is essential to get the eyes tested regularly. If there is disturbance in vision then it should be treated in the beginning stages itself. If it is not treated properly and early enough, then there may be loss of vision.

*Symptoms :*

Early symptoms are :

1. Flashes of light or floating lines in front of the eyes.

2. Small particles or specks which float in front of the eyes while shaking the head.

### Late symptoms

1. Decrease in vision or blurred vision. It is necessary that you get your eye check up with the retina specialist as soon as the early symptoms arise.

### Prevention

1. After 3 years of the onset of diabetes, one should get eyes tested once a year. It is better to consult a retina specialist instead of a general eye doctor. If the specialist feels it necessary, you may consult every 3-6 monthly.
2. You should always try to keep the blood glucose under control. In addition, keep good control of your blood pressure.
3. You should recognize the early symptoms and consult the doctor immediately.

**Treatment:** Treatment of retina changes is done by laser. The results of this treatment are best when the problem is in its early stages.

### B. Diabetes and the kidneys

Kidney complications can be seen generally in people whose glucose level has not been controlled over a long time. In addition, people with high blood pressure or whose family members have high blood pressure have more chances of developing this complication.

**Symptoms:** The first change is the presence of small amounts of protein in the urine. This has no symptoms and can only be found out by doing urine microalbumin test.

**Late symptoms:**

1. Swelling in the legs and face.
2. Frequent episodes of hypoglycemia.
3. Increase in blood pressure.

### **Prevention**

1. Urine microalbumin test should be done every year. Presence of protein in the urine may be the first indication of possible kidney complication. If it is positive, you need to test it twice more within 6 months. If at least 2 tests are positive, it is called persistent microalbuminuria.
2. You should try to keep good control of blood pressure and blood glucose.

### **Treatment**

1. In the early stages the treatment is to control blood glucose and blood pressure and to reduce the amount of protein in your food if it was excessive (your dietician and doctor will advise you). Even if your BP is normal, your doctor may start a medication.
2. When the kidney function decreases significantly, you may need dialysis as well as other medications. A kidney specialist (nephrologist) will advise you in detail.
3. Sometimes transplant becomes necessary. This operation is done in many hospitals in India.

### **C. Diabetes and the nervous system**

Diabetes can affect your nerves. It occurs less commonly in people who have good control of diabetes.

#### **Symptoms**

1. Burning sensation in the soles of the feet.
2. Numbness of feet and a feeling of walking on cotton and not on the floor.
3. Due to reduced pain sensation in the feet even a trivial injury may become a big wound before you realize its presence.
4. Giddiness while standing, loss of appetite, vomiting, diarrhea, difficulty in passing urine, weakness and seeing things in double images, loss of libido.

**Prevention:** Keeping blood glucose in good control.

#### **Treatment**

1. Fortunately, these symptoms usually become alright on their own, after a few weeks or months.
2. There are several medicines by which these could be treated in the meanwhile. Sometimes one may need to take two or three different medicines. Your doctor will advise you.

### **D. Diabetes and blood circulation**

When fat gets deposited in the blood vessels, they narrow down, leading to poor blood supply to different parts of the body. This may result in stroke (if parts of the brain have poor blood supply) or heart attack (if the heart muscle has poor blood supply) or leg pain (if blood supply to the calves and feet is poor).

#### **Symptoms**

1. Pain in the chest, breathlessness or feeling of suffocation while doing exercise.
2. Pain in the calf muscles while walking.
3. Non healing wound in the foot
4. Paralysis.

#### **Prevention**

1. Blood glucose should be controlled right from the onset of diabetes.
2. Daily exercise for at least 45 minutes is very important.
3. Saturated fats (ghee, butter, cream) and trans fats (vanaspati ghee, all purchased fried items & cakes, pastries, biscuit) to be kept at a minimum. Unsaturated oil are more desirable. (see chapter-3 on Diet).
4. Body weight should be maintained and over weight should be avoided.
5. Smoking should be avoided.

### **E. Care of the foot**

1. With diabetes, there is increased risk of wounds on the feet.
2. Good care of the feet can prevent such wounds.
3. Wash your feet daily with soap and water; wipe them dry. If the skin is dry, apply cold creams or moisturizing cream. No spirit should be applied. If there is excessive sweating, use talcum powder, but do not let the powder get caked between the toes.
4. Inspect the feet daily for any wound; remember, due to decreased sensation, you may not feel pain on a wound and thus your attention will not be drawn to it.
5. Cut your nails carefully (fig.1); do not cut them too close.

