**Living with type 1 diabetes**

A practical guide for children and parents

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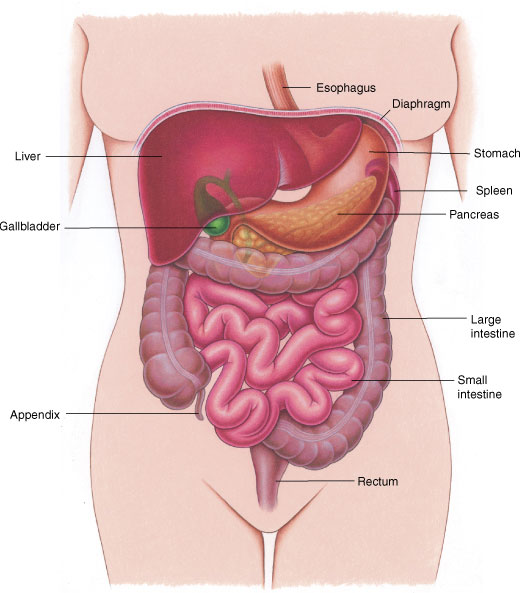
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31. **What is diabetes?**

Diabetes mellitus is a group of diseases characterized by high levels of glucose in the blood resulting from defects in insulin production, insulin action, or both. In the human body, there is a hormone called insulin produced by an organ situated close to the stomach called ‘pancreas’.Insulin in the body controls blood sugar levels by increasing utilization of glucose in various organs of the body. When there is no insulin, blood sugar increases and results in diabetes. Common symptoms in children arefrequent urination (even in night/ bed wetting), increasedthirst,frequenteating,weight loss and change in behavior (inadequate sleep)

1. **Diabetes? But I thought only adults can have diabetes…**

No, children can have diabetes too. There are various types of diabetes. Type 1 diabetes occurs in children. Here, the pancreas stops making insulin. So, one has to provide insulin from outside on regular basis. In type 2, which is usually seen in adults, though insulin is produced it is not able to functionnormally.Differences between type 1 and type 2 diabetes:

|  |  |  |
| --- | --- | --- |
| Features | Type1 | Type2 |
| Age at onset | Children (usually less than 14yrs) | Adults (usually more than 40 yrs) |
| Risk factors | Genetic and autoimmunity - more important | Family history and Obesity |
| Insulin production from beta cells | Low /Absent (insulin deficit) | Normal/ increased (insulin resistance) |
| Insulin cell antibodies | Present | Absent |
| C peptide in blood | Reduced or absent | Normal |
| Acanthosisnigricans (hyperpigmentation and thickening of skin – behind neck | Absent | Present |
| Associated autoimmune diseases  Like hypothyroidism, celiac disease | Common | absent |



**Pancreas and its islet cells isthe organ defective and causing Type 1 Diabetes.**

**LEFT**

**RIGHT**

Location of Rt&Lt Kidneys

**Figure 1: Pancreas and other abdominal organs**

1. **Why did my child have diabetes?**

In a genetically prone child some environmental trigger like viral infection causes inflammation in islet cells of pancreas. Parts of these broken cells go into blood circulation and activate antibody formation against them. Local inflammation of islet cells also releases number of chemicals in pancreas leading to further damage of islet cells. When 90% of these cells are damaged by repeated such episodes over a period of months to a year, type1 diabetes will occur.There is no reason for parents to feel guilty that their child has developed diabetes because of some mistake on their part.

1. **What medical problems can occur in type1 diabetes?**

**In the short term,** lack of insulin increases the blood sugar levels by decreasing utilization of glucose by the different cells in the body. Normally, like automobileneeds petrol as fuel to run, different organs/cells in our body require sugar as a fuel/energy to work. Insulin helps the organs in using the sugar that is present in the blood. When there is no insulin, the organs are unable to use the sugar though there is plenty of it. The blood sugar then leaks out in the urine along with water. Urine output increases, the child becomes more thirsty, hungry and tired. Despite consuming more food and water, child feels hungry and tired and there is loss of weight as the organs are unable to use the sugar in the blood. High blood sugar levels can also cause infections, like boils in the skin. Most important and serious acute complication of insulin deficiency is ‘diabetic ketoacidosis (DKA)’. It occurs due to production of ketoacids when body uses fats (in absence of glucose in the cells) to provide energy to cells. DKA presents with above features of diabetes with lethargy, deep breathing, vomiting, pain abdomen, dehydration (with high or normal urine output usually) and finally loss of consciousness.

**In the long term,** when high blood sugars persist for many years,the most important organs that are affected are the eyes, kidneys, nerves, heart and the blood vessels. Most of these complications do not occur in childhood and start at least 10-15 years after diagnosis. Many of them can be life threatening and the main purpose of treating diabetes and maintaining normal blood sugars is to prevent these complications.

The complications in the eye are cataracts (which require surgery) and changes in the retina, the back of the eye (which may cause permanent loss of vision). The damage to the kidneys can increase the blood pressure and can cause permanent kidney failure. Damage to the nerves can cause tingling, numbness, severe limb pains and ulcers. Changes in the blood vessels increase the risk of ‘heart attacks’ and strokes.

1. **What is treatment fortype1 Diabetes? Is it curable?**

Diabetes cannot be permanently cured but can be controlled. Since the problem is lack of insulin within the body, insulin has to be given from outside as daily injections. These injections have to be *continued lifelong.*

1. **Is there any alternative to injections?**

No. As of now, insulin can be given only as injections under the skin, since in tablet form; it will be destroyed by the digestive juices in the stomach. As of now there are no oral tablets/medicines which control sugar levels in type 1 diabetes. However, there are different ways/modes of delivering insulin injections e.g. Insulin Syringes, Insulin Pens and Insulin Pumps (Continuous Subcutaneous Insulin Injections).

1. **But my uncle also has diabetes and he takes tablets…**

As mentioned earlier, in type 2 diabetes that occurs in adults, insulin is present but does not function normally, which can be made to work by giving some oral medicines. But in type 1 diabetes where there is no insulin in the body, insulin injections are the only answer. Insulin given orally is destroyed in the stomach and is not absorbed.

1. **What about homoeopathy and ayurveda?**

No type of medicine is presently known to ‘cure’ diabetes. The most important thing is not to stop insulin injections as that is the only way to control blood sugars.

1. **How can we manage diabetes at home?**

For effectively managing diabetes at home, you need to understand the following aspects:

1. ***How to check blood sugar at home?***

Of the various good quality glucometers available in the market, one can choose any easy to use, cheaper option available keeping in mind the cost of the glucose checking strips and their availability. Finger pokers or lancets are available with adjustable depths for different ages. Simple sterile needles of size 22-26 can be used. Blood should be drawn from the sides of the pulp of finger rather than tip/centre of the pulp. Hands should be washed with warm water before testing and dried. Spirit swab for cleaning is not recommended.

Frequency of blood sugar monitoring depends on the age of the patient, number of insulin injections per day (i.e. type of insulin regimen), adequacy of sugar control etc. Ideally sugar is to be monitored at least 4 times in a day i.e before each meal and at bed time. More frequent testing may be required when sugars are repeatedly high or low, when child is ill and with heavy exercises.

Common problems causing inaccurate sugar levels could be:

1. Unclean hands and finger (sugar on finger, alcohol/water on finger)
2. Unclean glucometer (dried blood etc)
3. Too small/too large blood drop
4. Strips have expired
5. Codes on strip and glucometer do not match
6. Strips exposed to very high /cold temperature
7. ***Record keeping/Diabetes Diary (Log Book)***

Record keeping of blood sugar levels,insulin dose, low sugar episodes and any special activity/event on day of high or low sugars is very important to make changes in insulin doses and further decision making by parents or doctors.

Recording should be done in a manner which clearly depicts trends in blood sugar levels with respect to time of the day. A sample monitoring/recording sheet is given at the end.

1. ***What should be target blood sugar levels?***

Target/Optimal plasma blood sugars as per time of the day are given in table 1 below.

