

AS WE SEE IT

What You Don't Know About Blood Sugar

The most cherished benefit of Foundation membership is discovering something new in every Life Extension publication. Unlike typical health journals, we inform members about what they don't know concerning medical findings that are overlooked by conventional and alternative doctors.

In our relentless review of the scientific literature, we have uncovered data that calls into question what the safe range of blood sugar really is. Current guidelines state that a person is diabetic if fasting blood glucose levels exceed 126 mg/dL on two consecutive occasions. Fasting glucose levels over 109 are flagged as potential prediabetic (glucose intolerant) states. Life Extension has long argued that optimal glucose ranges are less than 100.

In a new hypothesis that shakes the pillars of conventional wisdom, it now appears that optimal fasting blood glucose levels should probably be under 86 mg/dL. This means that those with high "normal" glucose (86-109) are at an increased risk of premature death. While the medical establishment clearly understands the lethal dangers of hyperglycemia (blood sugar over 126), they have yet to recognize that even high normal glucose levels pose a serious threat to one's health.



William Faloon

Why "Normal" Glucose Levels Are Dangerous

To support our hypothesis that higher "normal" ranges of blood glucose represent a health risk, we first investigated the multifaceted toxic effects that sugar inflicts throughout the body. We found many studies showing that sugar damages cells via multiple mechanisms and is a causative factor in common diseases of aging.¹⁻³⁷ It thus appears desirable to maintain the lowest level of blood glucose needed to sustain healthy metabolic function.

We then looked at the effects of caloric restriction, and noted one study in which fasting glucose declined from an average of 92 to 74 mg/dL in a group of adults who reduced their food intake.³⁸ This corresponded to animal studies in which caloric restriction induced significant reductions in blood glucose levels.³⁹⁻⁴¹ It is well established that cutting calorie intake reduces one's risk of age-related diseases and probably slows aging itself.⁴²⁻⁵⁰ One reason for this may be the reduction in blood glucose levels that occurs in response to ingesting fewer calories.

As people age, their fasting glucose levels normally increase as their health declines. Standard laboratory reference ranges show an aging person having a "normal" fasting glucose level of up to 109 mg/dL. Yet the most effective anti-aging therapy—caloric restriction—lowers glucose levels to the low 70s (mg/dL).

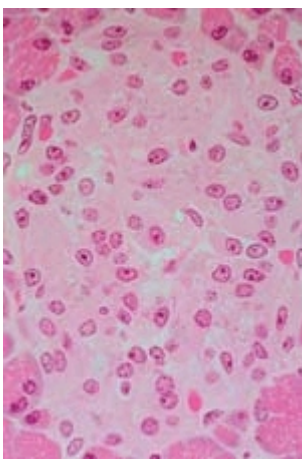
Many theories of aging focus on the deleterious effects of glucose itself. Only a few studies have evaluated disease risk in people whose fasting blood glucose levels are in normal ranges. One study of nearly 2,000 men looked at fasting blood glucose levels over a 22-year period. Its startling results showed that men with fasting glucose levels over 85 mg/dL had a 40% increased risk of death from cardiovascular disease. The researchers concluded, "fasting blood glucose values in the upper normal range (appear) to be an important independent predictor of cardiovascular death in nondiabetic apparently healthy middle-aged men."⁵¹

Conventional Medicine's Interpretation Of Fasting Glucose Blood Tests

70-109 mg/dL Normal glucose tolerance
 110-125 mg/dL Impaired fasting glucose (prediabetes)
 126+ mg/dL Probable diabetes

Life Extension's Fasting Glucose Guidelines

70-85 mg/dL Optimal (no glucose intolerance)
 86-99 mg/dL Borderline impaired fasting glucose
 100+ mg/dL Probable prediabetes



A light micrograph of a human pancreas.

The pancreas is a digestive gland, but also controls blood sugar levels by secreting insulin.

Foundation members often have their blood tested through our discounted mail-order blood-testing service. In addition to using the results of these blood tests to improve members' health, Life Extension is able to use this information to evaluate trends that can lead to better recommendations for extending longevity. We compiled data from all fasting glucose tests conducted over the past 12 months. The average reading was 94 mg/dL. While physicians would consider this "normal" result to be excellent, our new hypothesis indicates that optimal glucose levels should be below 86 mg/dL (and ideally as low as 74 mg/dL).

Where Your Pancreas Thinks Glucose Levels Should Be

The pancreas plays a major role in regulating blood glucose levels by secreting insulin to transport sugar out of the blood and into cells for energy production or storage.

Insulin also drives fat into cells, prevents fat from being released from cells, and makes people hungry. High insulin levels contribute to obesity and the disease states associated with being overweight, such as type II diabetes, cardiovascular disease, kidney failure, and certain types of cancers.