6. During winter, do not warm your feet close to a heater or fire.
7. Never walk barefoot even inside the house. Use comfortable (not tight fitting) shoes, and cotton socks without tight elastic.
8. Treat wounds immediately, with clean water and cover with a clean cotton dressing.
9. If it does not improve in 24 hours, meet a doctor.
10. Never try to cut a corn on your foot yourself. Do not use 'corn cap' or 'corn remover'. Use vaseline or moisturiser. If there occurs a corn on starting to use on starting to use a new shoe which may be tight, change to a more comfortable shoe.

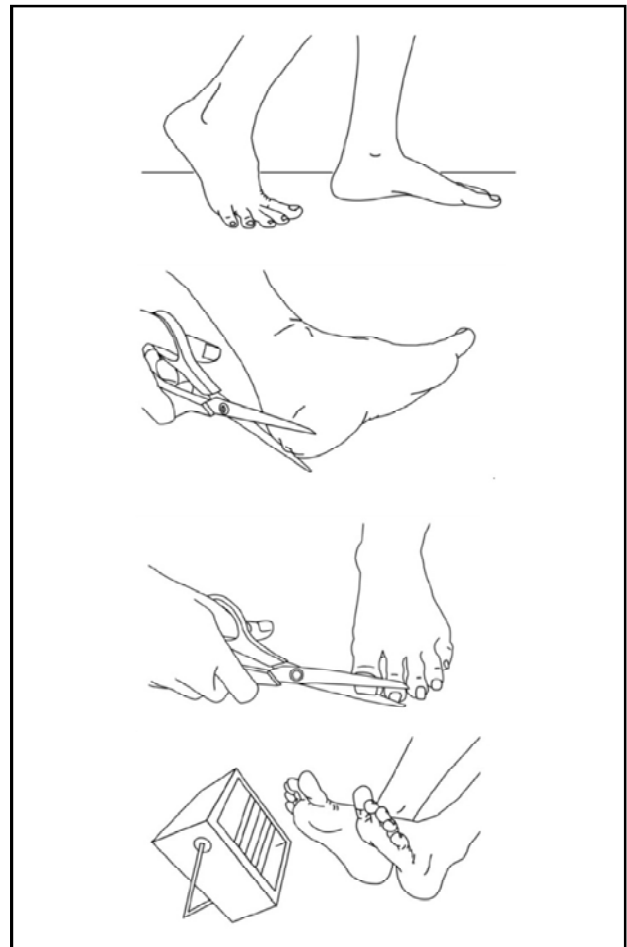
### Treatment of wounds

1. Treat wounds without delay
2. Wash the wound with clean, lukewarm water and savlon.
3. Then apply an ointment like Neosporin or mupirocin. Don't use a strong irritant like betadine, mercurochrome, or carbolic acid, or "Bandaid."
4. Cover with a clean cotton dressing.
5. Do not use warm fomentation on a wound.
6. If it does not improve in 1-2 days or develops swelling, pus, redness, meet your doctor urgently.

#### Dos



#### Donts



**Fig. 1: Care of the feet: Dos: After bathing, wipe your feet with a soft cotton cloth, wear cotton socks. Before wearing shoes, check with your hands for any sharp object inside the shoe which may hurt your feet. Donts: Do not walk barefoot, wear slippers even inside the house. Do not cut corns yourself, and do not apply any corn cap. Cut your nails with a nail cutter, not with scissors. Do not keep your feet close to a blower, heater or fire.**