**Table 1: Target blood sugars (all pediatric ages)**

|  |  |  |
| --- | --- | --- |
| **S.No** | **Timing** | **Optimal level of Plasma sugar (mg/dl)** |
| 1 | Morning fasting/Before meals | 90-145 |
| 2 | After meal | 90-180 |
| 3 | Bed time | 120-180 |
| 4 | Night time (anytime) | 80-162 |
| **Optimal HbA1c < 7.5%** | | |

(American Diabetes Association {ADA}- International Society of Pediatric and Adolescent Diabetes (ISPAD) guidelines, 2011)

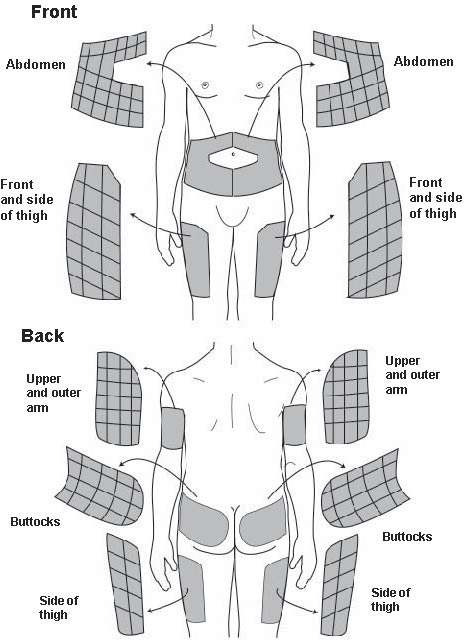
1. ***How do I administer insulin at home?***

**Syringes** – Insulin syringes of different companies are available of 40 units and 100 units marking. One can choose as per the number of units of insulin being taken. One should have separate syringes for different types of insulin if syringes are being reused. This is done because 1-2 insulin units will always remain in the syringe even after injection and will mix with the other insulin being given with same syringe.

**Needles** – Needles are attached to the syringes and are of different thickness (from 26 gauge to 30 gauge) and lengths (4mm to 8mm). Generally 28G and 4-6mm length needles are appropriate for children less than 6 yrs and 28G with 6-8 mm for older children. Preferably, syringes and needles should not be reused. Smaller the needle length better it is.These syringes/needles should be kept in refrigerator to avoid infection.

**Injection sites and rotation** – Insulin injection is given under the skin in the fat (subcutaneous). It is absorbed fastest from abdomen followed by arms, thighs and buttocks in that order. Also insulin is absorbed fast from the part which is being exercised (e.g. from thighs if someone starts walking/jogging after taking insulin short in thigh). Because of difference in absorption from different sites, a proper rotation plan for injection should be followed. Generally one can use one site for 10 days with rotation within the site, so that in 30 days we rotate between 3 sites i.e. arms (5 days on each side), abdomen (10 days, by rotation 1.5-2 inches away from umbilicus) and thighs (5 days on each side). Rotation is important because insulin injection causes damage to the skin (lipodystrophy) if given at the same site over long period. This will lead to poor absorption of insulin.

**Figure 2: Suggested Scheme for rotation of sites for insulin injections.**



**Insulin storage**

All insulin vials or pen injections which are currently in use (opened) can be safely kept at room temperature for upto 1 month. All sealed Insulin vials or pen refills/cartridges kept for backup should be stored in fridge at 2-8 degrees (lower shelf or door of fridge)i.e.they should never be frozen (if frozen, one has to discard). During journey by train or bus, they can easily be kept in a bag at cool dry space without excesses of temperature (not near engines of bus/car). There is no need to keep icepacks until there are very high temperatures.

**Steps of injection**

1. Gather everything required (insulin vials, syringes, spirit swab, diary with current glucose value and insulin dose)
2. Wash hands and site with soap and water. If in hospital, clean site with spirit swab. Cleaning every time with spirit is not recommended as it damages and thickens the skin making injections difficult.
3. Shake NPH/mixtard insulin well to mix any particles in the vial (this is not required for clear insulin i.e regular or lantus insulin). Warm the vial keeping in the palms (if refrigerated). Wipe the tops of insulin vial with spirit swab.
4. Push and pull the plunger of the syringe a few times to remove any insulin remaining in the syringe and to smoothen movement. Draw same amount of units of air in the syringe as dose of insulin is to be given. Push this air into the insulin vial and invert the vial and then draw the number of units of insulin needed.
5. If insulin was refrigerated, the syringe can be kept in the palm to bring it to room temperature so that injection is less painful.
6. Choose the site as per rotation plan. Relax the site (deep slow breathing will help). Lift up the skin with gentle pinch between thumb and index finger of opposite hand.
7. Needle should be inserted at 45 degree to skin and 90 degree if shorter needle i.e 8mm. Touch the tip of needle with skin and gently push the insulin in with pinch intact.
8. Wait for 5 to 10 seconds for insulin to spread and then remove needle slowly. Release pinch after removing the needle.
9. Put a dry cotton or finger over the site and press and gently rub for a few seconds.
10. Observe for any insulin leaking back. Observe for any blood or bruising of skin which means one needs to change to some other site which has more fat.

### Types of Insulin

* **Rapid-acting insulin**, such as insulin lispro (Humolog by Eli Lilly), insulin aspart (Novo Rapid by Novo Nordisk), or insulin glulisine (Apidra by sanofi-aventis), begins to work about 10-15 minutes after injection, peaks in about 1-1.5 hour, and continues to work for 2 to 4 hours.
* **Regular or Short-acting insulin** usually reaches the bloodstream within 30 -45 minutes after injection, peaks anywhere from 2 to 3 hours after injection, and is effective for approximately 5 to 6 hours.
* **Intermediate-acting insulin**(NPH insulin) generally reaches the bloodstream about 2 to 4 hours after injection, peaks 4 to 12 hours later, and is effective for about 12 to 16 hours.
* **Long-acting insulin**- There are also two **long-acting insulin analogues:**glargine (Lantus &Basalog) and detemir (Levemir). They both tend to lower glucose levels fairly evenly over a 24-hour period with less of a peak of action than ultralente.
* **Ultra long acting ‘Degludec’ Insulin- action lasts for 42 hours. It has recently been launched in India. It is not yet approved for use in children.**

**Figure 3. Schematic diagrams showing sugar trend after meal (a) and insulin actions after injection of 4 different types of insulins (b-e)**

2 hrs

**Blood sugar trend after a meal**: sugar starts rising after ~30 mts, max by 2hrs and back to pre meal level in 3 hrs.

(a)

30mts 3 hrs

Meal time

(b)

**Rapid acting insulins**: insulin starts acting after 5-10mts, max action by 1.5 to 2hrs and disappears in 3 hrs.e.g. Novorapid/Humalog/Apidra

1.5-2 hrs

Insulin5-10mts

3hrs

**Short acting insulins**: insulin starts acting after 30mts, max action by 3 hrs and disappears in 5-6 hrs.e.g Regular Human insulin

3 hrs (c)

30mts 5-6 hrs

**Intermediate acting insulins**: insulin starts acting after 2hrs, max action by 5-6 hrs and disappearsin 12hrs.e.g. NPH

(d)

5-6 hrs

2-3 hrs 12 hrs

**Long acting insulins**: insulin starts acting after 1-2hrs, has stable EQUAL action over 24 hours (no peak effect like other insulins) e.g. Lantus/Levemir

(e)

1-2 hrs 24hrs

**Premixed insulins**– They are available in different compositions (different ratios of long acting and short acting insulin) but 70/30 (70% intermediate acting and 30 % short acting) premixed insulin is most commonly used. **Premixed insulins are not advisable for children as it is difficult to change dose of short acting/long acting insulins separately, which is frequently required in children because of variable food intake and wide fluctuations of sugars on daily basis.** These are better reserved for adults with diabetes. Only advantage premixed insulin have is that it is easy for ignorant/uneducated parents as they do not have to separately sequentially draw two types of insulins into syringe and titrate two different types of insulins.

**Pen injections –** They are even more convenient to use as there is no need to draw insulin into a syringe every time. Cartridges carrying different types of insulin including premixed preparations are available and need to be changed regularly. Moreover, the needle is not visible to the child and is particularly useful for children having needle phobia. Every time 1-2 units of insulin are shot in the air to remove dead space in the needle and then the desired insulin units are dialed and injected the same way as with insulin syringe. All other steps remain the same.

**Frequency of insulin injections**

There are different insulin regimens developed over the years. As per current understanding, the regimen closest to the pattern of insulin release in normal persons, is a single shot of long acting lantus/glargine in a day (given usually in the morning/bedtime) along with short acting insulin shots with each meal. This will require 4 injections of insulin in a day which may be taxing for some parents and kids. For the sake of convenience most of our children are on 2 shots per day of split-mix insulin regimen (short acting + intermediate acting) with breakfast and dinner. Some children may need short acting insulin pre lunch if required. Frequency of injections may decrease significantly in *honeymoon period (grace period)* in which some insulin is being produced in the body. This phase occurs within 2 years of diagnosis and the child may do well with a single shot of long acting insulin or two small doses of intermediate acting insulin given in morning and evening.

*Regular/Rapid acting boluses before meals*



Figure 4: Basal bolus regimen. Long-acting insulin (glargine or detemir) is given at bedtime (40-50% of total daily dose).Rapid acting insulin (aspart or lispro) or short acting (Regular) is given before each meal (50-60% of total daily dose). The timing and amount of meal is flexible as insulin is directed by meals.



