

*Al-Rasheed University College
Department of Dentistry*



practical Biochemistry

For the second class

lab 3

Glucose Tolerance Test



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lab 3

Glucose Tolerance Test

The Glucose Tolerance Test (GTT), also referred to as the Oral Glucose Tolerance Test (OGTT), is a method which can help to diagnose instances of diabetes mellitus or **insulin resistance**. The test is used to **determine whether the body has difficulty metabolizing intake of sugar/carbohydrate**

The **glucose tolerance test** is a medical test in which glucose is given and blood samples taken afterward to **determine how quickly it is cleared from the blood**. The test is usually used to test for diabetes, insulin resistance, impaired betacell function, and sometimes reactive hypoglycemia and acromegaly, or rarer disorders of carbohydrate metabolism. An oral glucose tolerance test (OGTT), a standard dose of glucose is ingested by mouth and blood levels are checked two hours later.

There are two kinds of glucose tolerance tests:

- 1-the oral glucose tolerance test (**OGTT**), which is more common,
- 2- the intravenous glucose tolerance test (**IGTT**).A glucose tolerance test measures how well the body is able to break down glucose, or sugar.

This can be a useful test in helping to diagnose:

- 1-Pre-diabetes
- 2-Gestational diabetes in pregnant women
- 3-Insulin resistance
- 4-Reactive hypoglycemia

Preparation

The patient is instructed **not to restrict carbohydrate intake in the days or weeks before the test**. The test should **not be done during an illness**, as results may not reflect the patient's glucose metabolism when healthy.

A full adult dose should not be given to a person weighing **less than 42.6 kg (94 lb)**, or the excessive glucose may produce a false positive result.

Usually the OGTT is performed in **the morning** as glucose tolerance can exhibit a diurnal rhythm with a significant decrease in the afternoon. **The patient is instructed to fast (water is allowed) for 8–12 hours prior to the tests.**

Preparation of the patient for GTT:

1. The subject is pack on an unrestricted diet containing at least 150 gm of carbohydrates per day for at least 3 days before the test this is because carbohydrates restriction results in decreased tolerance for glucose.
2. Preferably the test is done in the morning after overnight fasting.
3. No extraordinary exercise is performed before the test.
4. No trauma inter current infection or recovery from serious illness.
5. No drugs that affect glycemic state like cortisone or diuretic.
6. No smoking before or during the test.

Glucose load:

1.25 gm/kg body weight or a standard does of 75 gm glucose for an adult is dissolve in 250-350 ml of cold water which may be flavored with lemon juice. The dose should be drunk within 5 minutes.

- A variant is often used in pregnancy to screen for gestational diabetes, with a screening test of 50 grams over one hour. If elevated, this is followed with a test of 100 grams over three hours.
- The recommendation is for a **75g oral dose** in all adults and is adjusted for weight in children. However is also used the concentrations of 50g and 100g and usually in 3 flavors and aroma (orange, lemon and cola).

If renal glycosuria (sugar excreted in the urine despite normal levels in the blood) is suspected, urine samples may also be collected for testing along with the fasting and 2 hour blood tests.

Procedure

1. A zero time (baseline) blood sample is drawn.
2. The patient is then given a measured dose of glucose solution to drink within a 5 minute time frame.
3. Blood is drawn at intervals for measurement of glucose (blood sugar), and sometimes insulin levels. The intervals and number of samples vary according to the purpose of the test. For simple diabetes screening, the most important sample is the 2 hour sample and the 0 and 2 hour samples may be the only ones collected. A

laboratory may continue to collect blood for up to 6 hours depending on the protocol requested by the physician.



Normal Minimum curve

Time	[hours]	0	0.5	1	2	3	4	5	6
Blood glucose [mg/dl]		80	90	105	90	80	80	80	80

A "Normal-Min" curve means the pancreas is still in very good shape. Insulin release is strong and sufficient to keep glucose from rising.

Normal Maximum curve

Time [hours]	0	0.5	1	2	3	4	5	6
Blood glucose [mg/dl]	120	135	160	130	110	100	110	105

The "Normal-Max" response means the patients already well started on the road to diabetes. This is **"normal" but it is not good.**

The pancreas is still releasing enough insulin, but maybe 10% to 30% of your beta cells are not functioning. The stream of insulin is not as much as it was before which is the reason why glucose is rising.

