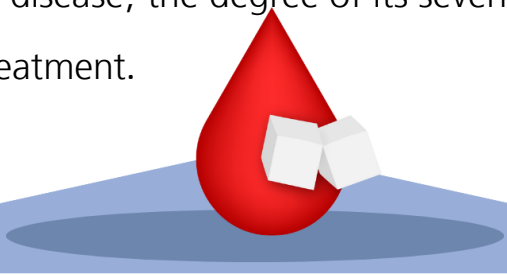
جامعة الإمام عبدالرحمن بن فيصل
IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY

مستشفى الملك فهد الجامعي
King Fahad Hospital The University

Type 1 Diabetes Mellitus in School

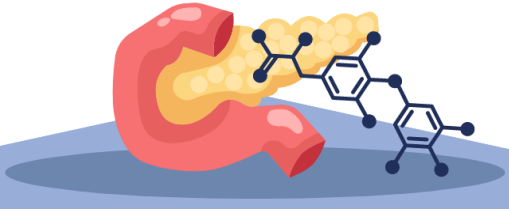
What does it mean to have a diabetic child at school?

It means that a diabetic child has type 1 diabetes, which is the type of diabetes that is completely dependent on insulin (insulin pens or insulin pump). because type 1 diabetes is the result of a defect in the immune system that leads to the production of antibodies that attack the beta cells in the pancreas, which are the insulin-producing cells. Exposure to the antibodies causes it to break down and become damaged, and it becomes unable to produce the hormone insulin. It is completely different from type 2 diabetes (which does not depend on taking insulin doses and is treated with diet, exercise and medications only), which adults suffer from. This difference between type 1 and type 2 diabetes mellitus is due to the difference between the cause of the disease, nature of the disease, the degree of its severity, and the method of treatment.



What is the hormone insulin? And what is its importance? And why should we worry about its absence in the body when we have type 1 diabetes?

Insulin is the body-building (anabolic) hormone. It builds the body by absorbing small particles of sugar (glucose) in the blood from carbohydrates in our food into the cells. This glucose is the blood sugar that we measure with measuring devices. Insulin transfers glucose to the cells to function in building the body, by converting these sugar molecules into fat and proteins. Thus insulin is the building hormone that builds the body and makes it healthy, and filters the blood from sugar, ketones and acids that harms the body and the important organs such as (heart, brain, and kidneys).



What does it mean that the production of insulin from the beta cells of the pancreas stops when being diagnosed with type 1 diabetes?

When the production of insulin stops this means the disappearance of the building hormone from the body. As a result, in an attempt to build the body, sugar molecules (glucose) that are released from the liver towards the blood via glycogen and collect in large quantities in addition to the fat being destroyed to release glucose into the blood as well. Proteins break down into amino acids in the blood, as well as release small acid particles called ketones that harm body due to increasing blood acidity and becoming very viscous, which is a dangerous condition because it is accompanied by severe dehydration and high acidity in the body, so cells and organs become unable to perform their functions properly. All these substances in the blood in the absence of the insulin hormone due to the interruption of insulin production (or not taking insulin doses) leads to this dangerous ketoacidosis, which requires entry to intensive care.

After the diagnosis, how is the treatment?

The treatment of type 1 diabetes is by taking insulin doses through pens containing a small needle given under the skin. There are two types of insulin used by child simultaneously: (1) Long-acting insulin - such as the Lantis or Tresiba that works for 24 hours to protect the body from insulin interruption and (2) Short-acting insulin Such as the Novorapid pen or the Apidra, which covers carbohydrates in the meals and prevents the rise of blood sugar after meals.

What can I expect to happen with a diabetic child at school?

The majority of diabetic children will attend school after having breakfast at home with a dose of insulin (there is insulin in the blood). Therefore, it is expected expect that the child will feel very hungry because of the insulin and be prone to hypo/low blood sugar with any muscle exertion or when being late for your next snack or meal.