Figure 5.Split-Mix Insulin regimen. Insulin is given before breakfast (two-third ofdaily dose) and dinner (one third of daily dose). Each injectionis a combination of intermediate (NPH) and short (regular) or rapid acting insulin (lispro or aspart). Regular meal pattern is required to prevent hypoglycemia.

1. ***What to do if my child has low or high sugar?***

One must first understand why a child with diabetes on insulin therapy can have a low or a high sugar. Once a child eats, blood sugar rises and insulin then reduces the sugar level by helping various organs consume it. So, when sugar is low, it means that (1) the child has not eaten adequately or (2) if the meal was adequate, more sugar was used up in excessive activity/exercise or (3) if both the meal and activity were normal, then more insulin than required was given. Similarly if sugar is high, it means that (1) the child has eaten high sugar items or (2) if the meal was normal, then less insulin than required was given.

**How to identify and treat hypoglycemia?**

**Blood sugar less than 70mg/dl is called hypoglycemia. However, symptoms usually start below 60 mg/dl.**In a well controlled child *Common Causes* are:

1.Missing or delaying meal/snacks. 2. Giving more dose of insulin by drawing more in insulin syringe. 3. Extra exercise. 4. Injecting insulin deep in muscle (rapid absorption). 5. Taking warm water bath immediately after taking insulin shot.

*Symptoms*: following are common symptoms which occur in sequence as sugar further decreases.

1. feeling of hunger/nausea
2. giddiness/shakiness
3. pale/red face
4. sweating/palpitations (feeling of heart beat)/ anxiety
5. headache
6. confusion
7. drowsiness
8. abnormal behavior- irritable/angry/cry
9. double vision
10. unconsciousness
11. seizure

*Special features of night time hypoglycemia*

1. inability to sleep- feeling hungry, restless
2. feeling tired on waking up
3. waking up with rapid heartbeat, sweating, headache
4. sleep walking
5. waking up with confusion and loss of memory

*Treatment of hypoglycemia*

Table 2 shows commonly available household items which can be given in emergency as per the age of the child.

Table 2: Amount of glucose rich items required for treatment of hypoglycemia

|  |  |  |  |
| --- | --- | --- | --- |
| Items | < 5yrs | 6-10 yrs | >10 yrs |
| Sugar | 2tsf | 3tsf | 4tsf |
| Glucon –D | 2tsf | 3tsf | 4tsf |
| Honey | 2tsf | 3tsf | 4tsf |
| Milk (1cup= 200ml) | ¾ cup | 1 cup | 1 ½ cup |
| Orange juice | ½ cup | ¾ cup | 1 cup |

**Remember 5 gm of sugar (carb) increases blood sugar by 10-15 mg/dl. Amount of sugar or any of the above item required to target blood sugar 70-80, can thus be calculated.**

Inj. Glucagon should be given in two situations with hypoglycemia:

1. When child is unconscious. ( dose of 30 units in insulin syringe of 100 units i.e 0.3ml for < 6 yrs, 50 units (0.5ml) for 6-18 yrs and 100 units (1.0 ml) for >18 yrs)
2. When child cannot take orally because of vomiting or any other reason. (low dose glucagon i.e 1UNIT per yr of age)

Inj. Glucagon is given in same way and site as insulin injection. Inj. Glucagon should thus be kept for emergency with every diabetic child.

Blood sugar should be checked 15 minutes after above measures are taken for hypoglycemia and all sugar containing food or glucagon should be repeated if sugar is still below 70mg/dl after 15 minutes.

All patients with severe hypoglycemia (unconscious child) should be taken to hospital while above measures are started on way to hospital.

*How to prevent hypoglycemia?*

1. Giving extra snacks/ decreasing insulin dose before heavy exercise.
2. Not missing/ delaying meals after insulin injection.
3. Giving extra snacks if blood sugar is < 120 mg/dl when going to bed.
4. Not giving insulin immediately before bath with warm water (increases insulin absorptionand chances of hypoglycemia)
5. Doing extra sugar checks during /after exercises and whenever suspecting low sugar.

**How to identify and treat hyperglycemia (high blood sugar)?**

Any sugar level more than 200mg/dl in a diabetic child should be taken as high and acted upon.It is identified usually by repeated blood sugar checking as moderately high sugar (200-300) will not have many symptoms. However, this much blood sugar will also cause poor blood sugar control and high HbA1c levels and this need to be prevented. Very high sugars will have all symptoms of diabetes as child had before diagnosis (excessive thirst, frequent and night time urination, excessive hunger, weakness etc) and if not controlled may lead to diabetic ketoacidosis.

*Treatment of intermittent hyperglycemia (high blood sugar)*

Most common cause of occasional high sugar in a well controlled child is intake of sugar containing snacks/foods (after attending birth day/ marriage party) or missing insulin dose. Other reasons can be inter-current infections, stress (exams, menses etc), puberty and wrong assessment of insulin dosage.

Unfortunately, most parents are not much concerned about occasional high sugar values as much they are concerned about low sugar values. One reason for this is that hypoglycemia has dramatic symptoms and mild to moderate hyperglycemia usually does not cause any symptoms and only has long term implications. Even transient hyperglycemias cause increased HbA1c levels and poor diabetic control leading to more likelihood of long term complications. So, occasional high sugars should also be taken as seriously and dealt with immediately.

**If blood sugar is more than 200mg/dl (150-180 for older children for tighter control) any time, extra dose of short acting insulin should be given (even if insulin dose is not due otherwise at that time). Extra dose required is 1 unit for each 50mg (100 mg for children less than 5 years) increase in blood sugar above 200mg/dl.**

Also one should **check for ketones when fasting sugar is >240 and any other time >300 mg/dl. One should keep a watch for any symptoms of DKA when sugars are so high.**

If there is trend of high sugar for 2-3 days at particular time, appropriate dose adjustment of insulin regimen should be made.

1. **How to do insulin dose titration (changes as per sugar levels) for repeated low or high sugars?**

To avoid repeated high and low sugars, insulin dose titrations are to be done. Blood sugar level is not the only factor requiring dose adjustment one should also consider food intake and other factors like exercise etc. It is not very easy to make insulin dose adjustments at home, but one learns by time and many parents (depending on their understanding) start making these adjustments on their own after 6-9 months of insulin treatment. It is easy to make titrations when one is using separate short acting and intermediate acting vials or pens as premixed (mixtard)insulin have fixed units of short and intermediate acting insulin and is difficult to increase or decrease each separately. Adjustments are better made when we keep a good record of sugar levels and insulin dose given every time. A well maintained diary helps us look at the trends of sugars and insulin doses required.

General rules for insulin dose adjustments are

1. No adjustment is required if sugars are within the target range which is : < 5 years 80-200 mg/dl, for 5-11yrs 70-180 mg/dl and for 12 yrs or more 70-150 mg/dl.
2. At any time of the day if value is less than 60-70 mg/dl, child is given some sugar containing snack/meal and insulin dose if due, is to be given when sugar level reaches above 80 mg/dl**(5 gm of sugar usually increases blood sugar by 10-15 mg/dl)**.
3. **At any time if sugar level is more than 200 mg/dl, one should add regular/rapid acting insulin to the usual dose due at the rate of 1 unit per every 50 mg (100 mg for less than 5 years) rise in sugar above 200.**
4. Previous corresponding (as per the table below) Insulin dose increments/decrements should not be more than 1 unit in children less than 5 yrs and not more than 2 units in older children. One may decide no. of units to be increased or decreased depending on degree of high/low sugars.
5. Previous corresponding (as per the table below)Insulin dose adjustments should not be made on the basis of a single abnormal sugar value but if there is a trend of low or high sugars over 2-3 consecutive days.
6. One should wait for2-3 days for the new dose to have its desired effect.
7. One should also remember that short acting insulin will have its effect from breakfast to lunch and then from dinner to bedtime (for patients on Short/rapid acting and NPH insulin regimen). NPH or intermediate acting insulin will have its effect from lunch to dinner and from bedtime till morning. Long acting insulin given any time of the day will have its effect for 24 hours.

Decreasing insulin dose

1. If sugar is low on 2 days at a particular time the corresponding dose has to be reduced by 1-2 units.
2. When 2 consecutive sugars in a day are low, next dose due has to be reduced.
3. Preceding dose of insulin should also be reduced whenever increase in activity is expected.

Increasing insulin dose

1. When sugars at a particular time are high for 2-3 consecutive days without any specific reason, the corresponding insulin dose has to be increased by 1-2 units.
2. When child is growing fast like at puberty (insulin dose increases usually by 1 unit/kg gain in weight)
3. When psychological stress like exams or menses in girls.
4. When HbA1c is high.
5. During illness insulin dose has to be increased temporarily,especially when urine ketones are positive.
6. Extra 1 unit of short acting insulin should be given for each 50 mg/dl (100 mgfor less than 5 years) increase in sugar above target.

