

Effects of Caffeine and Coffee on Diabetes, Insulin Resistance Syndrome & Hypoglycemia

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Diabetes, particularly Type 2, is a growing health concern. Statistics reveal approximately 18.2 million Americans have diabetes, although only 13 million are currently diagnosed. Rates of diabetes prevalence are rising: 1.3 million new adult cases are diagnosed each year. Diabetes is the sixth leading cause of U.S mortality and is believed to be underreported as a cause of death.¹ Type 1 diabetes is the inability to produce insulin while Type 2 diabetes results from insulin resistance combined with insulin deficiency. Diet is a significant contributing factor to the incidence of Type 2 diabetes as well as to a person's ability to regulate blood sugar levels. Caffeine and coffee can negatively affect blood glucose through both directly raising serum glucose levels as well as causing subsequent hypoglycemia.

Insulin Resistance Syndrome:

In Type 2 diabetes, the body either does not produce sufficient insulin or the tissues do not adequately respond to the released insulin. Related conditions include insulin resistance syndrome, a pre-diabetic condition. In insulin resistance syndrome, glucose levels are higher than normal, yet not high enough to be classified as diabetes. According to the American Diabetes Association, 41 million people in the U.S. between the ages of 40 and 75 are pre-diabetic.

Hypoglycemia:

Hypoglycemia, or low blood sugar, may either be associated with diabetes or be a stand-alone condition. People who suffer from hypoglycemia may not recognize that their mood swings, fatigue, dizziness, forgetfulness and irritability are linked to their low blood sugar. The lowered blood sugar occurs as a result of the over production of insulin in response to excess refined carbohydrate intake, inadequate protein and fat, an impaired stress response and caffeine.

Diabetes and Diet:

Diabetics are prone to developing a number of other health problems and cardiovascular disease is their primary cause of premature death. Fortunately, relatively small improvements in blood glucose, lipid levels and blood pressure can decrease the risk of developing cardiovascular problems.² Coffee drinking can adversely affect a number of risk factors for heart disease and thus, reducing or eliminating coffee intake is advisable for diabetics. Lifestyle health recommendations for diabetics emphasize frequency in eating small meals, taking medications and exercising. An optimal diet should include a variety of whole, unprocessed foods, limited saturated fats and refined carbohydrates, and caffeine-free beverages to help maintain healthy weight.

Recent epidemiological studies suggest that coffee drinking is associated with a reduced risk of developing type II diabetes, but this reduction occurs with significant consumption of 4-6 or more cups of coffee daily. The reason for this correlation and the presence of a cause-and-effect relationship between coffee consumption and diabetes risk is unclear and it is not recommended to increase coffee drinking as a method of preventing diabetes.^{3,4} Other studies clearly demonstrate the negative effects

of caffeine and coffee on blood sugar levels and insulin resistance. Many people with diabetes, insulin resistance syndrome and hypoglycemia will have more success in regulating blood glucose levels without coffee in their diets.^{5,6,7}

Of all the dietary habits that people find difficult to change, coffee drinking is one of the most challenging because it is so entrenched in cultural habits and caffeine addiction.⁸ Withdrawal symptoms can involve painful headaches, nausea, vomiting and loose stools as well as depression, fatigue and anxiety.^{9,10} People whose health problems would be ameliorated if they gave up coffee can improve their chance for successfully quitting coffee if they have both a satisfying alternative and a method to slowly decrease their caffeine intake to reduce withdrawal symptoms.

The following characteristics of coffee have an adverse effect on blood sugar and conditions associated with diabetes:

- **Coffee Elevates Stress Hormones**
 - Caffeine in coffee elevates the stress hormones cortisol, epinephrine (also known as adrenaline) and norepinephrine.^{11,12,13,14} These hormones are responsible for increased heart rate, increased blood pressure, and a sense of “emergency alert”. Circulation of oxygen to the brain and extremities is decreased and the immune system is suppressed. Elevated epinephrine levels can decrease insulin sensitivity.¹⁵
 - The purpose of this “fight or flight” response is to provide the body with a temporary energy boost for intense physical activity. With today’s sedentary lifestyle, the continual state of increased stress resulting from caffeine consumption negatively impacts health. Although research about the effect of stress on diabetes is inconclusive, stress management has been shown to improve blood sugar regulation.¹⁶
- **Caffeine Aggravates Hypoglycemia**
 - Caffeine triggers hypoglycemia through the activation of the sympathetic nervous system and the adrenal glands, causing constriction of blood vessels, decreased circulation to the brain and a feeling of low blood sugar, even if the value is within the low range of normal. This adversely affects mental and physical performance.¹⁷
 - The body’s reaction to hypoglycemia results in food cravings, often of higher fat foods with a lower glycemic index, further increasing the hypoglycemic effect.^{18,19}
- **Caffeine is Related to Insulin Resistance**
 - In order for the tissues to effectively utilize sugar for energy, they must respond to the circulating plasma insulin. Resistance to insulin is a major factor in Type 2 diabetes. Studies suggest that caffeine ingestion contributes to insulin resistance and impairs glucose and insulin homeostasis.^{20,21} Even coffee in moderation has this effect.²²
- **Caffeine Raises Blood Sugar Levels**
 - Studies investigating the effects of caffeine on glucose tolerance suggest that caffeine intake causes a rise in blood glucose levels.²³ Caffeine interferes with the metabolism of glucose and a new study shows that caffeine during and after a meal raises blood sugar levels in Type 2 diabetics.²⁴ In people with diabetes, this creates problems with self-regulation of blood glucose.

- **Coffee Increases Homocysteine and Risk of Diabetic Complications**
 - Increased plasma homocysteine increases a person's risk of suffering from a heart attack. Coffee drinking significantly increases homocysteine in the bloodstream, even more so than caffeine alone. The negative effect of coffee occurs with both caffeinated and decaffeinated coffee, and is noted within hours of coffee consumption.²⁵
 - Both caffeinated and decaffeinated coffee consumption increase homocysteine levels, a plasma-based amino acid, even within hours of coffee consumption.^{26,27,28} For people with diabetes, raised homocysteine levels increase the risk of developing degeneration of the blood vessels in the eyes.^{29,30,31}

- **Coffee Decreases Magnesium Absorption**
 - Coffee drinking is associated with decreased absorption of magnesium resulting in lower blood levels of magnesium.³² Caffeine reduces the reabsorption of calcium and magnesium in the kidney, causing minerals to be excreted in the urine.^{33,34} Magnesium is an essential mineral utilized in more than 300 enzymatic reactions and physiological processes including energy metabolism, effective utilization of glucose, hormonal balance and proper heart function.³⁵
 - Magnesium deficiency is a contributing factor in diabetes and the development of diabetic complications.^{36,37,38} Low levels of magnesium increase the development of insulin resistance and alter the ability of cells to take up glucose.³⁹

- **Coffee Increases Risk of Heart Attack in People with Diabetes**
 - Coffee drinking increases the risk of succumbing to an acute myocardial infarction in people with diabetes.⁴⁰ Diabetes itself is a risk factor in heart disease, and a J-shaped association is suggested for the link between coffee drinking and risk of developing acute coronary disease: the more coffee consumed, the greater the risk.⁴¹

- **Caffeine Interferes with GABA Metabolism**
 - GABA (Gamma-aminobutyric acid) is a neurotransmitter naturally produced in the brain and nervous system that plays an important role in mood and stress management.
 - Caffeine has been found to interfere with binding of GABA to GABA receptors, preventing it from performing its calming function.⁴² In diabetes, all areas of the nervous system are affected and neuropathic pain can be a complication of the disease, particularly in areas where there is a reduction in GABA-ergic influences.⁴³

- **Caffeine Affects Fetal Development**
 - Caffeine has a negative effect on pancreatic cells and fetal development. Continued research is being conducted to explore a link between coffee consumption and childhood diabetes.⁴⁴

Recommendation:

Individuals who suffer from or are susceptible to problems with blood sugar regulation would do well to avoid coffee as it has been demonstrated to be a contributing factor associated with increased insulin resistance, raised blood sugar levels, higher levels of blood cholesterol and lipids, and increased cardiovascular disease risk. Nutrition professionals can support people with problems regulating blood sugar by guiding them through the process of substituting a non-caffeinated, alkaline herbal coffee that brews and tastes just like coffee.