Some children attend school without eating breakfast and taking any insulin dose, so they need to take the insulin dose with any meal they eat at school and if he does not take the correct dose that matches the amount of carbohydrates in his meal that he ate, he will have high blood sugar (hyperglycemia), which is more than 200 mg /dl.

The decrease in blood sugar (hypoglycemia) means that the blood sugar level is less than 80 mg / dL for children with type 1 diabetes under the age of five years and less than 75 mg / dL for those older than 5 years.

What is the right thing to do in such cases?

The child must be contained on the first day of school and made aware of his safety and that he is able to express all his symptoms or fatigue in the event of low sugar, which is accompanied by symptoms such as:

What are the symptoms expected in diabetic children?

Hyperglycemia, elevations in blood sugar above 200 mg/dL that are accompanied by symptoms such as:

- Thirst and excessive water drinking.

- Urination

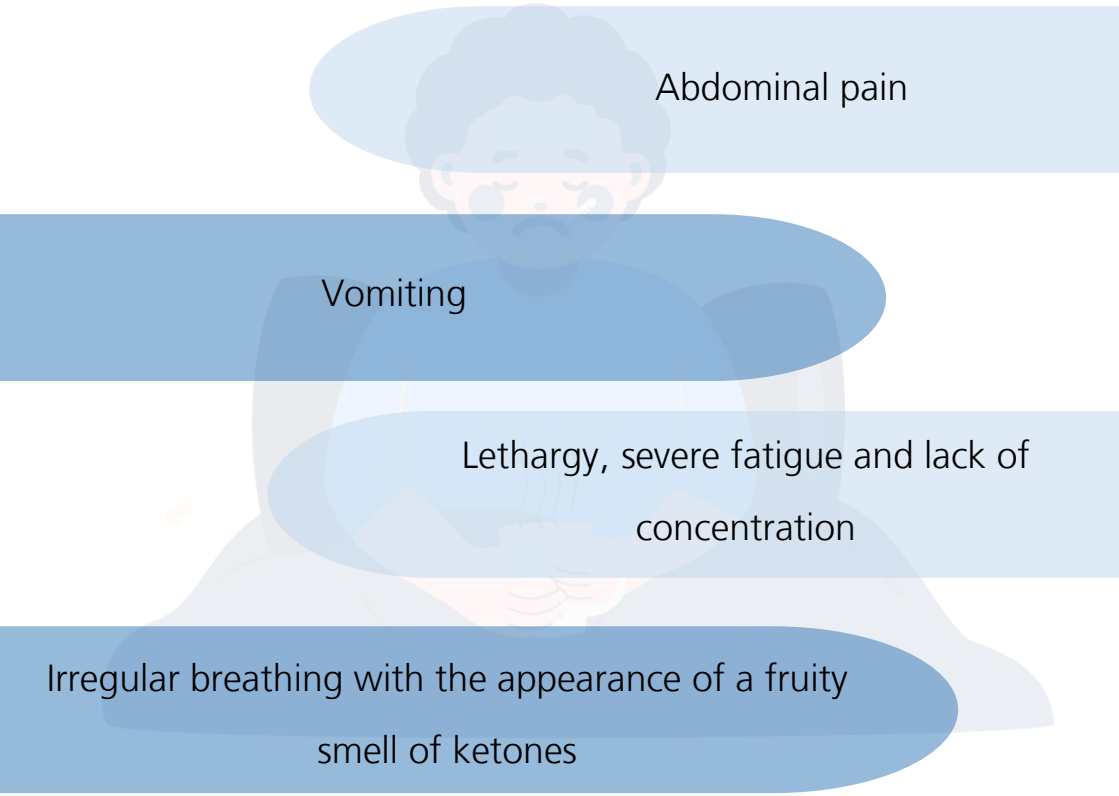
- Frequent requests to go to the bathroom to urinate

- Headache

- Vertigo

- Fatigue and lethargy

In stage of reaching ketoacidosis due to high blood sugar and not taking insulin doses, the symptoms of which are:



Abdominal pain

Vomiting

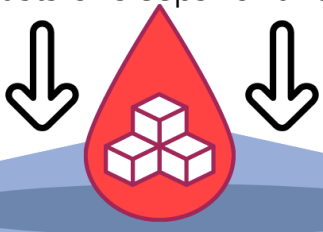
Lethargy, severe fatigue and lack of concentration

Irregular breathing with the appearance of a fruity smell of ketones

Knowing the symptoms of low and high blood sugar and symptoms of ketoacidosis due to persistent high blood sugar is the first step, whenever we see that the child has readings of high blood sugar level or low blood sugar, it is evidence of an emergency situation that requires correct and proper behavior and communication directly with the health care provider.