**Table 3: Insulin titration for Split-mix Regular/Rapid Acting+NPH insulin regimen.**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Time Of Sugar Testing** | **Higher than target** | **Lower than target** |
| 1 | Pre Break fast (or any time from 12 midnight to Breakfast (BF) | Increase Predinner NPH | Decrease Pre-dinner NPH |
| 2 | Pre-Lunch ( any time after BF to Pre-Lunch) | Increase PreBF Regular/rapid acting | Decrease PreBF Regular/rapid acting |
| 3 | Pre Dinner (any time after Lunch to Pre-Dinner) | Increase Pre BF NPH (Pre Lunch REGULAR if taking) | Decrease Pre BF NPH (Pre Lunch REGULAR if taking) |
| 4 | Bed time ( any time after Dinner to 12 midnight) | Increase Pre-dinner Regular/rapid acting | Decrease Pre-dinner Regular/rapid acting |

**Table 4: Insulin Titration For Premixed (short-acting +NPH) Insulin Regimen**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Time Of Sugar Testing** | **Higher than target** | **Lower than target** |
| **1** | Pre Break fast (or any time in the night) | Increase Predinner mixed insulin dose | Decrease Pre-dinner mixed insulin dose |
| **2** | Pre-Lunch ( any time after BF to Pre-Lunch) | Increase PreBF mixed insulin dose | Decrease PreBF mixed insulin dose |
| **3** | Pre Dinner (any time after Lunch to Pre-Dinner) | Increase Pre BF mixed insulin dose¶ | Decrease Pre BF mixed insulin dose |

**(¶ Add pre-lunch short acting insulin if Pre Lunch sugars are in target rangei.e one should not further increase morning insulin dose, otherwisePrelunch hypoglycemia will occur)**

**Table 5: Insulin Titration for Regular/ Rapid acting (Lispro/aspart/gluisine) + Long acting (glargine/detemir) regimen**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Time Of Sugar Testing** | **Higher than target** | **Lower than target** |
| **1** | Pre Breakfast (or any time from 12 midnight to BF) | Increase Long acting insulin dose, given any time of the day | Decrease Long acting insulin dose, given any time of the day |
| **2** | Pre-Lunch ( any time after BF to Pre-Lunch) | Increase PreBF Regular/rapid acting | Decrease PreBF Regular/rapid acting |
| **3** | Pre Dinner (any time after Lunch to Pre-Dinner) | Increase Pre Lunch Regular/rapid acting insulin | Decrease Pre Lunch Regular/rapid acting insulin |
| **4** | Bed time ( any time after Dinner to 12 midnight) | Increase Pre-dinner Regular/rapid acting | Decrease Pre-dinner Regular/rapid acting |

1. ***How toprevent low or high sugars?***

A very tight control of sugars is neither possible nor desirable, especially in younger children in whom there is a risk of brain damage because of low sugars. In older children, mild to moderately low sugars occurring say 3-4 times in a month is an indicator of good control. To avoid fluctuations in sugars,

1. Develop and follow a regular routine of meal timings (see section on diet) and activity.
2. Anticipate situations where sugars might become high (eating out at parties/weddings, periods of low physical activity like vacations etc,) and low sugars (excessive physical activity, low intake) to adjust insulin dose accordingly.
3. Do not change insulin dose based on a single abnormal record, especially when there are other known causes for the same.
4. **Should there be any restriction in the diet?**

Diet is an important part of management. Foods rich in sugars and fat should be restricted. These include chocolates, pastries, ice cream, biscuits, fried items, chips and carbonated beverages like pepsi, cola etc. Encourage intake of fibre rich foods like raw vegetables, fruits and whole grains. Planning a regular schedule helps in sugar control. It is important to remember that occasional excesses are allowed, as in parties and weddings, provided the meal and insulin are planned so that the child does not become rebellious and start eating stealthily.

1. **Should there be any restriction in activity?**

Physical activity is an important part of the treatment of diabetes. Regular physical activity helps in improving sugar control, physical fitness, muscle strength and psychological well being of the child. Activity consumes sugar and thus low sugar is a frequent consequence. The following precautions are to be taken in case of *pre-planned physical activity:*

1. Reduce the pre-meal insulin dose by 20-50%.
2. With prolonged especially unaccustomed exercise, reduce the evening dose by 20-50%.
3. The child should have a ready access to sweet drinks/snacks in case of symptoms of low sugar.
4. Sugar should be checked at bedtime and at 3 am.
5. Extra snacks should be taken if sugar is less than 120 at bedtime.
6. Do not inject insulin into a site that will be heavily involved in muscular activity.
7. Strenuous physical activity should be avoided when sugar is more than 250, especially if urine ketones are positive.
8. **What essential items do I need to have at home?**

Essential things that you should have at home are:

1. Sugar strips
2. Glucometer
3. Needles
4. Insulin: regular/NPH/long acting
5. Insulin syringes
6. Diary to record sugars regularly
7. Urine ketosticks
8. Glucon-D Powder/Inj. glucagon
9. **How much will it cost every month?**

The approximate cost in rupees of some common items a diabetic child needs is given in the table;one can accordingly calculate the cost per month depending on the frequency of sugar monitoring, insulin type/regimen and dose being given. (see table).

1. **When should I immediately contact my doctor?**

Please contact your doctor in the following situations:

1. High blood sugars with positive urine ketones
2. Fever with vomiting, poor oral intake
3. Persistent low sugars
4. Low sugars with loss of consciousness/abnormal body movements
5. Whenever there is a doubt regarding any aspect of management.
6. **How frequently should I visit my doctor in routine?**

Once a child is on a particular insulin regimen, sugars are stable and parents are confident, 3 monthly visits with HbA1c levels are sufficient. More frequent visits may be necessary in the initial phase after diagnosis, when sugars are fluctuating and when insulin regimen is changed.

1. **What do I do when my child has minor illnesses like fever/cold/loose motions etc.?**

Minor illnesses can be managed at home or by the family doctor as for any other normal child, provided sugars are controlled. Diabetes as such does not increase the risk of infection unless sugars are uncontrolled. During acute illness one should expect increased (sometimes low) blood sugars and check sugars more frequently. One should also check ketones in blood/urine (by ketostix) if sugars are high. Also give more water to ensure adequate hydration.

1. **What are ketones and what is their significance?**

When sugars are high and there is no insulin to use the sugars for energy, as happens in an untreated or inadequately treated type 1diabetic child, the body starts burning fat for energy. Ketones are chemicals produced when the body starts burning fat instead of sugars for energy. When ketones increase in the body, they leak out in the urine and the child can develop diabetic ketoacidosis. One should check for ketones when fasting sugar is >240 and any other time >300 mg/dl, any episode of vomiting and whenever child gets sick (flu etc.)

Ketones in the blood can be measured by a ketometer (like glucometer). They can also be measured in the urine by a dipstick method, in which KETOSTIX strip is dipped in urine and colour matching done within 15 seconds with the colour code supplied, to get value of ketones in urine as negative, small, moderate and large. Any urine ketone values of moderate and above needs medical attention.

In the blood ketometer (precision extra meter) shows values as mmols/L. Values of less than 1 are normal. In India, ketone strips for blood ketones are not freely available and are expensive (Rs 150/strip). However, urine ketostix are freely available.

**Table 6: Ketone levels and action required**

|  |  |  |
| --- | --- | --- |
| **Blood ketones (mmol/L)** | **Urine ketones** | **ACTION** |
| <0.6 | Negative | No |
| O.6-1.5 | Small to moderate (+ to ++) | Take extra fluids |
| 1.5-3.0 | Large (+++) | Take regular/rapid insulin and extra fluids. Consult your doctor |
| >3.0 | Very large (++++) | Rush to emergency |

1. **My child refuses to comply with diet, what do I do?**

It is difficult to impose strict dietary restrictions, especially in younger children. Decreasing the amount of food consumed or totally prohibiting anything sweet is not the answer. Different food items increase blood sugars to different levels because of their different ‘glycemic index’ (see annexure). Meals will have to be accordingly planned depending on the age of the child. Dietician advice should also be sought (more details are given in accompanying Diet Plan).

1. **Will my child have a normal lifespan?**

It has been estimated that average life span of individuals with diabetes is about 10 years shorter than that of non diabetic population. This is likely to improve with improved care and newer forms of insulin and newer methods of insulin delivery (insulin pumps with continuous glucose monitoring). Quality of life and complication free life span is directly related to degree of sugar control.

1. **Will it affect my child’s reproductive potential? Will his/her children also be at risk?**

No, if appropriately managed, diabetes does not affect the reproductive potential of an individual. Children born to diabetic parents have an increased risk of having diabetes; 2% if the mother is a diabetic and 8% if the father is a diabetic.