**Table 1: Long term complications of diabetes, their early symptoms and prevention**

Organs	Early symptoms	When to test	Types of tests	Precautions or preparation for the test(s)	Prevention
<b>Eyes</b>	<ul style="list-style-type: none"> <li>* There may be no symptoms at all</li> <li>* A shower of black dots may float in the front of your eyes like flies</li> <li>*Some lights may shine in your eyes</li> <li>*Your vision may become blurred (unclear)</li> </ul>	<ul style="list-style-type: none"> <li>* Once a year, if your last eye checkup was normal</li> <li>* Every 3-6 months(or as instructed by the eye doctor) if your last checkup was not normal</li> </ul>	<ul style="list-style-type: none"> <li>* Fundus or retina checkup</li> <li>* Eye pressure or tension</li> </ul>	<p>Drops put into your eyes to dilate the pupil during the checkup, will cause blurred vision for 6-8 hours.</p>	<p>Good control of BP (blood pressure), blood glucose, lipid (cholesterol)</p>
<b>Kidneys</b>	<ul style="list-style-type: none"> <li>* There may be no symptom at all</li> <li>* Swelling over face or feet</li> <li>* Poor appetite, weight loss</li> </ul>	<ul style="list-style-type: none"> <li>Once a year, if your previous test was normal</li> <li>*If your previous test was not normal, take instructions from your doctor.</li> </ul>	<ul style="list-style-type: none"> <li>* Urine microalbumin</li> <li>* 24 hour urine protein</li> <li>* Serum (blood) creatinine</li> </ul>	<ul style="list-style-type: none"> <li>*Do not collect urine during fever, heavy exercise, menses, uncontrolled blood glucose and high lipid (cholesterol)</li> </ul>	<p>Good control of BP, blood glucose, lipid (cholesterol)</p>
<b>Nervous system</b>	<ul style="list-style-type: none"> <li>*Burning sensation or numbness on the soles of your feet</li> <li>*Slipping of chappals from your feet</li> <li>*Wound on your feet, which don't seem painful</li> </ul>	<p>Nervous system examination once a year by your diabetes doctor</p>	<ul style="list-style-type: none"> <li>*Examination of feet &amp; toes daily by yourself</li> <li>*Examination of feet and nervous system by your diabetes doctor and nurse once a year</li> <li>*Examination of the foot</li> </ul>		<ul style="list-style-type: none"> <li>* Do not walk barefoot</li> <li>* Cut your toe nails and finger nails carefully</li> <li>* Wash feet with soap daily, keep them dry</li> <li>* Wear loose &amp; comfortable shoes</li> </ul>
<b>Heart</b>	<ul style="list-style-type: none"> <li>*Chest pain, pain in your arms</li> <li>*Breathlessness after a short walk</li> </ul>	<p>Once a year or as instructed by your doctor</p>	<ul style="list-style-type: none"> <li>*ECG, Echo-cardiogram</li> <li>* Serum (blood) cholesterol</li> </ul>		<ul style="list-style-type: none"> <li>*Do not smoke</li> <li>* Good control of - BP</li> <li>- Blood glucose</li> <li>- Weight</li> </ul>
<b>Brain</b>	<ul style="list-style-type: none"> <li>*Paralysis or weakness of one leg or arm</li> <li>*Difficulty in speech or swallowing</li> </ul>	<p>Consult your doctor immediately or go to a hospital</p>	<ul style="list-style-type: none"> <li>* MRI or Doppler test of blood vessels of the neck</li> <li>* MRI of the brain</li> </ul>		<p>Meet your doctor urgently</p>

## Diabetes and Your Sentiments

Are you shocked to hear about the diabetes in yourself or your child? You must be wondering how your child, who till the other day was healthy and playing and going to school or college, suddenly has this condition now. Various thoughts may be entering your mind as to how this has come about, whether you have done something wrong and whether it can be rectified. "Perhaps we should not have gone to attend that function, or not eaten the sweets that day?". You may be angry, and ask why only me or my family?

Diabetes definitely does not occur due to anything you did or did not do. If you are having such thoughts, you are not alone, this is a normal reaction. It is human tendency and happens with every body when you have bad news. Some people may not even accept the diagnosis and may consult different doctors in the hope that the diagnosis may be proved wrong. It is natural to have such ideas in the beginning. But unless you accept the situation, you will not be able to give proper attention and treatment to your child.

Several families have gone through this and have faced this challenge successfully. Mostly the children have done better than their classmates in school. Such people and families can best reassure you about your child's future through sharing their experiences. You will realize that your child can have a happy life with the help of our diabetes team and this big family of people who deal with childhood diabetes every day. In the beginning, everything will look difficult as you hesitate to learn new things but ultimately our whole team can come together to help you to overcome the difficulties.

You will feel sorry to see your child getting injections and finger pricks but you should be brave, and you will find your child will get adjusted faster than you. You will find that these injections and precautions about food etc. will become daily routine. Just like your child brushes his teeth and does his home work, similarly sugar testing and insulin injections will also become a part of his life. The more you accept these new realities and get on with the tasks of daily life, the better it will be for the child's happiness.

Remember that your attitude and conduct towards this child should be the same as towards the other children in the house.

### **Fear of needles**

A word about fear of the injections-generally children are afraid of injections and so parents are also nervous and hesitate to inject their child. As the child gets afraid, his hands and legs get stiff, which will make the injection more painful. An insulin pen is helpful as the needle in this is very small, and does not appear threatening to a young child. Parents should try to remove the fear from the child's mind. To direct the mind away from the injection, his attention can be focused on T.V. or music etc.

