



Strange Biology

PHENOMENA PECULIAR TO DIABETES THAT CAN AFFECT BLOOD SUGAR

The Complete Guide to Achieving Normal Blood Sugars
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Sometimes, even when you think you're doing everything right, your blood sugars may not respond as you expect. Often this will be due to one or more of the biologic curiosities that affect diabetics. The purpose of this chapter is to acquaint you with some real phenomena that can confound your plans, but which you can frequently circumvent if you are aware of them.

GLUCONEOGENESIS, THE DAWN PHENOMENON, AND DELAYED STOMACH-EMPTYING

You may begin to notice as you regularly monitor your blood sugars that your fasting blood glucose on waking in the morning is considerably higher than it was when you went to bed, even though you didn't get up for a midnight snack. There are three common causes for this: gluconeogenesis, the dawn phenomenon, and gastroparesis (delayed stomach-emptying).

Gluconeogenesis

Gluconeogenesis, which we discussed briefly in Chapter 1, is the mechanism by which the liver (and, to a lesser degree, the kidneys and intestines) converts amino acids into glucose. Dietary protein is not the only source of amino acids. The proteins of your muscles and other tissues continually receive amino acids from and return them to the bloodstream. This constant flux ensures that amino acids are always available in the blood for conversion to glucose (gluconeogenesis) by the liver or to protein by the muscles and vital organs. Some diabetics still make adequate insulin to prevent gluconeogenesis. However, once your insulin production drops below a certain level, your liver (and your kidneys and intestines) will inappropriately produce glucose and thus raise your blood sugar even while you're fasting.

In all likelihood, you won't be able to control this phenomenon by diet alone, particularly if you're a type 1 diabetic or a type 2 making far too little insulin to offset your insulin resistance. For type 2s, appropriate weight loss and vigorous exercise may be the most help in improving the sensitivity of the liver to whatever insulin remains. The most reliable treatments will involve medication, either certain oral agents or insulin. If you're obese, however, large doses of insulin can make you more obese and more resistant to insulin. So a major goal should be to bring your weight into line.

The Dawn Phenomenon

As you know, I'm a type 1 diabetic. I no longer make any insulin at all. If I decide to fast for 24 hours—eat absolutely nothing—I will need to inject 3 units of long-acting insulin in the morning to prevent gluconeogenesis for 18 hours. If I check my blood sugar every few hours, it will remain constant, confirming that the insulin is suppressing gluconeogenesis.

If, 18 hours after my first injection—and while still fasting—I inject another 3 units of insulin, common sense would maintain that this second dose should suppress gluconeogenesis overnight.

So I go to sleep and awaken 9–10 hours later. On arising, I check my blood sugar. Instead of being constant, as it was during my waking hours, it's now 20–100 mg/dl higher than it was at bedtime.

If I were to try the same experiment a week later, I'd experience about the same overnight rise in blood sugar. Why?

Although the mechanics of the dawn phenomenon aren't yet entirely clear, research suggests that the liver deactivates more circulating insulin during the early morning hours than at other times of the day. It doesn't matter whether you made the insulin yourself or injected it; the liver has no preference. With inadequate circulating insulin to prevent gluconeogenesis, your blood sugars may be higher in the morning than they were at bedtime.* This isn't a problem for a nondiabetic, because a body with fully functional pancreatic beta cells will just make more insulin.

Investigators have actually measured blood sugar every hour throughout the night under similar circumstances. They find that the entire blood sugar increase occurs about 8–10 hours after bedtime for most people who are so affected. That doesn't mean, however, that you should sleep only 7 hours a night to try to avoid it. Both the time it takes for blood sugar to increase and the amount of the increase vary from one person to another. An increase may be negligible in some and profound in others. This is one of many reasons why any truly workable program for blood sugar normalization must be tailored to the individual.

Though it is more apparent in type 1 diabetics, many type 2 diabetics also show signs of the dawn phenomenon. As you will see, the treatments described in this book take this phenomenon into account.

*Consuming alcohol at bedtime can inhibit gluconeogenesis overnight, but not in a predictable fashion.

Gastroparesis

This condition has a chapter all its own (Chapter 22), and we will discuss it there in detail. However, it's important to mention it in any list of factors that can lead to puzzling blood sugar readings.

Most people who've had long-standing diabetes develop some degree of damage to the nerves that govern the muscles of the stomach and intestines. Gastroparesis diabetorum (the weak or paralyzed stomach of diabetics) is caused by many years of elevated blood sugars. If you're a type 1, or a type 2 who isn't making significant amounts of insulin, it can have unpredictable effects on blood sugar.

Like diabetes itself, gastroparesis can be mild to severe. In extreme cases, people may walk around for days with constipation, belching, midchest burning, and bulging stomachs. Much more common, however, is mild gastroparesis in which physical symptoms are not apparent but blood sugars are erratic.

The big problems with gastroparesis arise if you're taking insulin. If you take your insulin before a meal to cover a rise in blood sugar but the meal remains in your stomach and glucose doesn't enter the bloodstream as predicted, the insulin can take your blood sugar dangerously low. I know three individuals who experienced daily episodes of unconsciousness and seizures from time to time after meals for several years before I met them and diagnosed this condition.

There are, however, ways of controlling blood sugars in spite of the unpredictability of this condition, and these are discussed in Chapter 22, "Delayed Stomach-Emptying."

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