1. **Are my other children at risk?**

Siblings of a type 1 diabetic child have increased chances of developing diabetes. The risk in sibs is estimated (in USA) to be around 6% as compared to 0.4% in normal population. Some antibodies and genetic screening tests in siblings have been used to roughly estimate the chances of developing diabetes in them. Unfortunately, there is no fool proof method to prevent development of type1 diabetes till now.

1. **Where are Children with type1 Diabetes seen in PGIMER? Is there a special clinic for these children?**

YES, they are seen in our weekly **Pediatric diabetic Clinic: APC-4D, Room No: 4412-14 on Thursdays at 2 pm.** All patients with Emergency can be brought to Pediatric Emergency (APC-2B) at any time/day.

1. **What is to be monitored in follow-up?**

Weight and height of the child is checked every visit (3 monthly). A child growing normally means diabetes control is fair to good. BP is monitored at least every year. HbA1c is monitored every 3 monthly (it is not required to be done after fasting). Thyroid function test and test for wheat allergy has to be done every year. After 3-5 years of diagnosis of type 1 diabetes or after 11 yrs of age, screening tests for chronic complications of diabetes are to be done. Screening for retinopathy should start from age 11 years and after two years diabetes duration. Annual screening for microalbuminuria should start from age 11 years and after 5 years diabetes duration (24 hour urine collection for micro albumin). Screening for fasting blood lipids should be performed when diabetes is diagnosed in children aged over 10 years. If normal results are obtained, screening should be repeated every 5 years (if abnormal every year). Peripheral and autonomic neuropathy should be assessed by history and physical examination from age 11 years with two years diabetes duration.

**DIET FOR DIABETIC CHILDREN**

Generally children with diabetes do not need special or restricted diet (except if associated with obesity, hyperlipidemia, nephropathy, hypertension and celiac disease). However, **meal planning is important to match for insulin injections, exercise and other daily activities of the child. It is also important to avoid wide fluctuations of blood sugars due to irregular diet plan**. Diet recommended for diabetic children is also beneficial for whole of the family if they also follow the same plan.

**General principles** of diabetic diet management in children are:

1. Total calories, mineral and vitamin requirement is same as other healthy children of the same age.
2. Timing of the meals, amount of meal, timing of insulin injections, time and duration of exercise etc should be kept constant as far as possible (try not to change by more than half to 1 hour early or late)
3. **50-60% of total calories should be provided as carbohydrates, < 30 % by fats (restrict saturated fats e.g butter, ghee etc to < 10% of total fat and no trans fat at all) and 10-20% of calories by proteins.**
4. Foods with low glycemic index (GI) should be encouraged and foods with high GI should be avoided.
5. Carbohydrate exchanges (listed later) should be tried to increase variety in the meals.
6. Sweets (sucrose) should be avoided as for as possible. If given they should be covered with extra short acting insulin units. Complex sugars (e.g.in fruits) are preferred over sucrose. Avoid keeping sweets and chocolates in refrigerator at home.
7. One should not be very hard on children and put too many restrictions, rather modify insulin dose for *occasional* high sugar intakes. This may avoid children eating out sugar rich snacks and hiding from parents.

**MEAL PLAN**

Meal plan for different age groups for different meals are suggested in the diet chart attached. Modifications can be done seeing the options available for same amount of carb containing exchanges.

**GLYCEMIC INDEX OF DIFFERENT FOODS**

Glycemic Index (GI) is a ranking of carbohydrates (in different foods) on a scale from 0 to 100 according to their immediate effect on blood glucose levels. It measures the time taken for a food containing 50 g of carbohydrate to be absorbed into the blood. The lower the GI, the slower and more even the rate of release of glucose into the blood, while high GI means the carbohydrate is rapidly released.

List of foods and their glycemic index is given later. In general foods with high GI are to be avoided and foods with low GI are to be taken more. **Foods to be avoided** are: all sugary items like sugar, jaggery, sweets, honey, glucose, shakes, ice-cream, pudding, pastry, cakes etc. Other **items which require restriction** are – banana, chikoo, grapes, dates, mango, watermelon, white bread, all fried foods, beet root, potato chips, finger chips, pickles, jams etc.

**COMMERCIALLY AVAILABLE SNACKS WHICH CHILDREN LIKE**: These should be given in moderation after checking their carbohydrate content specially. List of commonly available snacks commonly taken by children is provided along with their carbohydrate and other contents.

**CARBOHYDRATE CHOICES/EXCHANGES**: For introducing variety in the meals one can exchange with different foods with similar carb content. List of such suggested carb exchanges for snacks (10-15 gm carb) and for meals (30-45 gm carb) is provided. These items can be used exchangeably. Carb exchanges for fruits, vegetables, cereals etc are provided. These are also helpful in modifying dose of short acting insulin before the meals. Generally, one unit of short acting insulin will neutralize 10-15 gm (one carb choice) of carbohydrate of any food item (depending on age and weight of child).

**Table 7: MEAL PLAN**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Age group** | **3-5 years** | **6-8 years** | **9-11 years** | **12-14 years** | **15 years+** |
| **Kilo Calories** | **1200-1400** | **1400-1600** | **1600-1800** | **1800-2000** | **2000-2200** |
| **BREAKFAST** | | | | | |
| Milk | 150ml | 150ml | 150ml | 200ml | 250ml |
| Bread OR  Roti(30gm.) OR  Prantha OR  Dalia | 11/2  1  1  30g | 11/2  1  1  30g | 2  1  1  50g | 3  2  2  60g | 3  2  2  60g |
| Vegetables | ½ serving | ½ serving | 1 serving | 1 1/2 serving | 1½ serving |
| **MID MORNING/TIFFIN** | | | | | |
| Roti/parantha/idli/ Rice | 1/1/3/25 g | 1/1/3/25 g | 2/1/4/50g | 2/1/4/50g | 2/1/4/50g |
| Vegetables | ½ serving | ½ serving | ½ serving | ½ serving | ½ serving |
| Fruit | 1 | 1 | 1 | 1 | 1 |
| **LUNCH** |  |  |  |  |  |
| Rice/Roti | 50g/2 | 50g/2 | 50g/3 | 50g/3 | 75g/3 |
| Dal/curd/  OR  Chicken/Paneer | ½ katori/65g  40g/15g | 1katori/125g  80g/25g | 1katori/125g  80g/25g | 1katori/125g  80g/50g | 1katori/125g  80g/50g |
| Vegetables | 1 serving | 1 serving | 1 serving | 1 serving | 1 serving |
| Salad/soup | As desired | As desired | As desired | As desired | As desired |
| **EVENING** | | | | | |
| Milk | 150ml | 150ml | 150ml | 200ml | 250ml |
| Sprout OR  Bread OR  Besanpura OR  Biscuit OR  Cereals | 20g  2 piece  20 g  2  10-15g | 20g  2 piece  10-15g  2  10-15g | 20g  2 piece  10-15g  2  10-15g | 20g  2 piece  20 g  2  10-15g | 20g  2 piece  20 g  2  10 G |
| Butter | - | - | - | 2.5g | 2.5g |
| **DINNER** | | | | | |
| **Age group** | **3-5 years** | **6-8 years** | **9-11 years** | **12-14 years** | **15 years** |
| Roti/rice | 1/25 g | 2/50 g | 2/50 g | 3/75g | 3/75 g |
| Dal/ chicken/fish | ½ katori/  40g/50g | 1katori/80 g/100g | 1katori/80 g  /100g | 1katori/80 g  /100g | 1katori/80g  /100 g |
| Vegetables | 1 serving | 1 serving | 1 serving | 1 serving | 1 serving |
| Salad/soup | As desired | As desired | As desired | As desired | As desired |
| Fruit | - | - | 1 | 1 | 1 |
| **BED TIME** | | | | | |
| Milk | 150ml | 150ml | 150ml | 150ml | 250ml |
| Biscuit( high fibre)or  Paneer or  Atta bread | 2  -  1 | 2  25g  1 | 2  25g  1 | 2  25g  1 | 3  35g  2 |

**Total oil used per day 4-5 tsp(20-25gr)per day**

**Table 8: Carbohydrate Exchange**

|  |  |  |
| --- | --- | --- |
| **Diet of 15g carbose** | **SWEETS with 15 g Carbose** | **Healthy snack options with 15-20gm.carbohydrates** |
| Chappati=1(flour=20g)  Brown Bread=1 slice  Rice= 20 g(raw), cooked 2/3 katori)  Dalia= 10g  Dahi=500 g  Sooji= 20 g  Daal (all)= 25-30 g  Soya Bean Daal= 70 g  Oats= 25 g  Cornflakes= 13 g  Fish/Paneer: 300g | Burfi 1/25g  Laddu 1/40g  Rasgulla 30g  Gulabjamun 25g  Sonpapdi 25g | Milk 150ml +Fruit(1 Exchange)  Milk 150ml+Oats 10gms+Fruit( ½ exchange)  Vegetable Oats Poha(with 20gm. Oat)  Vegetable Poha(20gms. Chirwa) |