Causes of low blood sugar and treatment method for low blood sugar:

- The doses of insulin should be disproportionate to the amount of food (carbohydrates) that the child eats, vomiting or not eating during times of illness.
- That the child exert a high physical effort, such as long walks, strenuous play, or exercise and football.
- To take frequent, high corrective doses of insulin.
- That the child fasts or sleeps for a long time or delays eating his meals.



Treatment method:

- If the child is awake in his normal position, able to eat and does not feel the desire to vomit, the decrease should be treated by taking half a cup of juice or water with sugar (quick liquid sugar) and then monitoring the sugar after 15 minutes because juice and water with sugar may raise the sugar only a little and then The drop returns. If the sugar rises to more than 70 mg/dL, then he eats 15 grams of carbohydrates, such as bread, to keep the blood sugar stable within the normal limits.

- If the child is unable to eat because of vomiting or feels dizzy and lacks concentration and is unable to speak or in a state of fainting, he must be given a glucagon injection as soon as possible and check blood sugar 10-15 minutes later and then follow up whether he has returned to his focus awake knowing that giving a of a glucagon injection at the time of fainting should be accompanied by going directly to the hospital emergency room.

Causes of high blood sugar and treatment method for high blood sugar:

- Sickness such as (cold - respiratory infections - intestinal flu - toothache and inflammation - wounds - infections - menstruation in girls).
- Child frequently eats foods or snacks that contain starches and sugars, or eats them without taking doses of short-acting insulin.
- That the ratio of insulin doses is not appropriate to the amount of carbohydrates (Carb).

Treatment method:

If the blood sugar is high two hours after the meal rotation and reaches more than 250 mg per deciliter, the child should take a correction dose of short-acting insulin equal to only one unit (and may increase based on the child's weight and the child's insulin sensitivity factor as shown in the plan Treatment from the treating physician) to bring the sugar down to the required level between (180 to 200) mg per deciliter, while making him drink water and stop muscle stress until the sugar reaches the normal range that mentioned previously, and communicate with the health care provider.

Every time the sugar rises above the range of 250 and above, the level of ketones (through blood or urine). If it is positive, it must be quickly communicated with the health care provider. If the child is sick, the blood sugar should be monitored every 3-4 hours, or a correction dose of short-acting insulin should be given if there are readings more than 250 mg per deciliter, with a check on the ketones in the blood or urine, and contact with the health care provider.

Is there a critical state diabetic child?

Yes, vomiting in both cases is dangerous to a diabetic child and required communication with the health care provided and visiting the emergency room for two reasons:

First: The child will enter a hypoglycemic state due to absence from eating in the time that insulin is in the blood.

Second: Vomiting is considered a sign of diabetic ketoacidosis.

What are the causes of diabetic ketoacidosis and how to deal with them?

Causes of diabetic ketoacidosis:

- Stopping basal long-acting insulin.
- Insulin doses are low and insufficient for a long time causing high blood sugar to persist without correction.
- Sickness without following up and correcting the rises in blood sugar.
- Physical strain such as playing and sports at a time when blood sugar levels are high.
- Rising hormones at the time of the menstrual cycle for girls.
- If the insulin pump stops for any reason. It is a critical stage and requires going directly to the emergency.