In normal health, the pancreas stops secreting insulin when glucose levels drop below 83 mg/dL.⁵²⁻⁵⁴ As I noted earlier, healthy aging people typically have fasting glucose levels over 90 mg/dL, and even competent doctors wait until fasting glucose is over 109 before suspecting a pre-diabetic (glucose-intolerant) condition.

But insulin continues to be secreted when blood glucose levels are over 83 mg/dL, which indicates that the pancreas is striving to drive glucose levels down to a range safer than what aging people typically are able to achieve.

An in-depth discussion about the lethal dangers of excess insulin can be found in the chapter on obesity in our Disease Prevention and Treatment reference book (4th edition). In the obesity protocol, we present evidence that excess insulin is a causative factor for body fat accumulation.

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Dr. Roy Walford is a pioneering scientist who demonstrated that maximum life span could be extended when calorie intake is reduced. Dr. Walford's research showed that caloric restriction lowers fasting glucose by 21% (from 92 to 74 mg/dL) in humans. Even more significant was Dr. Walford's finding that these calorie-restricted people had a 42% reduction in fasting insulin!

Overweight and obese people have very high insulin levels.⁵⁵⁻⁵⁶ Chronically elevated insulin contributes to a host of degenerative diseases.⁵⁷⁻⁶³ Our new hypothesis suggests that lowering fasting glucose levels results in an even greater reduction in fasting insulin. By secreting insulin when blood sugar levels exceed 83 mg/dL, the pancreas is telling us to keep blood glucose far below the high "normal" reference ranges used by blood test labs. While today's standard fasting glucose reference range extends to 109 mg/dL before flagging a problem, our new hypothesis suggests that fasting glucose over 85 mg/dL is cause for concern.

As you will read in this month's cover story, "Pathways of Aging," excess blood glucose induces enormous damage to tissues throughout the body. The question is, what to do about it?

How to Assess Your Fasting Glucose Status

In order to assess your fasting blood glucose status, a standard blood chemistry test provides this information at a modest cost.

New Glucose Guidelines Issued by American Diabetes Foundation

On October 24, 2003, a scientific committee of the American Diabetes Association issued a new definition of "impaired glucose tolerance," also known as a "prediabetic" state.

Under the new definition, the cut-off point for normal fasting blood glucose levels was reduced from 109 to 100 mg/dL, meaning that a value of 100 mg/dL or above would lead to a diagnosis of impaired fasting glucose (or prediabetes). Studies show that many people who fall in the prediabetic range will develop diabetes within 10 years.

A member of the Association's scientific committee stated that lowering the fasting glucose threshold to 100 mg/dL should help doctors identify more people at risk for developing type II diabetes. These people could then be prescribed an intensive diabetes-prevention program, such as diet and exercise therapy. The objective in intervening early, according to the American Diabetes Association representative, is to reduce the risk of diabetic complications such as heart disease.

Now that the American Diabetes Association has joined the Life Extension Foundation in recommending optimal fasting glucose levels below 100 mg/dL, blood testing laboratories may change their "standard reference range" to alert more people who are in a prediabetic state.

The problem is that the Life Extension Foundation's new hypothesis indicates that fasting glucose levels above 85 mg/dL are cause for concern. So even if blood labs lower their upper limit range to 100 mg/dL, many people will not be warned that their blood sugar levels are too high.



Ways to Lower Blood Glucose

The safest, most effective way to lower blood glucose levels is caloric restriction. Few people, however, are able to consistently under-eat. Consuming a lower glycemic index/load diet reduces blood glucose levels somewhat.⁶⁴⁻⁶⁹ (For more information about the "glycemic index/load," see pages 1151-4 of Disease Prevention and Treatment.)

Chromium supplements have been shown to reduce blood glucose significantly.⁷⁰⁻⁷⁴ The dose used in human studies ranges from 200 to 1000 mcg of elemental chromium a day, with best results occurring when 400 mcg or more of chromium is taken daily.

Of interest is an animal study showing that chromium extended mean and maximum life span.⁷⁵ This study surprised gerontologists, as chromium had not been considered a particularly promising antiaging nutrient. It may have been chromium's effect in lowering glucose levels that resulted in the significant prolonging of life span demonstrated in this study.