### **Meals and snacks**

Many parents feel sad and guilty that there will be lot of restrictions on the child's diet and that they will no longer be able to offer him or her all the tasty food he or she used to enjoy. Well, the fact is that excessive intake of chocolates, cold drinks, mithai, ice cream or fried food, is not very good for any child or adult, not just for someone with diabetes. So even if no one in your family had diabetes, you should not be consuming these items often; they should be reserved for special days or celebrations or festivals. Used in that way, it is alright for your child with diabetes to eat some of these items in measured quantity without feeling guilty or worried. Your diabetes team will advise you how to handle diet on special days.

### **The diabetes team**

Our team consists of doctors, diabetes nurse specialists, dieticians, social workers and "senior" families with diabetes with you in the centre of the team. Do make use of all the help we can give you.

### **Group meetings**

We organize group meetings and picnics for families with childhood diabetes, 2-3 times a year on Sundays. Here, you will meet many children and young adults and their family members, all of whom have

been dealing with diabetes for the last several years. From their words and experiences, you will gain a lot of confidence in being able to look after your child. You will be able to share your own feelings, concerns and joys with a group who fully understand what is involved in caring for a child with diabetes. The 3-4 hours spent with this group is worth much more than the doctor's visit.

### **Diabetes camp**

In many countries, residential diabetes camps are held every summer, where children and adolescents can spend 3-4 to 15 days with each other, playing, sleeping, eating and learning with each other. Children will not feel they are different from anyone else. They have a safe environment in which to stay and play, so parents can send the child without hesitation. In our country also, such camps are getting established; do try to attend such a camp.

### **School**

Your child has just got diagnosed with diabetes; you will wonder whether he can ever attend school and play, in a safe way. The answer is certainly 'Yes'. After going back home, do meet the class teacher and school principal, hand over the "Back to School", "Aao School Chalein" pamphlet, and if needed, you could enable a phone call to the diabetes team doctor, for the teacher to speak with. When your child is of older age, he/she can test and inject in school on their own. The school should give a quiet clean place for this. Your child can and must take part in picnic, sports day, competitive sports and all other activities of a school child.

### **Diabetes and adolescence**

During adolescent age, just as the child slowly demands independence for all things, so also will he or she need independence for diabetes related activities. As good parents, you have to learn to slowly share the responsibility for diabetes related tasks with the youngster. You will see that most children carry out their tasks very well and with responsibility.

### **Marriage**

Your child will, and should, want to get married as he or she grows older. In chapter 12 of this book, you will find some information and advice so that your daughter with diabetes can have a safe pregnancy.

### **Financial matters**

A certain part of your monthly budget will now have to be kept aside for diabetes related expenses. The blood glucose testing strips are particularly costly. Please take the help of our diabetes team to talk about cost issues also. Government of India and state government are coming up with schemes for helping children with chronic disease. Our medical social worker can help you with this information.

### **Special advice for the adolescent with diabetes**

If you now feel quite grown up, are in high school/inter college/university and feel you are capable of looking after yourself, then your responsibility towards your health will also increase. You should continue to look after your health the way your parents used to when you were a child. You should tell your close friends about your diabetes, without any hesitation, so that their help is available to you during times of need. If you are in a hostel and your parents have given you money for your daily needs, spend it wisely. If you have a doubt as to how to conduct yourself in any situation, do that which you feel would make your parents proud of you.

## Some Suggestions For Travel

You might have to or want to travel sometime and be away from home. Here are some precautions to be taken :

Preparing for a journey : Preparing well before leaving home will enable you to feel safe and confident and enjoy your trip.

1. Please visit your doctor and get any necessary test done.
2. Get a letter from your doctor about your diabetic condition. It is all the more necessary if you are going abroad, as there will be enquiries at the airport regarding syringes and needles.
3. Get a prescription from your doctor for needles, syringes and medicines. If by chance your insulin gets lost on the way, it may be required.

### What you should carry on your journey?

1. **Medicines:** Carry enough stock of insulin. If the weather is hot, then insulin should be kept in a thermos flask or in a thermocol box with an icepack. This is not necessary during winter months. If you are traveling by air, keep the insulin with you in the cabin, not in the checked-in baggage.
2. If you use insulin injections, then keep enough syringes and needles with you.
3. The blood glucose meter and sufficient glucose testing strips should be kept with you.
4. In order to avoid hypoglycemia, always carry glucose (or sugar /sweet/candy/lozenges). In addition you should keep other food (moderate glycemic index like fruit, biscuits and low glycemic index like roasted gram, sattu for taking care of blood glucose for longer number of

hours). If you are unable to get meals on time these may come in handy. Keep a bottle of drinking water also.

5. An ID card should be kept in the pocket saying that you have diabetes, what medicines you take and that if you are found unconscious or not behaving properly you should be taken to hospital immediately.