In rise the blood sugar with symptoms of ketoacidosis, in addition to the presence of ketones in the blood or urine test, is one of the most important signs of entering into ketoacidosis, so the child must go quickly and directly to the emergency, in addition to the fact that children may develop ketoacidosis and ketones appear by examining Blood or urine (especially if the child is sick), although we do not notice high blood sugar, and this does not mean the absence of acidity, but that the child may be in the stage of ketoacidosis, but because of the disease he refuses to eat or has vomited and thus the blood sugar will be within the limits normal or low.

Therefore, it is a critical stage and requires going directly to the emergency.

What other important things to watch out for a diabetic child at school?

A diabetic child, like other children, may be one of the most creative, intelligent and distinguished of them. His diabetes will not hinder him from achieving a very high academic achievement, and he does not have any impediments to mental and recreational activities, but there are always special precautions at certain times such as (muscular effort for more than 30 minutes such as sports - or at the time of sick days, which is a time when he was infected with viral and bacterial infections, gastroenteritis and menstruation in girls as mentioned previously) and the diabetic child is usually given a complete treatment plan to deal with these times.

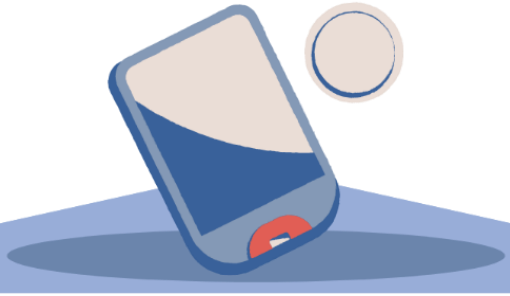
What can I expect to see in my diabetic child bag? What are the necessary supplies that he always needs to provide at school?

A diabetic child may be placing a sensor in his arm or in his stomach, which is responsible for measuring blood glucose levels, along with a reader (for example, a Freestyle Libre device).

Some children have continuous sensors of blood glucose levels that are connected to the mobile devices of their parents.

Some children have an insulin pump, which comes as different types that are attached to their stomach in a special belt, and some are adhesive.

Some children carry an I-port patch that allows insulin to pass through a small needle under the skin



A diabetic child daily bag must be kept in cool condition so as not to damage the insulin or the test strips or the glucagon with high temperature, and this bag requires the availability of:

- The treatment plan for correcting hyperglycemia and hypoglycemia
- Personalized calculation of insulin for meals based on carbohydrate coefficients and insulin sensitivity coefficient
- The treatment plan for managing diabetes **during sickness**
- The treatment plan for managing diabetes during or in **preparation for exercise.**

- Carbohydrates in food booklet for grams.
- Needle heads.
- Long-acting insulin pens.
- Short acting insulin pens.
- Alcohol swabs.
- Blood glucose meter.
- Blood glucose meter test strips.
- Blood ketone measuring strips
- Urine ketone test strips
- Sensor (gauge sensor)
- IPort
- Pump tools (reservoir - tube - sticky needle - insulin - battery)
- Glucagon needle

What are the other important things to be aware of for a diabetic child at school?

A diabetic child school should not be prevented from:

- Frequently visiting the bathroom.
- Drinking water.
- Going outside the classroom to check his sugar or take corrective doses.
- Going outside the classroom to drink juice or eat if he feels symptoms of low blood sugar such as hunger and confusion or other symptoms mentioned above.
- Regular school mental activities.
- Physical activities activities if his blood sugar is within the required range (140-180) milligrams per deciliter.

What are the other important things to be aware of for a diabetic child at school?

A diabetic child school should be prevented from:

- Make physical effort, muscular stress, and exercise in the event of a rise in blood sugar above 200 mg per deciliters.
- Eating sweets, sugars and food containing preservatives such as potato chips (chips) and soft drinks.
- Leave hid wounds without sterilization and dressing.
- Forcing him to participate in the class if he feels symptoms of low blood sugar and lack of focus.

What is the treatment plan for sick days?

Diabetes control during sick days:

Controlling diabetes and keeping it at regular levels is an important goal for every person diagnosed with diabetes, but it is even more important during sick days when a person has a disease such as:

- Cold or flu.
- Sore throat and infections in general.
- Injuries.
- Treatment of severe dental diseases.
- Undergoing surgery.
- Psychological stress.
- The menstrual cycle in girls.