Magnesium, carnitine, alpha lipoic acid, and biotin also can help maintain glycemic control.⁷⁶⁻¹⁰⁸ A prescription drug for diabetes called metformin significantly lowers glucose levels in most people, but not everyone can take this medication.¹⁰⁹⁻¹¹⁹

**Nutrients That Have
Been Shown to Reduce
Fasting Blood
Glucose Levels
(primarily in diabetic
patients)**

Alpha Lipoic acid⁸¹⁻⁹⁴
Biotin⁹⁸⁻¹⁰⁸
Carnitine⁹⁵⁻⁶
Chromium⁷⁰⁻⁴
Magnesium⁷⁶⁻⁸⁰
Vanadium¹⁴⁶⁻⁵⁰
Zinc¹³⁸⁻⁴⁵

Regrettably, many aging people will not be able to maintain optimal blood glucose levels of less than 86 mg/dL. In this situation, protecting the body from the toxic effects of glucose becomes paramount. Glycation is a pathological process that occurs when glucose binds to protein molecules, resulting in the formation of non-functioning structures in the body. Higher blood glucose levels mean more-damaging glycation reactions.

Glycation advances slowly and accompanies every fundamental process of cellular metabolism. Glycation accelerates aging and neurodegenerative disorders such as Alzheimer's disease. Fortunately, a nutrient called carnosine confers significant protection against glycation processes.¹²⁰⁻¹²¹

Higher blood glucose also causes increased oxidative stress. Consumption of antioxidants has shown beneficial results in type II diabetics.¹²²⁻¹⁵⁰ Based on our hypothetical definition that blood sugar over 85 mg/dL is too high, antioxidants may be more important to healthy people than previously thought.

A new fat-soluble form of vitamin B1 has demonstrated significant protection against sugar toxicity at the cellular level. In Europe, this vitamin B1 derivative called benfotiamine is prescribed for those suffering from disorders related to sugar toxicity, such as peripheral neuropathy. The good news is that this nutrient has been added to popular supplements already being taken by most Life Extension members. Consumers can thus help protect themselves against the lethal dangers of excess sugar (glucose) without having to swallow more capsules or spend more money.

Why Our Hypothesis May Revolutionize Antiaging Medicine

Despite their efforts to lead healthier lifestyles, many people are dying prematurely of age-related diseases. Heart attack remains the number-one killer. Kidney failure is a major problem in those fortunate enough to make it past 85 years of age.¹⁵¹ The diseases of aging can be related to an impaired glucose state that we hypothesize may be defined as fasting glucose levels chronically greater than 85 mg/dL.

Sugar levels higher than what cells require to sustain energy metabolism inflict greater damage than lower sugar levels. If moderate to high "normal" fasting glucose levels increase cardiovascular mortality by 40% (as was shown in one large human study), then high normal glucose (and the corresponding excess insulin secretion it provokes) could be one of the leading preventable risk factors for heart attack and stroke.

Because blood sugar levels over 126 mg/dL substantially increase the risk of disease, it might be logical to assume that levels somewhere below 126 also represent an unacceptable danger.

Our new hypothesis indicates that fasting blood glucose of greater than 85 mg/dL is a signal of a metabolic disturbance that may lead to the development of degenerative disease. Most aging people have glucose levels above 85, and this age group also suffers from a plethora of disease states.

We know that type II diabetes markedly accelerates the rate at which humans contract age-related diseases. Type II diabetes is initially characterized by high levels of glucose and insulin in the blood. Today's reference range for diabetes (fasting glucose of 126 mg/dL or greater on two consecutive occasions) does not adequately reflect the "prediabetic" quandary (fasting glucose over 85 mg/dL) faced by most aging people.



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The diseases associated with diabetes include heart attack, stroke, blindness, kidney failure, circulatory deficits, and more. Non-diabetic aged people, however, also suffer from these same disorders, albeit at an older average age. Our hypothesis asserts that diabetic-related diseases manifest as humans grow older, and these age-related diseases may be related to fasting glucose levels chronically above 85 mg/dL. In other words, while diabetics contract these diseases at an earlier age, if non-diabetics live long enough with fasting glucose levels above 85 mg/dL, they could develop similar illnesses.

The fact that most aging humans have higher than optimal fasting glucose levels (above 85 mg/dL) should not lull us into accepting this as an inevitable consequence of growing older. To the contrary, specific nutrient, drug, and dietary alterations can reduce glucose levels in virtually everyone. The impact of people maintaining fasting glucose blood levels of 85 mg/dL or lower could be a significant reduction in the crippling, lethal diseases that have overwhelmed our health care system.

Avoiding Hypoglycemia (Low Blood Sugar)

While most adults have blood glucose levels that are higher than that required to sustain metabolic processes, over 20 million Americans suffer from some form of hypoglycemia—i.e., blood glucose levels that are lower than desirable. Of the several different types of hypoglycemia, one of the most common is reactive hypoglycemia, which is caused by the excess release of insulin in response to ingestion of too many refined carbohydrates or sugars.