### After reaching your destination

1. Eat your meals at the appropriate time and in required quantities. You may find a little difficulty with strange foods in different lands, but if you follow directions as given in our booklet, you will be able to enjoy the variety.
2. If you are required to walk about or exercise more than usual, you may increase your intake of food and/or decrease your long acting insulin by 20%.
3. Do not forget to test your blood glucose frequently.

#### Items to be taken with you when traveling :

- a. Insulin
- b. Needles/syringes
- c. Cotton, spirit
- d. Glucose
- e. Materials for testing blood
- f. Some eatables like fruit, biscuits, bread or roti
- g. Glucagon injection
- h. Diabetes identity card.



## Diabetes and Pregnancy

You can have a healthy baby even if you have diabetes before or during pregnancy. But for this, you should take sufficient precautions and do some planning. You should be in close contact with your diabetes doctor and your obstetrician.

Good control of blood sugar before and during pregnancy will help you to have a normal healthy child. It will also help in reducing problems during pregnancy and avoid developing diabetes complications in the eyes and kidneys.

### What is the effect of diabetes on pregnancy and on the baby?

1. Uncontrolled sugars during pregnancy, especially during the ‘first 3 months of pregnancy’ can cause harm to the organs of the growing fetus, and may even cause some malformations. High blood glucose can sometimes result in abortion too.
2. The baby's birth weight may be high; this can cause problems during delivery.
3. The baby may have temporary hypoglycemia after birth, and may develop jaundice.
4. Later in life, the child or young adult may be at risk for diabetes. This risk is present even if the father of the child has diabetes, not just the mother.

### Some suggestions for a successful pregnancy

Your blood sugar should be well under control for 2-3 months prior to pregnancy (HbA1c should be between 6.0 to 6.5%). Do start taking folic acid even before you get pregnant.

1. Consult an expert gynecologist who has experience in looking after women with diabetes.
2. Do not forget to check the tests of long term complications of diabetes, in addition to daily blood sugar checks. Table 1 shows the target blood glucose and HbA1c during pregnancy.
3. Keep your sugar under control before getting pregnant. You might need to take insulin injections

instead of tablets after taking doctor's advice.

4. Diabetes related problems (eyes, kidneys or blood

**Table 1: Desirable blood glucose level during pregnancy**

Time	Desired blood glucose
Empty stomach	Less than 95 mg/dl
1 hr after meal	Less than 140 mg/dl
2 hr after meal	Less than 120 mg/dl
Hb A1c	6 - 6.5 %

pressure) should be attended to before pregnancy.

### Precautions during pregnancy

#### A-Keep sugar under control

1. For this you might need to take insulin injections several times (3 to 5) a day.
2. Test your sugar 5-6 times a day and keep a record.
3. Adjust insulin dose according to your meal, appetite and blood sugar. Your insulin dose may go up during pregnancy.

#### B. Diet

You should have a balanced diet, containing proteins as well as calories in somewhat greater quantity than you did before pregnancy. You may take the advice of your doctor or dietician for this.

Do not consume more of fatty foods. Women taking insulin should take a bedtime snack.

The following should be done after consulting the doctor:

1. Daily exercise-walking, swimming etc.
2. Checking of diabetes related long term complications 3 monthly.
3. After consulting a gynecologist, get ultrasound or other checkups done regularly.
4. Keep a watch on your weight and BP.

5. Do take folic acid and iron tablets.

**1. Is it necessary that delivery can only be by operation?**

No, it is not necessary. With diabetes you can still have a normal delivery. But sometimes, it may be

necessary to deliver the baby by operation.

**2. What should I remember after delivery:**

- a. Check blood glucose as frequently as during pregnancy and keep good control.
- b. Do not eat excess oily food.
- c. Do as much exercise as possible, and try to come back to your pre-pregnancy weight gradually.



## Insulin adjustment with blood glucose test and meals

### *I. Short term adjustment which you may do on your own*

#### A. Insulin adjustment for high pre meal blood sugar

The dose of quick acting insulin (eg: Huminsulin R, Insugen R, Humalog etc) should be increased if your pre meal blood sugar is above the target range. (The target before meals is usually between 70 to 130 mg/dl, though your diabetes team may change this for a particular child). This adjustment is for each dose taken before any meal. Your team will calculate how much extra quick acting insulin is to be taken for every 30 or 50 mg/dl blood glucose higher than the target, and they will write it in your blood sugar record diary.

#### B. Insulin adjustment for food

The dose of your quick acting insulin depends upon the amount of food to be consumed. Increased quantity of food requires an increase in the dose of pre-meal insulin and less food needs the dose to be reduced. Use the following table to adjust the dose of insulin for the meal to be eaten: if your usual pre-meal dose of regular or rapid insulin is small, you need to increase only ½ to 1 unit for a meal which is going to be heavier than usual. If your usual dose is about 10 units or greater, then you should increase the dose by 2 units for a meal which is going to be heavy.