Care should be done for the remaining beta cells by not stimulating release of insulin. To prevent the advance to

Curve with mild diabetes

Time [hours]	0	0.5	1	2	3	4	5	6
Bg [mg/dl]	115	145	180	160	120	130	130	130

The pancreas is already partly shut down... perhaps 40% to 60% of the beta cells are burned out, and the stream of **insulin is not enough to lower glucose quickly.** The pancreas is working overtime to bring down glucose. The low quality of the insulin is not as good as before, and the long time that insulin is present to bring down the glucose causes the body become resistant to insulin.

Curve with severe diabetes

Time [hours]	0	0.5	1	2	3	4	5	6
Bg [mg/dl]	200	235	265	280	300	295	280	270

Diabetes and hypoglycemia

Time [hours]	0	0.5	1	2	3	4	5	6
Bg[mg/dl]	100	160	220	160	85	60	50	85

This is a curve of a patient that is both diabetic and hypoglycemic. With such a curve severe symptoms can be expected.

Samples:

Blood samples are taken before intake of glucose load (zero time) after 30 minutes 60,90 and 120. At zero ,60 and 120minutes urine samples may be collected if patients with renal glycosuria are to be recognized tabulate results as the followings:

1. **Normal G.T.T** fasting glucose level is 70-120 mg/dl reaching peak of about 160 mg/dl at 30 -60 minutes and the normal fasting level is regained at 120 minutes.
2. **Diabetic G.T:** fasting glucose level is ≥ 140 mg/dl rising and exceeding 200 mg% after the does and takes few hours to return to the original fasting level
3. **Impaired glucose tolerance test :** fasting glucose level is 120-140 mg/dl rising to 180-200 mg/dl at 30-60 minutes, so there can be glycosuria and may take more than 120 minutes to return to the original fasting level only a percentage of such patients develop an overt diabetes mellitus in the future.

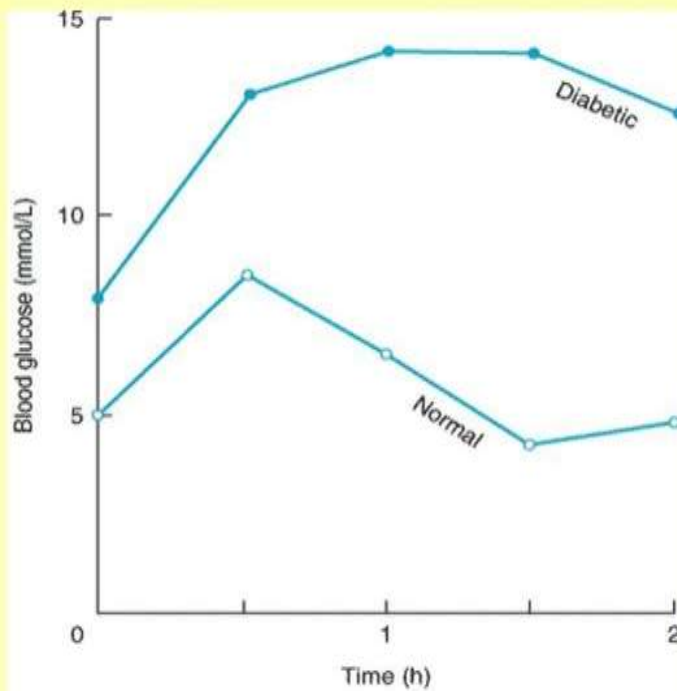
4. Flat G.T.T(increased tolerance): blood glucose fails to rise significantly after glucose load. It may be seen in malabsorption hypopituitarism(addition's diseases), hypothyroidism

5. lag storage G.T.T: there is a sharp rise in blood glucose early after intake of glucose load and may exceed a level of 180 mg/dl with resulting glycosuria. There is also a tendency for the 2-hour value to rapid absorption from intestine. It may be seen after gastric surgery or in patients with severe liver disease.

Note: two-hour post prandial blood glucose level is the most sensitive of the value of the G.T.T in establishing a diagnosis of D.M because by two hours the blood glucose level is to similar to the fasting level.

The OGTT begins with a fasting client ingesting a predetermined amount of sugar water. Blood sugar levels are established through blood tests repeated every half hour.

Glucose Tolerance Test



Blood glucose curves of a normal and a diabetic person after oral administration of 1 g of glucose/kg body weight.

Note the initial raised concentration in the fasting diabetic.

A criterion of normality is the return of the curve to the initial value within 2 hours.

Source: Murray RK, Granner DK, Rodwell VW: *Harper's Illustrated Biochemistry*, 27th Edition: <http://www.accessmedicine.com>

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