

# Bristlecone Med-fitness

*"Damaging truth, I prefer it to advantageous error. Truth heals the pain which perhaps it evokes." -Goethe*

## "A Metabolic Cinderella Story"

### The Sugar Trap!

I had a unique experience in a local high school this Spring. I was asked to speak to a health class regarding metabolism, the insulin/glucagon axis and nutrition. As part of the presentation, we took fasting glucose levels and body fat %. Much to my surprise, the majority of these high school students had high body fat and high fasting glucose! Many of these kids were the school's top athletes; most of the students *looked* normal. But, the inside view told a different story. *It's the story of a sugar based metabolism!*

Sugar! It has a powerful effect on the metabolism of the body. Most of us know that sugar can pack on the pounds, but few of us really understand the chemistry behind why. After seeing a classroom of 16 & 17 year olds on the verge of pre-diabetic, I decided to dedicate this newsletter to the biochemistry behind sugar digestion. **Sugar has an unique ability to pack on the pounds, raise our fasting glucose level, trap us in a fat storage cycle, and set in motion metabolic disturbances such as insulin resistance and diabetes.**

Nobody is exempt from the damage of sugar; passing years will ultimately reveal the long term consequences. However, it's the invisible, slow drip of sugar, day after day, that does the real metabolic damage. And, unfortunately our children are suffering silently!

### The Krebs Cycle

In science class, we learned of the intricate Krebs Cycle developed in the 1950's by Hans Krebs. In short, it is an interpretation of how the body produces energy, or ATP, at the cellular level within the mitochondria. Krebs proved that all three of the macronutrients, protein, fat and carb could equally produce the raw material needed to create energy within the cell. Previous to this, the common thought was that carbohydrate was the only energy producing macronutrient.

However, it was also noted that when carbs (sugar) are eaten there is immediate glucose in the blood stream; the body will always burn this immediate sugar first! However, in the absence of carb (sugar), (like in fasting or carb restriction) the body will begin to burn the fatty acids from the fat cells for energy!

*Did you get that? If we stop eating carbs, or sugars, long enough, the body will revert to fat burning. And, the reverse is also true, when we give ourselves a constant supply of carbs, the body can't burn the fat!*

**On an elementary level, it's a competition to burn between immediate sugars and stored fat!**

### Free Fatty Acid, Please!

If we go back to my initial example of the high school health class, these athletes are obviously burning a lot of energy, but it's energy that's primarily coming from the constant ingestion of high carb foods, not from fat burning. **Consequently, their body fat will ebb higher and higher as a result of sugar oxidation without fat burning.**

*This is the definition of a sugar based metabolism.*

The body literally craves sugar for immediate energy; the cycle will never stop until we force the body to burn its fat as an energy source. OK, you're asking...how do we do this from a practical stand point? First, we must have a basic understanding of how the fat was trapped in the first place, then we can literally "let it out" to burn.

Free fatty acids are continually passing in & out of the fat cell and into the bloodstream as a potential source of energy. However, there is a powerful molecule, produced when sugar burns, called **glycerol phosphate** that quickly binds these fatty acids up into 3's, forming a triglyceride, and escorts them back into the fat cell for storage.

*And, triglycerides, when stored as fat, are too big to escape the cell membrane.*

# Bristlecone Med-fitness

*"Damaging truth, I prefer it to advantageous error. Truth heals the pain which perhaps it evokes." -Goethe*

## Cinderella...

It's similar to a metabolic version of the "Cinderella Story" with two forces competing to be the object of oxidation! *From where will the fuel flow? Will it be from the sugary step sisters or from the fairest of free fatty acids?* And, don't forget the wicked step mother, glycerol phosphate...she's just waiting to bind up & lock away the fatty acid! **Glycerol phosphate is a molecular bi-product of sugar burning. So, the more we burn sugar for energy, the more glycerol phosphate we produce. And, the more glycerol phosphate, the more fat is stored away!**

But again, once we break our bend toward carbs, glycerol phosphate levels will decline and the fatty acids will be free for the burning! The science of this axis between glucose & fatty acid oxidation is referred to as the Randle Cycle. Basically, it describes the metabolic flexibility of a healthy lean individual...we burn glucose when it is present in the diet, and then, fatty acids when it's not! In a metabolically healthy person, the body will cycle between burning sugar and burning fat to keep blood sugar stabilized.

## Wicked Step Mother

The only way to access stored fat for burning is through fasting, or a dietary reduction of carbs. *So, Cinderella's great escape from the fat cell begins as we break the sugar cycle. The wicked step mother, glycerol phosphate, is only inhibited when there is a dietary reduction in carbs!*

The body must be hormonally trained and disciplined to access its stored fat and burn it as an alternate energy source. The constant ingestion of carbs, even good carbs, and/or the constant snacking throughout the day, keeps our metabolism burning sugar! **There was great wisdom and solid science behind Grandma's advice to not eat between meals.** Unfortunately, our society has moved away from between meal fasting and toward all day snacking! And, the obesity crisis says it all; snackers will store more fat (unless the snacking is carb free!)

Let's go back to our high school athletes, when an athlete can get into the metabolic zone of fat burning, instead of primarily sugar oxidation, he or she will soar to the next level athletically. Fatty acids provide that long term energy source needed for endurance, perseverance and proper muscular development. As the body gets into this "zone" of fat burning, fasting between meals is easy because there is no hunger when the burned fat keeps the blood sugar steady.

## Skeleton Key & Slipper

*In fact, the absence of hunger between meals is the first sign that you're actually burning fat!*

Let's revisit our Cinderella story for a moment, remember the skeleton key used to lock Cinderella away, and the famous glass slipper that ultimately set her free from the wicked step mother?

*The hormone insulin, secreted by the pancreas when we eat carbs, is the skeleton key.* Insulin is the direct hormonal agent of fat storage in response to sugar burning! You might say that insulin, sugar and glycerol phosphate are the Three Musketeers of Fat Storage!

But, let's not forget the glass slipper; during times of fasting, or when blood glucose & insulin levels finally fall, glucagon comes on the scene! Glucagon is the axis hormone to insulin. It is also secreted by the pancreas, and its job is to burn fat for energy!

*Glucagon is the perfectly fitting slipper that sets Cinderella free!* But remember, glucagon will always be suppressed by the sugary step sisters and the wicked step mother waving her skeleton key!

*Find Your Zone of Fat Burn & Live Happily Ever After!!*  
**Kelly & Julie**