Kicking The Caffeine Habit:

The social prevalence of coffee drinking and the addictive side effects of caffeine can cause problems with patient compliance. Caffeine-free herbal coffee marketed under the brand name of Teeccino[®] helps coffee drinkers replace their regular or decaf coffee with a satisfying alternative. Coffee drinkers need a dark, full-bodied, robust brew to help satisfy their coffee craving. Teeccino satisfies the 4 needs coffee drinkers require in a coffee alternative:

- 1) Teeccino brews just like coffee, allowing coffee drinkers to keep their same brewing ritual.
- 2) It has a delicious, deep roasted flavor that is very coffee-like.
- 3) It wafts an enticing aroma.
- 4) People experience a natural energy boost from nutritious Teeccino.

Teeccino offers the following health benefits to people suffering from upper blood sugar disorders:

<u>Beneficial Features of Teeccino</u>	<u>Teeccino Ingredients:</u> 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56
<ul style="list-style-type: none"> ▪ Inulin fiber from chicory <ul style="list-style-type: none"> • Unlike coffee, Teeccino has nutritional value, including inulin, a soluble fiber that is a nutrient important in maintaining healthy blood sugar levels. • Inulin improves mineral absorption. ▪ 65 mg of Potassium <ul style="list-style-type: none"> • Teeccino is a source of potassium, an electrolyte mineral that is important in the healthy functioning of the heart. • Potassium in liquid form is easily absorbed to help relieve muscle, mental and nervous fatigue. ▪ Alkaline – helps reduce acidity <ul style="list-style-type: none"> • As opposed to acidic coffee, Teeccino is alkaline, which reduces stomach acidity. ▪ Gluten Free <ul style="list-style-type: none"> • Gluten does not extract into boiling water. Tests show Teeccino is gluten free although it contains barley. ▪ Naturally caffeine-free <ul style="list-style-type: none"> • No chemical processing like decaffeinated coffee. 	<ul style="list-style-type: none"> ▪ Carob <ul style="list-style-type: none"> • May be useful in the treatment of diabetes; studies suggest that carob flattens the postprandial serum glucose curve, the rise and drop of blood sugar after a meal. ▪ Barley <ul style="list-style-type: none"> • Demonstrated to have a beneficial effect on lipid metabolism. High blood lipids increases heart attack risk in people with diabetes. ▪ Almond <ul style="list-style-type: none"> • Has a beneficial effect, lowers serum lipid levels. • Does not alter insulin sensitivity, safe for diabetics to consume. ▪ Figs <ul style="list-style-type: none"> • Contain polyphenols, powerful sources of antioxidants. • A good source of potassium. ▪ Dates <ul style="list-style-type: none"> • Contains potassium and magnesium. • Magnesium deficiency has been associated with a variety of conditions including diabetes mellitus. ▪ Chicory root <ul style="list-style-type: none"> • Chicory root reduces glucose absorption from the small intestine.

The Pain-free Way to Wean off of Coffee:

Start by mixing normal coffee 3/4 to 1/4 Teeccino Herbal Coffee. Gradually reduce the percentage of coffee over a two to three week period until only 100% Teeccino Herbal Coffee is brewed. Gradual reduction of caffeine is recommended.¹⁰ Side effects such as headaches, fatigue, and brain foginess can be avoided as the body gradually adjusts to less reliance on stimulants.

Example: Use the following proportions if you make a 10-cup pot of coffee daily:

DAY	Regular Coffee	Teeccino
Day 1-3:	4 tablespoons	1 tablespoon
Day 4-6:	3 tablespoons	2 tablespoons
Day 7-9:	2 tablespoons	3 tablespoons
Day 10:	1 1/2 tablespoons	3 1/2 tablespoons
Day 11:	1 tablespoon	4 tablespoons
Day 12-13:	1/2 tablespoon	4 1/2 tablespoons
Day 14:	0	5 tablespoons

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¹ NIH 2002 statistics.

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