**Table 9: VEGETABLE EXCHANGE (following amount of different vegetables will provide 7gm Carbohydrate and 40 Calories approx. one can double the amount for 15 gm carbohydrate content) FRUIT EXCHANGE (following amount of different fruits will provide 10gm Carbohydrate and 40-50 Calories approx. One can double the amount for 20gm carbohydrate content)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sr. No.** | **Vegetables ( Amount Containing for 7gm CARB)** | | | | **Fruits ( Amount Containing for 10gm CARB)** | | | |
| 1. | Bathua leaves | 240 g | Chukander | 60 g | Apple | 75 g (1 small) | Kharbuja | 285 g (1/4 med) |
| 2. | Cabbage | 150 g | Shimla Mirch | 160 g | Orange | 90 g ( 1 med) | Tarbuz | 300 g (2 slices) |
| 3. | Methi | 110 g | Kathal | 35 g | Mausami | 100 g (1 med) | Pineapple | 90 g (1 slice) |
| 4. | SarsonKaSaag | 220 g | Pumpkin | 150 g | Lemon | 90 g (3 med) | Anar | 70 g (1 small) |
| 5. | Palak | 240 g | Tomato | 200 g | Pear | 85 g (2 small) | Lichi | 70 g (3-4 pcs) |
| 6. | Camef | 65 g | Bhindi | 110 g | Arhu | 95 g (3 small) | Mango | 60 g (1/3 med) |
| 7. | Onion | 65 g | Arbi | 35 g | Alucha | 90 g (4 pcs.) | Cheeku | 45 g (1 small) |
| 8. | Radish | 200 g | Peas | 45 g | Khumani | 85 g (3 pcs.) | Khajur | 30 g (2 pcs) |
| 9. | Sweet Potato | 25 g | Lady finger | 109 g | Amrood | 90 g (1 big) | Grapes | 60 g (8-10 pcs) |
| 10. | Turnip | 115 g | Bottle guard | 280 g | Jamun | 70 g (7-8 pcs) | Rasberry | 85 g (5-6 pcs) |
| 11. | Karela | 170 g | Tinda | 206 g | Banana | 35 g (1/2 med) | Strawberry | 100 g (4-5 pcs) |
| 12. | Brinjal | 175 g | Parval | 320 g | Loquat | 105 g (5-6 pcs) |  |  |
| 13. | Cauliflower | 175 g | Tori | 213 g | Cherry | 70 g (8-9 pcs) |  |  |
| 14. | Cucumber | 200 g | Potato | 31 g | Papaya | 140 g |  |  |
| 15. | Frenchbeans | 155 g |  |  |  |  |  |  |