Conventional medical textbooks define hypoglycemia as blood sugar below 60 mg/dL. These textbooks acknowledge that hypoglycemic symptoms vary widely in individuals, meaning that some people experience hypoglycemic symptoms with fasting glucose levels above 60 mg/dL while others do not develop symptoms until fasting glucose levels are lower than 60mg/dL. A conservative principle of hypoglycemia diagnosis is a blood glucose level of less than 70 mg/dL at the time of symptom onset and relief after eating.



The body tries to maintain a nearly constant blood sugar level. This is especially important for the brain and nervous system. If blood sugar is depressed below normal, the brain is unable to function appropriately. This can lead to a wide variety of physical and psychological symptoms associated with abnormal nervous-system function, such as fatigue, mood swings, premenstrual syndrome, sugar craving, headaches, difficulty focusing the eyes, tremors, temperamental outbursts, depression, excessive sweating, palpitations, and feeling "spaced-out." Hypoglycemia must be treated when blood glucose falls below 60 mg/dL, with or without symptoms.

It is unlikely that any of the natural approaches to reducing blood glucose levels would induce a hypoglycemic state. These nutrients typically stabilize glycemic control in the body. Some caution should be employed, however, when using antidiabetic drugs such as metformin. Nondiabetics using metformin may start off at 500 mg a day and gradually build up to 1000-1500 mg a day. The objective is not to take so much metformin as to induce a hypoglycemic state. Healthy people have used metformin as an antiaging drug over a decade. For complete safety information about metformin, log on to www.glucophage.com.

Our Commitment to Your Longevity

Health-conscious people join the Life Extension Foundation for a variety of reasons. Some members are grateful for our pioneering scientific research, while others appreciate our war against FDA malfeasance. Many members value having personal access to knowledgeable health advisors, while others appreciate being able to obtain state-of-the-art supplements at discount prices.

The Life Extension Foundation is committed to helping members achieve and maintain the best possible state of health. We have been identifying new compounds to guard against age-related disorders at a record pace. Whenever possible, these nutrients are added to popular products so that members automatically receive the added benefits.

Whenever you purchase a Life Extension product, you support a revolutionary program to correct today's broken health care system. We have exposed flawed FDA policies to the extent that our logic has prevailed in Congress, the courts, and the law itself. The pioneering research we fund has enabled us to identify specific genes responsible for making us age. Our meticulous review of the published scientific literature has resulted in the discovery of novel methods for preventing and treating disease.

At the end of each year, Life Extension discounts the prices of all our supplements. Members take advantage of these "Super Sale" prices to stock up on the pharmaceutical-quality nutrients they use every day.

I want to thank Foundation members for their support this year, which has allowed us to expand our scientific research programs while simultaneously battling FDA tyranny. Every time you purchase a product from us, you support the most comprehensive program on the planet aimed at abolishing infirmity, disease, and death.

For longer life,



William Faloon.

Rebel Against the Reference Ranges

Commercial testing laboratories develop "standard reference ranges" based on typical blood level averages for particular indicators. If you and your doctor rely on these "average" reference ranges, you can expect your health and longevity also to be "average."

If your intention, however, is to live in an excellent state of health beyond an average life span, then you may have to rebel against the average reference ranges. This mandates taking action to bring your blood indicators into "optimal" ranges. Achieving these optimal ranges may involve changes in diet or the use of certain drugs, hormones, or nutrients.

The current reference range for fasting glucose is between 65 and 109 mg/dL of blood. Our new hypothesis indicates that optimal glucose levels are between 70 and 85 mg/dL.



The Life Extension Foundation has a track record of being many years ahead of conventional medicine in determining optimal reference ranges. For instance, when we first alerted members to the dangers of high homocysteine levels, standard reference ranges indicated that blood levels of up to 15 mmol/L were acceptable. Blood lab reports now show that higher levels of homocysteine statistically increase the risk of vascular disease. For many years, we advised that both LDL cholesterol and triglyceride levels be kept below 100 mg/dL. Only recently has conventional medicine recommended as "optimal" these very same lower levels for LDL and triglycerides.

While we do not know when conventional medicine will recognize fasting glucose above 85 mg/dL as too high, Life Extension members can request a low-cost blood chemistry test and ascertain their own fasting glucose levels. If fasting glucose is elevated, members can speak with our licensed medical doctors or take the blood-test results to their own physicians to discuss safe ways of bringing blood glucose levels into the optimal range.

Life Extension members can order a Chemistry Panel/CBC (complete blood count) test for just \$35. This test measures glucose, total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides, iron, liver enzymes, and many other important health indicators. To order, call 1-800-208-3444.

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