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## Insulin

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**Also known as:** Fasting Insulin

**Formal name:** Insulin, serum

**Related tests:** [C-peptide](#), [Glucose Tests](#)

### At a Glance

#### Why Get Tested?

To help evaluate insulin production by the **beta cells** in the pancreas; to help diagnose the presence of an insulin-producing tumor in the **islet cells** of the pancreas (**insulinoma**); to help determine the cause of low **blood glucose (hypoglycemia)**; to help identify **insulin resistance**, or to help determine when a **type 2 diabetic** might need to start taking insulin to supplement oral medications

#### When to Get Tested?

When you have low blood glucose levels with symptoms such as sweating, palpitations, dizziness, fainting; when you have diabetes and your health practitioner wants to monitor your insulin production; sometimes when it is suspected that you have insulin resistance

#### Sample Required?

A blood sample drawn from a vein in your arm

#### Test Preparation Needed?

You may be asked to fast for 8 hours before the blood sample is collected, but occasionally a health practitioner may do the test with, for example, a **glucose tolerance test**. In some cases, a health practitioner may request that you fast longer.

### The Test Sample

#### What is being tested?

Insulin is a **hormone** that is produced and stored in the **beta cells** of the pancreas. It is vital for the transportation and storage of **glucose**, the body's main source of energy. Insulin helps transport glucose from the blood to within cells, helps regulate blood glucose levels, and has a role in lipid **metabolism**. This test measures the amount of insulin in the blood.

Insulin and glucose blood levels must be in balance. After a meal, carbohydrates usually are broken down into glucose and other simple sugars. This causes the blood glucose level to rise and stimulates the pancreas to release insulin into the blood. As glucose moves into cells, the level in the blood decreases and release of insulin by the pancreas decreases.

If an individual is not able to produce enough insulin, or if the body's cells are resistant to its effects (**insulin resistance**), glucose cannot reach most of the body's cells and the cells starve, while blood glucose rises to an unhealthy level. This can cause disturbances in normal metabolic processes that result in various disorders and complications, including **kidney disease**, **cardiovascular disease**, and vision and neurological problems.

**Diabetes**, a disorder associated with high glucose levels and decreased insulin effects, can be a life-threatening condition. People with type 1 diabetes produce very little insulin and so eventually require insulin supplementation therapy. Type 2 diabetes is generally related to insulin resistance, which increases with time.

With insulin resistance, the body is unable to respond to the effects of insulin. The body compensates by producing additional amounts of the hormone. This results in a high level of insulin in the blood (**hyperinsulinemia**) and over-stimulation of some tissues that have remained insulin-sensitive. Over time, this process causes an imbalance in the relationship between glucose and insulin and, without treatment, may eventually cause health complications affecting various parts of the body.

In addition to type 2 diabetes, insulin resistance may be seen in those with **polycystic ovarian syndrome (PCOS)**, **prediabetes** or **heart disease, metabolic syndrome**, and with disorders related to the **pituitary** or **adrenal glands**.

Other than in insulin resistance, hyperinsulinemia is most often seen in people with tumor of the **islet cells** in the pancreas (**insulinomas**) or with an excess amount of administered (**exogenous**) insulin. Hyperinsulinemia causes low blood sugar (**hypoglycemia**), which can lead to sweating, palpitations, hunger,

confusion, blurred vision, dizziness, fainting, and seizures. Since the brain is dependent on blood glucose as an energy source, severe glucose deprivation due to hyperinsulinemia can lead fairly quickly to insulin shock and death.

### How is the sample collected for testing?

A blood sample is obtained by inserting a needle into a vein in the arm.

*NOTE: If undergoing medical tests makes you or someone you care for anxious, embarrassed, or even difficult to manage, you might consider reading one or more of the following articles: [Coping with Test Pain, Discomfort, and Anxiety](#), [Tips on Blood Testing](#), [Tips to Help Children through Their Medical Tests](#), and [Tips to Help the Elderly through Their Medical Tests](#).*

Another article, [Follow That Sample](#), provides a glimpse at the collection and processing of a blood sample and throat culture.