During illness, the body is in a state of stress, and to be able to deal with it, it secretes hormones that raise blood sugar, in addition to reducing the effect of insulin.

Rules for dealing with diabetes on sick days:

1. First go to the doctor to find out the main cause of the disease and treat it.

2. You should never stop a long-acting insulin, even if the child is not eating.

3. Drink water.

4. Blood sugar analysis every 3 hours:

- If blood sugar is more than 200 mg/dL: give a correction dose of 1 unit of insulin, or according to the child's correction factor.

5. Make sure your ketones:

-Check for ketones in blood or urine.

-When ketones appear, you should go to the emergency immediately.

6. If the child does not eat or refuses food, he must go to the emergency department to take the nutrient (sugar) and take the usual doses of insulin.

7. If the child is vomiting, he must go to the emergency department directly to take the nutrient (sugar) and take the usual doses of insulin.

8. If the child refuses to eat or is vomiting and the blood sugar is low under 80 mg/dL, he should go to the emergency room.

9. If there is a decrease under 100 mg/dL, he does not take the dose of short-acting insulin (meal insulin) with the meal, but eats first and then analyzes the blood sugar. If it rises above 150 mg in deciliters, he takes the dose of insulin for the meal while following up on the blood sugar.

10. If the child does not want to eat the meal or does not eat it completely, half the dose of the short-acting insulin should be taken.

Example: If he takes 2 units of insulin on his meal and the child does not want to eat the whole meal or does not eat it completely, then after eating the meal he takes only 1 unit of insulin instead of 2 units of insulin.

Table showing your ketones and blood sugar readings and the action required:

Blood Ketones	Urine Ketones		Blood Sugar Level		
mmol/L	ribbon color	Level	More than 180-250mg/dL	More than 250-400mg/dL	More than 400 mg/dL
less than 0.6	Slight color / no color change	Negative	Natural- no procedure is required and the same doses are completed.	Give the usual dose and add a correction of 1 unit.	- Give the usual dose and add a correction of 2 units if the age is more than 5 years and the weight is more than 25 kg. -Drink sugar-free fluids.
From 0.6 to 1.0	Light purple	Small to medium	-Give the usual dose and add a correction of 1 unit (or if the glucose reading is 250 if the age is less than 5 years or the weight is less than 20 kg) -Drink fluids that contain low sugar.	-Give the usual dose and add a correction of 1-2 units. Drink sugar-free fluids.	- Give the usual dose and add a correction of 2 units if the age is more than 5 years and the weight is more than 25 kg. -Drink sugar-free fluids.
1.0 to 3.0	Deep purple	medium to large	- Give the usual dose and add a correction of 1-2 units (or if the glucose reading is 250 if the age is less than 5 years or the weight is less than 20 kg). -Drink fluids that contain low sugar + add solid starches to avoid depression.	- Give the usual dose and add a correction of 2-3 units. -Drink sugar-free fluids.	- Give the usual dose and add a correction of 2-3 units if the age is more than 5 years and the weight is more than 25 kg. -Drink sugar-free fluids.ar-free fluids.
More than 3.0	Dark purple	Very large			

What is the treatment plan for the days of exercise?

Benefits of exercise for a diabetic child:

It is important for a diabetic friend to exercise, as it brings him many benefits, including:

√ Improve the ability to adjust blood sugar.

√ Exercise helps control weight, which reduces the risk of cardiovascular disease.

√ Improved sense of health.

Sports include these types of activities:

- Moderate to vigorous aerobic activity.
- Muscle strengthening exercises.
- Bone strengthening activities.

What are the contraindications to exercise?

Although exercise helps control blood sugar and improve physical health, it is forbidden to exercise in these cases:

1. When blood sugar is high to avoid ketoacidosis.

2. When you are in the dips stage (honeymoon stage) which often occurs at the beginning of the diagnosis.

3. When the week's readings contain significant declines.

What are the procedures followed when exercising?