**Table 10: Carbohydrate (along with fat, protein and energy) content of commercially available food items/snacks (per 100 g/100 ml of the item).**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1. **Bakery Products** | | | | | | |
| **Sr. No** | **Items/Snacks** | **Weight**  **of pack (g/ml)** | **Price** | **Energy (calories)** | **Protein(g)** | **Fat (g)** | **Carbohydrates CHO (g)** |
| 1. | Haldiram Tangy, Tomato (Banana Chips) | 200 | 44 | 576 | 4 | 40 | 50 |
| 2. | HaldiramChaipuri | 200 | 39 | 510 | 10 | 50 | 30 |
| 3. | Haldiram Samosa | 200 | 42 | 513 | 7 | 33 | 47 |
| 4. | HaldiramChakoli (rice flour) | 200 | 46 | 560 | 10 | 40 | 40 |
| 5. | HaldiramMatri | 200 | 40 | 554 | 4.3 | 57 | 34 |
| 6. | Haldiram Plain bhujia | 200 | 42 | 560 | 20 | 40 | 30 |
| 7. | HaldiramAlooBhujia | 200 | 42 | 610 | 5 | 46 | 44 |
| 8. | Lehar (peanut)  Roasted | 135 | 30 | 511 | 12 | 28 | 52 |
| 9. | Garden Diet Bhel | 160 | 35 | 406 | 9 | 24.80 | 23 |
| 10. | Good Day | 185 | 30 | 491 | 7.4 | 22 | 66 |
| 11. | Britania Nice time (Coconut biscuit) | 150 | 20 | 455 | 7 | 14.5 | 24 |
| 12. | Nutri Choice (Hi fibre digestive) | 100 | 18 | 455 | 7.5 | 19.6 | 62 |
| 13. | Tiger Crunch | 83 | 10 | 468 | 6 | 20 | 66 |
| 14. | 50-50 | 110 | 10 | 475 | 7 | 19 | 69 |
| 15. | Britania Milk Bikis | 200 | 35 | 494 | 7 | 22 | 67 |
| 16. | Mac Vities (Marie) Digestive | 100 | 15 | 482 | 6 | 19.6 | 70 |
| 17. | Bonn (frooty bread) | 200 | 12 | 268 | 9.9 | 3.1 | 50 |
| 18. | Plain bread (white) | 200 | 10 | 246 | 8.1 | 1.2g | 50 |
| 19. | Multi grain bread | 200 | 15 | 275.26 | 9.7 | 2.8 | 52 |
| 20. | Whole wheat bread (Brown) | 400 | 23 | 241 | 8.20 | 0.48 | 49 |
| 21. | Bonn burger | 225 | 20 | 276 | 10.50 | 0.60 | 60 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1. **Beverages** | | | | | | |
| **Sr. No** | **Items/Snacks** | **Weight**  **of pack (g/ml)** | **Price** | **Energy (calories)** | **Protein(g)** | **Fat (g)** | **Carbohydrates CHO (g)** |
| 1. | Real Fruit juice (mixed) | I lit | 85 | 56 | 0.4 | 0 | 14 |
| 2. | Pepsi diet | 250 | 20 | 0.3 | 0 | 0 | 0 |
| 3. | Soft soyamilk | 200 | 22 | 68.8 | 6.4 | 3.2 | 3.6 |
| 4. | Frooti | 1000ml | 50 | 65 | - | - | 16 |
| 5. | Limca | 600 ml | 27 | 44 | - | - | 11 |
|  | 1. **Dairy Products** | | | | | | |
| 1. | LassiPlainVerka | 1000 | 20 | 36 | 1.5 | 2.25 | 2.20 |
| 2. | Lassi sweet verka | 200 | 18 | 99.9 | 2.43 | 3 | 14.93 |
| 3. | VerkaKheer | 200 | 15 | 125 | 4 | 3.8 | 13.8 |
|  | **D. Sweets and Candies** | | | | | | |
| 1. | Haldiramsonpapdi | 500 | 190 | 388 | 15.2 | 4 | 72.8 |
| 2. | HaldiramRasgulla | 1kg | 170 | 200 | 6 | 6 | 50 |
| 3. | 5 star | 27 | 10 | 443 | 3.2 | 15.9 | 73.2 |
| 4. | Dairy Milk | 17 | 10 | 541 | 10.2 | 29.0 | 59.7 |
| 5. | Perk (Glucose) | 19 | 5 | 517 | 4 | 24.9 | 69.3 |
| 6. | Bar one | 28 | 10 | 409 | 3.9 | 12.9 | 69.3 |
| 7. | Kit Kat | 18 | 10 | 464 | 6.3 | 22 | 58 |
| 8. | Milki Bar | 18 | 10 | 507 | 7.6 | 28.6 | 54.8 |
|  | **E. Junk Food** | | | | | | |
| 1. | Crax | 90 | 10 | 479 | 6.2 | 21.5 | 65 |
| 2. | Lays(Baked) | 31 | 15 | 459 | 7.4 | 15.4 | 72.7 |
| 3. | Aliva Multigrain | 50 | 15 | 464 | 8.4 | 20.2 | 66.6 |
| 4. | Kurkure | 115 | 20 | 561 | 6.4 | 35.7 | 53.6 |
| 5. | Muffin | 100 | 20 | 348 | 6.7 | 18 | 51.2 |
| 6. | Choco | 250 | 90 | 371 | 0.9 | 2.5 | 83 |
| 7. | Popcorn Act II(Butter) | 50 | 10 | 602 | 9 | 42 | 46 |
| 8. | Burger | 265 |  | 700 | 33 | 73 | 39 |
| 9. | Pizza (one slice) | 108 |  | 310 | 13 | 34 | 13 |
| 9. | Pasta | 65 | 16 | 345 | 10.3 | 3.0 | 69 |
| 10. | Popcorn | 300 | 45 | 290 | Trace | Trace | 71 |
| 11. | Bambino Macroni | 950 | 70 | 349 | 10 | 1.0 | 76 |
| 12. | Maggi Multi grain | 80 | 19 | 420 | 9.5 | 13.9 | 64 |
|  | **F. Misc. Items** | | | | | | |
| **Sr. No** | **Items/Snacks** | **Weight**  **of pack (g/ml)** | **Price** | **Energy (calories)** | **Protein(g)** | **Fat (g)** | **Carbohydrates CHO (g)** |
| 1. | Mayonnaise (amul) | 275 | 75 | 502.2 | 0.5 | 51.8 | 8.6 |
| 2. | Cheese Amul | 200 | Per 100 g  (per Slice) | 311  62.2 | 20  4 | 25  5 | 1.4  0.3 |
| 3. | Complan | 450 | 218 | 419 | 1.8 | 11 | 62 |
| 4. | Horlicks Junior | 500 | 190 | 388 | 15.2 | 4 | 72.8 |
| 5. | Jam | 500 | 107 | 290 | - | - | 71 |
| 6. | Tomato Kietchup | 200 | 40 | 106 | 1.1 | - | 25.4 |
| 7. | Pichkoo (Ketchup) | 90 | 15 | 106 | 1.1 |  | 25.4 |
| 8. | Protinex Junior | 100 |  | 448 | 25 | 18 | 48.5 |
| 9. | Nusowin child | 100 |  | 357 | 46 | 1.8 | 37.16 |
| 10. | Fit Kid | 100 |  | 311 | 33 | 3.0 | 38 |
| 11. | Kids Pro | 100 |  | 400 | 24.0 | 8.0 | 58 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **LOW GI**  **Less than 55**  **(HEALTHY FOODS)** | **Grains** | | **Vegetables** | | **Pulses** | | **Fruits** | | **Snacks** | | **Dairy foods** | | **Sugars** | |
| Barley | 31 | Green Beans | 15 | Rajmah  (1/2 cup) | 19 | Peach | 30 | Peanuts,  ( rosted, salted) | 15 | Whole milk (1 cup) | 39 | Fructose, 1 tsp (fruit sugar) | 22 |
| Dats | 49 | Cucumber | 15 | Lentils, (1/2 cup) | 29 | Plums | 39 | Pongal | 55 | Skim milk (1 cup) | 46 |  |  |
| Buck Wheat (Kuttu) | 54 | Lettuce (Leafy veg) | 15 | Soyabean (1/2 cup) | 18 | Apple | 38 | Dried apricots | 31 | Ice Cream | 36 |  |  |
| Brown Rice (1 cup) | 55 | Peppers | 15 | Peas, dried | 22 | Orange | 44 | Custard | 43 | Curd | 36 |  |  |
| Corn | 51 | Spinach | 15 | Chanadaal (1/2 cup) | 8 | Cherries | 22 | Potato chips,  14 piece | 54 |  |  |  |  |
| Barley (1/2 cup) | 43 | Tomatoes | 15 | Green grams | 38 | Pear | 38 | Dhokla (100 gm) | 33 |  |  |  |  |
| Parboiled rice (1 cup) | 48 | Carrots cooked | 39 | Horse grams | 51 | Grape  fruit | 25 | Bengal g cheela  150 gm | 42 |  |  |  |  |
| Besan (1/2 cup) | 27 | Green Peas | 48 |  |  | Grapes (1 cup) | 46 | Veg Pizza,  100 gm | 49 |  |  |  |  |
| Chapati (60 gm) | 40 | Cauliflower | 15 |  |  | Banana underripe | 55 | Sweet Potato  ½ cup | 54 |  |  |  |  |
| Macroni (1 cup) | 45 | Sweet potatoes | 55 |  |  |  |  |  |  |  |  |  |  |
|  |  |  | Methi | 37 |  |  |  |  |  |  |  |  |  |  |
| **Medium GI 56-69 (FOODS TO BE TAKEN IN PRESCRIBED AMOUNTS)** | Basmati Rice boiled | 55 | Beetroot (1/2 cup) | 65 | Whole green gram | 57 | Pineapple, 2 slices | 66 | Popcorn | 55 |  |  | Sucrose (table/common sugar) | 87 |
| Bajra, ½ cup | 57 |  |  |  |  | Apricot, 90 g | 57 | Pizza 2 slices | 60 |  |  | Honey | 104 |
| Maize ½ cup | 62 |  |  |  |  | Raisins ¼ cup | 64 | Jam | 55 |  |  | Lactose | 65 |
| Whole wheat Bread | 65 |  |  |  |  | Papaya, ½ medium | 58 | Sponge cake (1 slice) | 60 |  |  |  |  |
| Macroni and cheese | 64 |  |  |  |  |  |  | Dosa with chutney (150 gm) | 66 |  |  |  |  |
| Puri, 150 gm | 57 |  |  |  |  |  |  |  |  |  |  |  |  |
| Spaghetti,1Cup | 59 |  |  |  |  |  |  |  |  |  |  |  |  |
| **HIGH GI**  **70 or more**  **(FOODS TO BE AVOIDED)** | Cornflakes | 84 | Potato,, ½ cup | 70 |  |  | Watermelon, 150 gm | 72 | Doughnutts | 75 |  |  | Glucose | 138 |
| Puffed wheat 2 cups | 80 | Pumpkin 120g | 75 |  |  | Dates, 90 gm | 103 | French Fried | 76 |  |  | Maltose | 105 |
| White Rice | 81 |  |  |  |  | Banana | 83 | Chocolate Bars | 70 |  |  |  |  |
| White Bread | 100 |  |  |  |  | Mango | 80 | Biscuits | 70 |  |  |  |  |
| Jowar, ½ cup | 77 |  |  |  |  |  |  | Idli, 250 gm | 77 |  |  |  |  |
| Ragi, 70 gm | 94 |  |  |  |  |  |  | Upma | 75 |  |  |  |  |
| Parantha | 70 |  |  |  |  |  |  | Cake | 87 |  |  |  |  |
| Sweet corn | 78 |  |  |  |  |  |  |  |  |  |  |  |  |

**Table 11: GLYCEMIC INDEX (GI) OF COMMON INDIAN FOODS- by definition each item is with amount of 50 gm, until specified.**

**Table 12: Approximate cost of items required for home management of type1 diabetes**

|  |  |  |  |
| --- | --- | --- | --- |
| ITEM | BRANDS | STRENGTH | COST (Rs) |
| Glucometer | 1.OptiumXceed/2.Accucheck Active |  | 1. 1500/-2. 1500/- |
| Sugar strips |  | 1. OptiumXceed/2. Accucheck Active | 1. 15/- per strip2. 17/- per strip |
| Insulin Syringe |  | 40U & 100U | 5/syringe |
| Needles |  | 26 or 28G | 1/needle |
| Lispro insulin | Humalog (Eli Lilly) | |  | | --- | | 100 IU / 1 mL x 3ml (pen catridge) |  |  | | --- | |  | | 100 IU/ml x 10ml vial | | 408  410 |
| Insulin Aspart | NOVORAPID (Novo Nordisk) | 100IU/ml(3mlpen)  5x3ml catridges (1500IU) | 556  2212 |
| Insulin Glulisine | Apidra(sanofi-aventis) | **100 IU / mL** (3mlpen) | **550** |
| Regular Insulin | ACTRAPID (Novo Nordisk)  HUMINSULIN-R  (Eli Lilly)  WOSULIN-R (Wockhardt)  INSUMAN RAPID (Aventis)  Human Actrapid (Torrent) | 40 IU/ml x10ml  40 IU/ml x10ml  100IU / ml x10ml  40 IU/ml x10ml  **100 IU/1 mL x 3ml(pen)**  40 IU/ml x10ml  40 IU/ml x10ml  100IU / ml x10ml | 145  147  365  129  **235**  165  153  380 |
| NPH (human isophane) | HUMINSULIN- N  (Eli Lilly)  WOSULIN-N  (Wockhardt)  HUMAN INSULTARD  (Torrent) | 40 IU/ ml x10ml  100 IU/ ml x10ml  5 x 3ml pen Catridge  40 IU/ ml x10ml  40 IU/ml | 147  365  1044  129  169 |
| Insulin Glargine | LANTUS(Aventis)  GLARITUS  (Wockhardt)  BASALOG (Biocon) | **100 IU /1 mL x 3ml x5 (set)**   |  | | --- | | **100 IU / 1 mL x 3ml**  100 IU x 3ml | | 2499  **483**  435 |
| Insulin Detemir | Levemir(Novo Nordisk), | 100IU/ml  5x 3ml pen  **100 IU x 1 mL x 3ml** | 4665  **988** |
| Glucagon Inj. | **GLUCAGEN HYPOKIT vial**  (Novo Nordisk),  **GLUGON vial (United biotech)** | **1 mg x 1ml**  **1 mg x 1ml** | **940** |
| Urine Ketosticks |  | 50/pack | **275/pack** |
| Glucon D powder |  | 100g packet | 25/packet |