### Is any test preparation needed to ensure the quality of the sample?

Typically, a person will be asked to fast for 8 hours before blood is collected, but occasionally a health practitioner may do testing when fasting is not possible, such as when a glucose tolerance test (see [Glucose](#)) is done. In some cases, the health practitioner may request that a person fast longer than 8 hours.

## The Test

### How is it used?

#### When is it ordered?

#### What does the test result mean?

#### Is there anything else I should know?

### How is it used?

Insulin testing has several possible uses. Insulin is a hormone that is produced and stored in the [beta cells](#) of the pancreas. Insulin helps transport [glucose](#), the body's main source of energy, from the blood to within cells. If a person makes too little insulin or is resistant to its effects, cells starve. If someone makes too much, as may happen with an insulin-producing tumor ([insulinoma](#)) for example, then symptoms of low blood glucose ([hypoglycemia](#)) emerge.

Insulin testing may be used to help:

- Diagnose an insulinoma, verify that removal of the tumor has been successful, and/or to monitor for recurrence
- Diagnose the cause of hypoglycemia in an individual with signs and symptoms
- Identify [insulin resistance](#)
- Monitor the amount of insulin produced by the beta cells in the pancreas ([endogenous](#)); in this case, a [C-peptide test](#) may also be done. Insulin and C-peptide are produced by the body at the same rate as part of the conversion of proinsulin to insulin in the pancreas. Both tests may be ordered when a health practitioner wants to evaluate how much insulin in the blood is made by the body and how much is from outside ([exogenous](#)) sources such as insulin injections. The test for insulin measures insulin from both sources while the C-peptide test reflects insulin produced by the pancreas.
- Determine when a [type 2 diabetic](#) might need to start taking insulin to supplement oral medications
- Determine and monitor the success of an [islet cell](#) transplant intended to restore the ability to make insulin, by measuring the insulin-producing capacity of the transplant

Insulin testing may be ordered with glucose and C-peptide tests. Insulin levels are also sometimes used in conjunction with the [glucose tolerance test \(GTT\)](#). In this situation, blood glucose and insulin levels are measured at pre-established time intervals to evaluate insulin resistance.

### When is it ordered?

Insulin levels are most frequently ordered following a low [glucose](#) and/or when someone has [acute](#) or [chronic](#) symptoms of low blood glucose ([hypoglycemia](#)) caused by, for example, an [insulinoma](#). Symptoms of hypoglycemia may include:

- Sweating
- Palpitations
- Hunger
- Confusion
- Blurred vision
- Dizziness
- Fainting
- In serious cases, seizures and loss of consciousness

These symptoms may indicate low blood glucose but may also be seen with other conditions.

An insulin test may also be done when an individual has or is suspected of having **insulin resistance**. This may include people with **type 2 diabetes**, **polycystic ovarian syndrome (PCOS)**, **prediabetes** or **heart disease**, or **metabolic syndrome**.

A health practitioner also may order insulin and **C-peptide** tests after an insulinoma has been successfully removed to verify the effectiveness of treatment and then order the tests periodically to monitor for recurrence.

Periodic testing may also be used to monitor the success of an **islet cell** transplant by measuring the insulin-producing capacity of the transplant.

### What does the test result mean?

Insulin levels must be evaluated in context.



Looking for reference ranges?

Results seen:

DISORDER	FASTING INSULIN LEVEL	FASTING GLUCOSE LEVEL
None	Normal	Normal
Insulin resistance	High	Normal or somewhat elevated
Not enough insulin produced by the <b>beta cells</b> (as seen in <b>diabetes</b> , <b>pancreatitis</b> , for example)	Low	High
<b>Hypoglycemia</b> due to excess insulin (may be seen in <b>insulinomas</b> , <b>Cushing syndrome</b> , excess administration of <b>exogenous</b> insulin, etc.)	Normal or high	Low

Elevated insulin levels are seen with:

1. **Acromegaly**
2. Cushing syndrome
3. Use of drugs such as corticosteroids, levodopa, oral contraceptives
4. Fructose or galactose intolerance
5. Insulinomas
6. Obesity
7. **Insulin resistance**, such as appears in **type 2 diabetes** and **metabolic syndrome**

Decreased insulin levels are seen with:

1. Diabetes
2. **Hypopituitarism**
3. **Pancreatic diseases** such as chronic pancreatitis (including **cystic fibrosis**) and **pancreatic cancer**

### Is there anything else I should know?

Insulin for injection used to come strictly from animal sources (cow and pig pancreas cells). Most insulin used today is synthetic, made by biochemical synthesis to identically match the biological activity of the insulin produced by human cells.

There are different pharmaceutical formulations of insulin with different properties. Some are rapid-release and quick-acting and others are slow-release preparations that act over a prolonged period. Diabetics may take mixtures and/or different types of insulin throughout the day.

Insulin **assays** are designed to measure **endogenous** human insulin. However, different assays react variably with **exogenous** (animal or synthetic) insulin. If someone is receiving insulin, these effects should be clarified with the testing laboratory. If several or periodic insulin assays will be performed, they should be analyzed by the same laboratory to ensure consistency.

The insulin tolerance test (ITT) is not widely used, but is one method for determining insulin sensitivity (or resistance), especially in obese individuals and those with **PCOS**. This test involves an IV-infusion of insulin, with subsequent measurements of glucose and insulin levels.

If someone has developed **antibodies** against insulin, especially as a result of taking non-human (animal or synthetic) insulin, these can interfere with insulin testing. In this case, a **C-peptide** may be performed as an alternative way to evaluate insulin production. Note also that most people with **type 1 diabetes** will also have **autoantibodies** against insulin.

## Common Questions

1. **Can I do an insulin test at home?**
2. **Why does insulin have to be injected?**
3. **How is an insulinoma treated?**
4. **What else is important about insulin resistance?**

### 1. Can I do an insulin test at home?

No. Although glucose levels can be monitored at home, insulin tests require specialized instruments and training are performed at laboratories.

### 2. Why does insulin have to be injected?

Insulin must be injected or given via an insulin pump. It cannot be given orally because it is a protein and is broken down in the stomach before it can be absorbed.

### 3. How is an insulinoma treated?

**Insulinomas** are insulin-producing tumors that are usually **benign**. They are typically treated by being located and removed. Once removed, generally they do not return.

### 4. What else is important about insulin resistance?

**Insulin resistance** is a warning signal that the body is having problems processing glucose and it is characteristic of **prediabetes**. People with early or moderate insulin resistance often don't have any symptoms, but if their condition is ignored, it puts them at a much greater risk of developing **type 2 diabetes**, **hypertension**, **hyperlipidemia**, and/or **heart disease** several years down the road. Abdominal obesity, insulin resistance, **dyslipidemia**, and hypertension form a set of risk factors that are referred to as **metabolic syndrome**.

Risk factors for insulin resistance include:

- Obesity, especially abdominal obesity
- Family history of **diabetes** or insulin resistance
- **Gestational diabetes**
- **Polycystic ovary syndrome**

Treatment of insulin resistance involves changes in diet and lifestyle. The American Diabetes Association recommends losing excess weight, getting regular amounts of moderate intensity physical activity, and increasing dietary fiber to lower blood insulin levels and increase the body's sensitivity to it.

## Related Pages

### On This Site

Conditions: [Diabetes](#), [Insulin Resistance](#), [PCOS](#), [Metabolic Syndrome](#)

### Elsewhere On The Web

[American Diabetes Association](#)

[CDC Diabetes Public Health Resource](#)

[National Diabetes Education Program](#)

[MedlinePlus Diabetes Interactive Tutorial: Diabetes - Introduction](#)

[MedlinePlus Medical Encyclopedia: Hypoglycemia](#)

[MedlinePlus Medical Encyclopedia: Insulinoma](#)

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### Sources Used in Current Review

Lin, J. (Updated 2012 February 21). Insulin. Medscape Reference [On-line information]. Available online at <http://emedicine.medscape.com/article/2089224-overview#showall> through <http://emedicine.medscape.com>. Accessed December 2013.