- Blood sugar monitoring:

✓ Glucose measurements should be taken before, during and after the completion of the exercise with attention to the direction of change in blood sugar.

✓ The blood sugar reading is supposed to be between 150 mg/dl to 180 mg/dl before exercising.

- High blood sugar:

✓ High blood sugar may occur during intense exercise, but also generally sugar rises after eating excessive carbohydrates or reducing or forgetting some doses of insulin.

- High blood sugar:

✓ During sports tournaments, may lead to stress and pressure to release some of hormones that also lead to high blood sugar, if this situation occurs, use a corrective dose.

- Low blood sugar:

✓ Hypoglycemia is an important consideration when planning exercise with diabetes.

✓ Hypoglycemia can occur during or immediately after exercise or after a long period and during sleep as well.

What are the proposed adjustments to insulin doses?

Exercise Type	Pre-workout meal		Meal after exercise
	The duration of the exercise is 30-45 minutes	The duration of the exercise is more than 45 minutes	
Moderate to vigorous aerobic activities such as swimming, running and soccer.	٪٥.-٪٢٥ reduction in the dose of rapid-acting insulin (insulin meals).	٪٧٥-٪٥. reduce the dose of rapid-acting insulin (insulin meals).	reduction ٪٥. in the dose of rapid-acting insulin (insulin meals).
Aerobic exercises with anaerobic exercises such as basketball, weight-bearing exercises, pull-ups, .and squats.	reduction in ٪٥. the dose of rapid-acting insulin (insulin meals).	٪٥. reduction in the dose of rapid-acting insulin (insulin meals).	reduction ٪٥. in the dose of rapid-acting insulin (insulin meals).

Decrease the dose of long-acting (basal) insulin the night before physical activity by 20% from the usual

What are the tips to avoid low sugar during exercise?

- Measure blood sugar before starting exercise.
- Don't forget to bring a glucagon needle.
- Always bring some snacks that contain carbohydrates.
- Gradually increase the intensity and/or duration of exercise.
- In the few hours before your workout, eat slowly absorbed carbohydrates.
- In the event of unexpected physical activity, reduce the dose of insulin during and after intense muscle activity.
- Do not inject insulin in a place that will have a significant role in muscle activity.

- o When physical activity is planned at the time of peak insulin action, a significant reduction in the insulin dose should be made.
- Measure your blood sugar before bed in the evening after vigorous physical activity and be sure to add additional carbohydrates and/or reduce the long-acting (basal) dose to reduce the risk of hypoglycemia during sleep.
- Measure your blood sugar after each change in your insulin dose.

What are the procedures followed when examining ketones?

Blood Sugar → / Ketones in the blood ↓	Blood sugar higher than 250 mg/dL	Blood sugar less than 250 mg/dL	What are you doing?
Blood ketones greater than 1.5 mmol/L	Give ½ a correction dose of short-acting insulin	Add carbohydrates + give ½ correction dose of short-acting insulin	Avoid exercising!
Blood ketones 1.1 - 1.4 mmol/L	Give ½ a correction dose of short-acting insulin	Add carbohydrates + give ½ correction dose of short-acting insulin	Wait 60 minutes after the correction and make sure the blood sugar value is low and then you can exercise
Blood ketones 0.6 - 1.0 mmol/L	Give ½ a correction dose of short-acting insulin	Add carbohydrates + give ½ correction dose of short-acting insulin	Wait 15 minutes after the correction and make sure the blood sugar value is low and then you can exercise

You can exercise if your blood ketones are less than 0.6 mmol/L, there are no symptoms of ketoacidosis, and your .blood sugar reading is between 150-180 mg/dL

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Sources and references:

The primary diabetes type 1 educational booklet. Dr. Rana albalwi, Ibtihal almuntasheri.

All Picture used are from canva.

Audit and review:

The content of this booklet has been reviewed by pediatrics endocrine and diabetes consultants at King Fahad Hospital of the University.

Department of Pediatrics - Endocrinology and Diabetology

Health Awareness Unit

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