**Table 13: Sample Log Book for daily monitoring/recording of blood sugars,Insulin doses and other activities**

1. **For patients on Rapid acting/Regular insulin + NPH**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Month** ( e.g. August) **/year** (2013) | | | | | | | | | | | |
|  | **Pre Breakfast** | | | **Pre Lunch** | | | **Pre Dinner** | | | **Bed time** | |
| **Date** | **Sugar**  **(mg/dl)** | **Rapid/Reg Insulin (Units)** | **NPH**  **(Units)** | **Sugar**  **(mg/dl)** | **Rapid/Reg Insulin (Units)** | **Remarks** | **Sugar**  **(mg/dl)** | **Rapid/Reg Insulin (Units)** | **NPH**  **(Units)** | **Sugar** | **Remarks** |
| 21/8 | 98 | 5 | 10 | 140 | 3 | - | 170 | 5 | 5 | 160 | - |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |

1. **For patients on Rapid acting + Long acting (Lantus/Levemir) insulin**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Month /year** | | | | | | | | | | | |
|  | **Pre Breakfast** | | | **Pre Lunch** | | | **Pre Dinner** | | | **Bed time** | |
| **Date** | **Sugar**  **(mg/dl)** | **Rapid/Reg Insulin (Units)** | **Long acting**  **(Units)** | **Sugar**  **(mg/dl)** | **Rapid/Reg Insulin (Units)** | **Remarks** | **Sugar**  **(mg/dl)** | **Rapid/Reg Insulin (Units)** | **Remarks** | **Sugar** | **Remarks** |
| 21/8 | 98 | 5 | 10 | 140 | 3 | - | 170 | 5 | - | 160 | - |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |

**Summary of Daily management of T1Diabetes children at home**

1. **Insulin Injection**- Always use new needle/syringe for every injection. Inj site rotation in a systematic manner is important to avoid lipodystrophy and variable insulin response. Always give injection at an acute angle (30-60 degree), subcutaneous in a pinch held in between thumb and index finger (especially in lean children). Remove air bubbles from syringe/pen before injections. NPH insulin should be shaken gently before injection. All insulins should be injected when at room temperature.
2. **Checking sugars with Glucometers**: Learn how to use your glucometer (different glucometers work differently). Always use Lancet pen for prick with proper needle depth to get uniform amount of blood drop every time. Proper cleaning of hands and asepsis is to be ensured. Use new needle every prick. Glucose strips should always be kept airtight and sealed before use. Check for their expiry date before use. Glucometer should be serviced and calibrated with simultaneous lab blood sugar checks, regularly.
3. **What to do for a single low sugar?**

Any sugar **below 70 mg/dl** should be considered low. It should be considered an emergency and treated immediately with Glucon-D, 2-3 tsf (or calculate accurately as 5gm of Glucon –D raises blood sugar by 10-15mg/dl) in small amount of water. Sugar should be retested after 15 mts to ensure that Glucose has reached above 70 mg/dl. When it is normalised give usual dose of insulin and meal after the Injection. If it is not meal time one should give around 15 gm of complex sugar eg. Milk (1 cup) or biscuits (3-4)etc . One should always try to find out reason for a particular low sugar, so that it could be avoided next time.

If sugar is so low that child gets unconscious, we should not give anything by mouth and rush to nearby Doctor for glucose drip (4ml/kg of 10% Dextrose). Inj GLUCAGON can be tried s.c if available in a dose of 30 units (in insulin syringe of 100 units) for < 6 yrs, 50 units (0.5ml) for 6-18 yrs and 100 units (1.0 ml) for >18 yrs. Inj Glucagon can also be tried when child cannot take orally because of vomiting or any other reason and has low sugar (low dose glucagon i.e 1UNIT per yr of age)

1. **What to do for a single high sugar value?**

If blood sugar is more than 200mg/dl (150-180 for older children for tighter control) any time, extra dose (**correction dose)** of short acting insulin should be given (even if insulin dose is not due otherwise at that time). Extra dose required is **1 unit for each 50mg (100 mg for children less than 5 years) increase in blood sugar above 200mg/dl.** Also one should check for ketones when fasting sugar is >240 and any other time >300 mg/dl. One should keep a watch for any symptoms of DKA when sugars are so high. If there is trend of high sugar for 2-3 days at particular time, appropriate dose adjustment of insulin regimen should be made.

|  |  |  |
| --- | --- | --- |
| **Sugar value above 200 mg/dl** | **Units of Extra Insulin to be given#** | |
|  | Age <5 yrs | Age > 5 yrs |
| 200-250 | 0.5 units or none | 1 |
| 250-300 | 1 | 2 |
| 300-350 | 1 to 1.5 | 3 |
| 350-400 | 2 | 4 |
| 400-450 | 2-2.5 | 5 |
| 450-500 | 3 | 6 |
| >500 | At least 3 Units | At least 6 units |

#These units are over and above the daily short acting insulin units due at the time of high sugars

1. **What to do for repeated high or low sugars?**

Target sugar level- 70-170 mg/dl. It should be kept slightly lower for older children (>12 yrs) and higher for younger children (< 5 yrs). To avoid fluctuations in sugars on frequent basis one should develop and follow a regular routine of meal timings (and quantity) and activity. One should also try to anticipate situations where sugars might become high (eating out at parties/weddings, periods of low physical activity like vacations etc,) and low sugars (excessive physical activity, less or delayedmeal intake) to adjust insulin dose accordingly.

For repeated high or low sugars, we need to identify trend and timing of low or high sugar and accordingly decrease or increase previous insulin dose (next day) which is active at the time of high or low sugars. One should wait for 2-3 days for the new dose to have its desired effectThis is elaborated in the table below:

1. **Insulin titration for Split-mix Regular/Rapid Acting+NPH insulin regimen.**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Time Of Sugar Testing** | **Higher than target** | **Lower than target** |
| 1 | Pre Breakfast (or any time from 12 midnight to Breakfast (BF) | Increase Predinner NPH | Decrease Pre-dinner NPH |
| 2 | Pre-Lunch ( or any time after BF to Pre-Lunch) | Increase PreBF Regular/rapid acting | Decrease PreBF Regular/rapid acting |
| 3 | Pre-Dinner (or any time after Lunch to Pre-Dinner) | Increase Pre BF NPH (Pre Lunch REGULAR if taking) | Decrease Pre BF NPH (Pre Lunch REGULAR if taking) |
| 4 | Bed time ( or any time after Dinner to 12 midnight) | Increase Pre-dinner Regular/rapid acting | Decrease Pre-dinner Regular/rapid acting |

1. **Insulin Titration for Regular/ Rapid acting (Lispro/aspart/gluisine) + Long acting (glargine/detemir) regimen**

|  |  |  |  |
| --- | --- | --- | --- |
| **S.No** | **Time Of Sugar Testing** | **Higher than target** | **Lower than target** |
| **1** | Pre Breakfast (or any time from 12 midnight to BF) | Increase Long acting insulin dose, given any time of the day | Decrease Long acting insulin dose, given any time of the day |
| **2** | Pre-Lunch ( or any time after BF to Pre-Lunch) | Increase PreBF Regular/rapid acting | Decrease PreBF Regular/rapid acting |
| **3** | Pre-Dinner (or any time after Lunch to Pre-Dinner) | Increase Pre Lunch Regular/rapid acting insulin | Decrease Pre Lunch Regular/rapid acting insulin |
| **4** | Bed time ( or any time after Dinner to 12 midnight) | Increase Pre-dinner Regular/rapid acting | Decrease Pre-dinner Regular/rapid acting |

1. **What to do for exercise?**

For planned aggressive exercise one can reduce 1-2 units of preceding rapid acting insulin dose. Check sugar before exercise and give a 15 gm Carb snack. If exercise is prolonged one should check sugar in between and at end of the exercise. Unscheduled exercise will require more close watch on sugar and snack before exercise.

1. **Diet management- General rules**

We should not restrict diet for these children, rather we should give normal healthy diet with lot of variety and match it with insulin dose. Carb exchanges as advised by dietician are very important to have variety in meals.Foods rich in sugars and fat should be restricted. These include chocolates, pastries, ice cream, sweet biscuits, fried items, chips and carbonated beverages like pepsi, cola etc. Encourage intake of fibre rich foods like raw vegetables, fruits and whole grains. Having a regular diet schedule helps in sugar control. It is important to remember that occasional excesses are allowed, as in parties and weddings, provided the meal and insulin are planned so that the child does not become rebellious and start eating stealthily.