Olatunbosun, S. and Dagogo-Jack, S. (Updated 2013 March 8). Insulin Resistance. Medscape Reference [On-line information]. Available online at <http://emedicine.medscape.com/article/122501-overview> through <http://emedicine.medscape.com>. Accessed December 2013.

(© 1995–2013). Insulin, Serum. Mayo Clinic Mayo Medical Laboratories [On-line information]. Available online at <http://www.mayomedicallaboratories.com/test-catalog/Overview/8664> through <http://www.mayomedicallaboratories.com>. Accessed December 2013.

(© 1995-2013). Blood Test: Insulin. KidsHealth from Nemours [On-line information]. Available online at [http://kidshealth.org/parent/system/medical/test\\_insulin.html](http://kidshealth.org/parent/system/medical/test_insulin.html) through <http://kidshealth.org>. Accessed December 2013.

(Reviewed 2013 June 7). Insulin Basics. American Diabetes Association [On-line information]. Available online at <http://www.diabetes.org/living-with-diabetes/treatment-and-care/medication/insulin/insulin-basics.html> through <http://www.diabetes.org>. Accessed December 2013.

Delgado, J. et. al. (Updated 2013 January). Hyperinsulinemic Hypoglycemia. ARUP Consult [On-line information]. Available online at [http://www.arupconsult.com/Topics/HyperinsulinemicHypoglycemia.html?client\\_ID=LTD#tabs=0](http://www.arupconsult.com/Topics/HyperinsulinemicHypoglycemia.html?client_ID=LTD#tabs=0) through <http://www.arupconsult.com>. Accessed December 2013.

Pagana, K. D. & Pagana, T. J. (© 2011). Mosby's Diagnostic and Laboratory Test Reference 10th Edition: Mosby, Inc., Saint Louis, MO. Pp 585-586.

Clarke, W., Editor (© 2011). Contemporary Practice in Clinical Chemistry 2nd Edition: AACC Press, Washington, DC. Pg 345.

McPherson, R. and Pincus, M. (© 2011). Henry's Clinical Diagnosis and Management by Laboratory Methods 22nd Edition: Elsevier Saunders, Philadelphia, PA. Pp 211-212.

Tietz Textbook of Clinical Chemistry and Molecular Diagnostics. Burtis CA, Ashwood ER, Bruns DE, eds. 4th edition, St. Louis: Elsevier Saunders; 2006, Pp 850-851.

#### Sources Used in Previous Reviews

Thomas, Clayton L., Editor (1997). Taber's Cyclopedic Medical Dictionary. F.A. Davis Company, Philadelphia, PA [18th Edition].

Pagana, Kathleen D. & Pagana, Timothy J. (2001). Mosby's Diagnostic and Laboratory Test Reference 5th Edition: Mosby, Inc., Saint Louis, MO.

MedlinePlus (2002 April 03, Updated). Insulin (Systemic). MedlinePlus Health Information [On-line information]. Available online at <http://www.nlm.nih.gov/medlineplus/druginfo/uspdi/203298.html>.

Hirsch, I. (1999 November 15). Type 1 Diabetes Mellitus and the Use of Flexible Insulin Regimens. American Family Physician (AAFP) [On-line Journal]. Available online at <http://www.aafp.org/afp/991115ap/2343.html> through <http://www.aafp.org>.

ARUP. Insulin, Free and Total. ARUP's Guide to Clinical Laboratory Testing (CLT) [On-line information]. Available online at [http://www.arup-lab.com/guides/clt/tests/clt\\_a19b.htm#1837257](http://www.arup-lab.com/guides/clt/tests/clt_a19b.htm#1837257) through <http://www.arup-lab.com>.

Sapin, R., et. al (2001). Elecsys Insulin Assay: Free Insulin Determination and the Absence of Cross-Reactivity with Insulin Lispro. *Clinical Chemistry* [On-line Journal] (47) 602-605.