Usual pre –meal dose of regular or rapid insulin	For a heavy or light meal, increase or decrease usual dose, respectively, by
1-3 U	0.5 U
4-9 U	1 U
10 or more	2 U

Note: Be cautious while adjusting for an increase in pre-dinner quick acting insulin, or before increasing the dose of night time NPH, to avoid hypoglycaemia during the night.

#### C. Insulin adjustment for low pre meal sugar

In case the pre-meal sugar is below 70 mg/dl, correct it by taking glucose or sugar, until you feel better. Once blood sugar is more than 100 mg/dl, inject the usual dose of insulin and eat your meal within 10 to 15 mins (if on regular insulin) or immediately (if on rapid acting insulin). You need not routinely decrease the dose of insulin in case of hypoglycemia or low blood sugar. This may be occasionally required if the blood sugar falls below 50 mg/dl.

If the pre-meal blood sugar values are persistently low, then the dose of the long acting insulin must be decreased. Please also contact your diabetes team urgently.

### *II. For fine adjustments with more experience*

- i) Insulin adjustment for high pre meal sugar: With experience, you may be able to do fine adjustment at home yourself. By using the formula below, you can calculate the adjustment of premeal insulin dose.
- ii) For regular insulin, calculate 1500/total daily dose of insulin. For each value derived from this formula the dose of insulin should be increased by 1 unit. And for Humalog/Novorapid, calculate 1800/total daily dose of insulin.

**For example:** If you take a morning dose of:

10 U regular + 15 U NPH before breakfast,

8 U regular before lunch,

2 U before evening snack

5 U regular + 10 U NPH before dinner,

then your total daily dose would be  $10 + 15 + 8 + 2 + 5 + 10 = 50$ . Then calculate  $1500/50 = 30$ .

So, 1 unit insulin should be increased for every 30 mg/dl pre meal blood sugar elevated beyond range (i.e. beyond 130 mg/dl, usually). In the above example, if the pre breakfast blood sugar reads 210 mg/dl (80 mg/dl above 130 mg), then the morning dose would be  $10 + 2$  or 3 units regular and 15 units NPH, if pre lunch is elevated, dose would be  $8 + 2$  or 3 units regular and if pre-dinner value reads 210 mg/dl the dinner time insulin dose would be increased as  $5 + 2$  or 3 units regular and 10 units NPH.

### iii) Fine tuning Insulin adjustment for food

With experience, you can make meal related adjustments in a more precise way, using Insulin Carbohydrate Ratio (ICR) as follows :

- a. Insulin Carb Ratio = 500 divided by the total daily dose of insulin.
- b. This value enables you to know, for every how many gram of extra carbohydrate consumed you need to increase the dose of insulin(regular/rapid) by 1 unit.

For example, if you take

5 U regular + 7 U NPH pre breakfast,

4 U regular pre lunch

4 U regular and 5 U NPH pre dinner,

then your total daily dose would be  $5 + 7 + 4 + 4 + 5 = 25$ ; your insulin carb ratio (ICR) would be  $500/25 = 20$ .

This means, for every 20 gram extra carbohydrate consumed in your meal, an extra dose of 1 unit regular/rapid insulin must be added in the pre meal dose.

To know how many grams carbohydrate are there in your foods, please refer to tables 5A to 5E in the Diet chapter, and to Appendix C, and meet the dieticians often.

### Long term adjustments to be done with the help of the diabetes team

If your pre-meal blood sugar value is persistently above the target range over a period of 3 to 4 days, then the dose of long acting insulin such as NPH or glargine may be increased from the following day onwards. Seek the help of your doctor or diabetes nurse educator for the adjustment in dose of long acting insulin for initial few times, before doing it on your own.

Further fine adjustment in the dose of quick acting insulin is also made according to the 2 hour post meal blood sugar values obtained on the dose of pre-meal insulin taken. If your post meal blood sugar is persistently above or below the target range, (i.e. you are requiring constant adjustment), then the usual dose of the short acting insulin like regular or rapid insulin may need to be increased or decreased respectively with help from the diabetes team.

The above guidelines for insulin adjustment are updated often. You need to consult your doctor and diabetes nurse educator and be updated about these changes. Read your diabetes education book often, at least once in every 3 months.