CSU (1999 June 15, Updated). Physiologic Effects of Insulin. Colorado State University, Pathophysiology of the Endocrine System [On-line Biomedical Hypertextbook]. Available online through <http://arbl.cvmb.colostate.edu>.

CSU (1999 June 15, Updated). Glucagon. Colorado State University, Pathophysiology of the Endocrine System [On-line Biomedical Hypertextbook]. Available online through <http://arbl.cvmb.colostate.edu>.

Fish, S. Updated (2002 February 18, Updated). Insulin test. Medlineplus Encyclopedia [On-line information]. Available online at <http://www.nlm.nih.gov/medlineplus/ency/article/003700.htm>.

CSU (1999 June 15, Updated). Insulin Synthesis and Secretion. Colorado State University, Pathophysiology of the Endocrine System [On-line Biomedical Hypertextbook]. Available online through <http://arbl.cvmb.colostate.edu>.

Bruno Geloneze, Marcos A. Tambascia, José C. Pareja, Enrico M. Repetto and Luis A. Magna. The Insulin Tolerance Test in Morbidly Obese Patients Undergoing Bariatric Surgery. *Obesity Research* 9:763-769 (2001). Available online at <http://www.obesityresearch.org/cgi/content/full/9/12/763> through <http://www.obesityresearch.org>.

Kolodziejczyk B, Duleba AJ, Spaczynski RZ, et al. Metformin Therapy Decreases Hyperandrogenism and Hyperinsulinemia in Women With Polycystic Ovary Syndrome. *Fertil Steril*. 2000 Jun;73(6):1149-1154.

Pagana, K. D. & Pagana, T. J. (© 2007). Mosby's Diagnostic and Laboratory Test Reference 8th Edition: Mosby, Inc., Saint Louis, MO. Pp 567-568.

Clarke, W. and Dufour, D. R., Editors (© 2006). Contemporary Practice in Clinical Chemistry: AACC Press, Washington, DC. Pp 290-291.

Wu, A. (© 2006). Tietz Clinical Guide to Laboratory Tests, 4th Edition: Saunders Elsevier, St. Louis, MO. Pp 618-619, 622-623.

Dowshen, S. (Reviewed 2009 January). Blood Test: Insulin. The Nemours Foundation, KidsHealth for Parents [On-line information]. Available online at [http://kidshealth.org/parent/system/medical/test\\_insulin.html](http://kidshealth.org/parent/system/medical/test_insulin.html) through <http://kidshealth.org>. Accessed December 2009.

Dugdale, D. and Wexler, D. (Updated 2008 August 9). Insulinoma. MedlinePlus Medical Encyclopedia [On-line information]. Available online at <http://www.nlm.nih.gov/medlineplus/ency/article/000387.htm>. Accessed December 2009.

Hussain, A. N. and Vincent, M. (Updated 2009 July 2). Diabetes Mellitus, Type 1. eMedicine [On-line information]. Available online at <http://emedicine.medscape.com/article/117739-overview> through <http://emedicine.medscape.com>. Accessed December 2009.

Ligaray, K. and Isley, W. (Updated 2009 October 28). Diabetes Mellitus, Type 2. eMedicine [On-line information]. Available online at <http://emedicine.medscape.com/article/117853-overview> through <http://emedicine.medscape.com>. Accessed December 2009.

(2008 November). Diabetes Overview. National Diabetes Information Clearinghouse [On-line information]. Available online at <http://www.diabetes.niddk.nih.gov/dm/pubs/overview/index.htm> through <http://www.diabetes.niddk.nih.gov>. Accessed December 2009.

(Updated 2009 August). Insulinoma. ARUP Consult [On-line information]. Available online at [http://www.arupconsult.com/Topics/Insulinoma.html?client\\_ID=LTD#](http://www.arupconsult.com/Topics/Insulinoma.html?client_ID=LTD#) through <http://www.arupconsult.com>. Accessed December 2009.

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