*For any information, you may speak to the doctor or diabetic nurse educator in the endocrinology OPD, at 0522-2496237 and to the dietician at 0522-2496236.*

*In case of emergency, you may contact at the above phone number during the working hours (9.30 am to 5 pm) or call the emergency phone numbers given to you.*

### More information on carbohydrate counting

Glucose in blood is dependent on carbohydrate consumed in food

How will I know how much carbohydrate is in a food?

For packaged foods, you can look at the food label and find out how much carbohydrate is in the food. For home cooked food, the following list will help you get started. Foods already listed in Tables 5A to 5E in chapter 3 are not listed here again.

#### Carb Counting Food List

Remember 1 Carb choice = 15 gms. Carbohydrate; 1 cup = 150 ml; Foods marked with an asterisk \* contain fat

Each portion is 1 carb choice (15 g carbohydrate)

##### Cereals and Breads :

1 small pau/dinner roll	¾ cup poha
¾ paratha or thepla, 6"*	¾ cup pasta
½ paneer paratha*	¾ cup bisi bela bhath*
¾ potato paratha, 6"*	¾ cup biryani/pulao meat*
¼ of 8" x 2" naan	¾ cup khichdi
2 puris (5" each)*	1 square dhokla
1 dosa (approx 10" diameter)*	½ uttapam vegetable (small)*

##### Starchy Vegetables :

1½ cup kaddu
1 small potato boiled or baked
¾ cup sweet potatoes
¾ cup peas

##### Sweets

5 vanilla wafers
1 small gulab jamun*
½ cup carrot halwa*
½ cup sooji halwa*
6 pcs. khandavi*
¾ cup kulfi*
½ small laddoo*

##### 1 medium rasgulla

##### Fruit/Fruit Juices

½ small mango (¾ cup)
1 small orange
1½ cup papaya cubes
1 small pear
1¼ cup fresh pineapple
3 tbsp raisins

##### Pulses/dals/beans: 1 cup

1½ cup sprouted moong salad
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##### Fruit/Juices (contd.)

4 whole apricots (fresh)
8 halves dried apricots
1½ cup melon cubes
1 medium chiku (sapota)
12 sweet cherries
3 dates
1½ dried figs
1 kiwi
1 med seetaphal (sharifa)
1½ cup watermelon cubes
¾ cup apple juice
½ cup grape juice
½ cup mango juice
¾ cup guava juice
¾ cup orange juice.
(all juices without sugar)

**Snacks :**

30 gm bhelpuri  
6 pani puri\*  
2 papad  
1 medium vegetable cutlet\*\*  
3 pcs pakoda spinach\*  
1 kachori (mung dal)\*  
2 pcs dahi vada\*  
6 cups popcorn\*\*  
2½ cups laiya (murmura)  
10 potato chips\*\*  
10 French Fries\*\*  
12 chicken nuggets\*  
¼ of 10 inch pizza\*  
1 small rasmalai  
¼ cup shrikand\*  
¾ cup ice cream\*  
¾ of a granola bar  
1 small cupcake\*

**Vegetables :** 5 g (Count if serving

size more than 15g)  
¾ cup cooked vegetables (green beans,  
beets, cabbage, carrots, cauliflower,  
brinjal, bhindi, onions, spinach,  
tomato, turnips etc).  
1½ cups raw vegetables

**Free Foods :** <5g carbs and 20 calories

Sugar free aerated drinks (cold drinks)  
Spices and seasonings  
Salads

(Modified from Carbohydrate Counting for Traditional Indian and Pakistani foods 4<sup>th</sup> version)  
[<http://www.sjsu.edu/people/ashwini.wagle/Southasians>]

\*Should be avoided due to high calories and fats

\*\*High salt and fat

## Appendix-D

Checklist for education for childhood diabetes

### 1. Introduction

- i. What is diabetes? Pancreas, insulin- its deficiency or lack of action
- ii. Difference between type 1 and type 2 diabetes
- iii. Why does it happen? - autoimmunity, heredity, obesity
- iv. Importance of good blood glucose control
- v. Components of management - insulin, diet, exercise, monitoring and knowledge
- vi. Alternative and complementary therapy?

### 2. Insulin

- i. Different types of insulin-onset and duration of action, modes of delivery
- ii. Handling and care of administration devices: syringes (warn about U 40 vs. U 100), pens, pumps
- iii. Injection technique, mixing/priming, rotation of sites, marking of sites, reuse of syringes
- iv. Transport and storage of vials/cartridge, extra vial/cartridge for breakages, safe disposal of sharps, precautions while buying new insulin
- v. Warning that insulin requirement may come down temporarily during the honeymoon phase.

### 3. Diet

- i. Diabetic diet is a normal balanced diet with a few additional precautions
- ii. Components of balanced diet, 3 major meals and 1-2 snacks per day
- iii. Quantity, timing and composition of meals to be consistent from day to day as far as possible.
- iv. Reduce simple sugars, excessive salt, excessive fats, especially saturated fats.
- v. Exchange lists to be used for variety.
- vi. Visit to dietician: exchange list, carbohydrate counting and insulin carb ratio
- vii. Encourage low glycemic index foods. Provide lists for these foods.
- viii. Inform about free foods
- ix. Adjustment for special occasions

### 4. Hypoglycemia

- i. Causes, prevention, recognition and treatment
- ii. Management of severe hypoglycemia - glucagon prescription/glucose paste application and reminder to family members/ school staff on how to use
- iii. Always carry glucose or candy and preferable hypo-kit
- iv. Have a diabetes identity card.
- v. Let a few close friends and teachers and a nearby physician know how to help you.

### 5. Exercise/Play

- i. Importance, precautions
- ii. Daily for 30 to 45 minutes, aerobic. Do anaerobic also.



- iii. Exercise and hypoglycemia, extra snack and insulin dose adjustment for prevention
- iv. Frequent monitoring of blood glucose esp. at bedtime and 2 AM as risk of late hypoglycemia

**6. BG (blood glucose) testing**

- i. Importance of monitoring BG in minimizing complications
- ii. Frequency of monitoring and target BG
- iii. Sites for checking BG, use of pricker
- iv. Appropriate BG meter, urine ketone testing strips, storage of strips, expiry dates, coding
- v. Periodic validation of meter values; review testing technique, BG goals
- vi. Maintaining log of BG with insulin doses and diet/ exercise variations
- vii. Importance of writing remarks
- viii. CGMS (Continuous Glucose Monitoring System) what is it?

**7. Lab/other Monitoring**

- i. Glycosylated hemoglobin (HbA1c) every 3 months
- ii. Need for monitoring growth, puberty, BP, fundus
- iii. Need for periodic TSH, TTG, microalbuminuria, lipids, for long term complications

**8. Sick day rules**

- i. Test frequently on sick days. Do not omit insulin altogether. Read sick day guidelines given by doctor
- ii. If hypoglycemia due to poor intake, take sugar containing foods.
- i. If blood glucose more than 250, check ketones and take extra insulin as per calculation.
- ii. Rest, plenty of fluids.
- iii. Emergency numbers to contact in case of difficulty
- iv. Danger signs, ketoacidosis
- v. Indications for hospitalization.

**8. Miscellaneous**

Foot care; traveling; parties, festivals and fasts; alcohol; education and career planning; pregnancy and contraception; driving, long term complications; diabetes "identity" card. Contact nos.- emergency and diabetic educator, next appointment.

## Appendix-E- Internet link and resources

1. American Diabetes Association  
<http://www.diabetes.org>
2. Understanding Diabetes/School of Medicine/Univ. of Colorado Denver [www.ucdenver.edu/academics/colleges/medicalschool/centers/Barbara Davis](http://www.ucdenver.edu/academics/colleges/medicalschool/centers/Barbara%20Davis).
3. International Society for Pediatric and Adolescent Diabetes  
[www.ispad.org](http://www.ispad.org)
4. Diabetes UK  
<http://www.diabetes.org.uk>
5. International Diabetes Federation  
<http://www.idf.org>.
6. Dietary Guidelines for Indians-National Institute of Nutrition:[ninindia.org/DietaryGuidelinesforNINwebsite.pdf](http://www.ninindia.org/DietaryGuidelinesforNINwebsite.pdf)  
[http://icmr.nic.in/guidelines diabetes/guide diabetes.htm](http://icmr.nic.in/guidelines%20diabetes/guide%20diabetes.htm)
7. National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK)  
<http://www.niddk.nih.gov/health-information/diabetes>
8. Joslin Diabetes Center  
<http://www.joslin.org/diabetes-information.html>
9. SGPGI teaching videos on diabetes

Insulin	<a href="https://www.youtube.com/watch?v=0OY-EXBEHWc">https://www.youtube.com/watch?v=0OY-EXBEHWc</a>
Diet	<a href="https://www.youtube.com/watch?v=H53yfstjllg">https://www.youtube.com/watch?v=H53yfstjllg</a>
Hypoglycemia	<a href="https://www.youtube.com/watch?v=dU0u6Vs9og8">https://www.youtube.com/watch?v=dU0u6Vs9og8</a>
Complications	<a href="https://www.youtube.com/watch?v=5xirOIY3CqQ">https://www.youtube.com/watch?v=5xirOIY3CqQ</a>

