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Today's lesson is on riboflavin. Riboflavin is also known as vitamin B2.

I call it the FAT-BURNER.

Why?

Because burning fat requires almost twice as much riboflavin as burning carbs. You use riboflavin to burn anything for energy, and you need all the other energy Bs to burn fat. But none of the other Bs stand out as so clearly related to fat-burning as riboflavin. This doesn't mean that extra riboflavin will help you lose weight. But it *does* mean that when you lose weight you need more riboflavin.

In fact:

- Losing weight increases your need for riboflavin by 60% during the active weight loss.
- Doing 20-50 minutes of cardio six days a week increases your need for riboflavin by 60%.
- Doing BOTH of these together more than DOUBLES your riboflavin requirement!

And what's nuts is that when you're losing weight you're eating less food. So your riboflavin intake goes down, but your riboflavin requirement goes up! 😬

As we will see, though, you don't need to be losing weight to run low in riboflavin. In fact, recent estimates suggest that almost half of adults and over 75% of children run short on it.

Amazing Things Riboflavin Does

Why is this a problem?

Because riboflavin does lots of other amazing things besides burn fat:

- It helps you absorb and utilize iron, which prevents anemia.
- It prevents oxidative stress. Remember this from the last lesson? It's the wear and tear on our tissues that occurs with age. It contributes to a lot of diseases, and a lot of diseases make it happen more. So does exposure to toxins like cigarette smoke and alcohol.
- It keeps the eyes healthy by preventing cataracts.
- It prevents preeclampsia. This is a dangerous condition in pregnancy involving high blood pressure and swelling. About 5% of women with preeclampsia wind up with eclampsia, which causes seizures, hemorrhage, and in the worst cases death.
- It lowers homocysteine, which may protect against heart disease and cancer.
- It supports a process called methylation, which contributes to mental and physical health in many ways that we'll talk about more when we get to folate (vitamin B9).
- It helps keep blood pressure under control.
- It helps you feel energetic and feel good when you exercise.
- In people who suffer from migraines, high doses of riboflavin make the migraines shorter and make them happen less often.

Riboflavin Deficiency

When riboflavin deficiency gets REALLY bad, things really start going haywire, especially in your skin:

- The outer edges of your lips get red and crusty.
- The corners of your mouth crack or fissure.
- Your tongue and all throughout the inside of your mouth gets red, bloody, and swollen.
- The skin gets red, scaly, itchy, greasy, and painful. It's often infected with candida, a nasty fungus. It's worst at the outer edges of the nostrils, the smile lines, ears, eyelids, and genitals.
- Your hands and feet can get unusually sensitive to touch, heat, or pain.

How Much Riboflavin Do We Need?

One way to look at how much riboflavin we need is to look at the RDA. The RDA is the recommended dietary allowance, the official recommendations for how much we need in a day. The RDA is 1.3 milligrams per day (mg/d) for men and 1.1 for women. Women require some extra during pregnancy and lactation, and children are adjusted down for bodyweight.

However, our true needs are probably closer to 2-5 mg/d. For children, I would divide the dose in two and multiply it by every 1000 Calories they eat. As we already covered, dieting and cardio will double the requirement by 60% each. High-fat diets increase the requirement by 20-40% depending on how much fat you eat. Exposure to sunlight and tanning beds increases your needs, but no one knows exactly by how much.

There is a famous gene known as MTHFR. We'll talk about it more when we get to folate, or vitamin B9. I won't tell you what people think that stands for, but I'll drop you a hint.

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That's my bad MTHFR.

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Yo, take my MTHFing nutrition class, MTHFR. 😡 👊

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People who have a variant of this gene known as C677T have double the need for riboflavin.

So we might think of 2 mg/d as the bottom of a good intake, but as we pile on things like weight loss, cardio, high-fat diets, MTHFR, sunlight exposure, and tanning beds, we move toward needing 5 mg/d.

Getting Riboflavin From Food

Food sources come in five tiers.

- Tier 1 gives you 2-5 mg for every 3-4 ounces (oz). These are foods where one serving a day keeps the deficiency away. Tier 1 contains liver. Chicken liver is at the bottom of the tier and pasture-raised lamb liver imported from New Zealand is at the top. But it's just liver in this tier. It's lonely at the top. 😢But someone's gotta be there. 👑
- Tier 2 provides 1-2 mg for every 3-4 oz. These are foods where two servings a day keep the deficiency away. Kidney, heart, and almonds are in this tier.
- Tier 3 provides 0.4-0.5 mg for every 3-4 oz. These are foods where four to five servings a day keep the deficiency away. Red meat, cheese, eggs, salmon, mushrooms, seaweed, sesame, wheat germ and bran are all in this tier.
- Tier 4 provides 0.2-0.4 mg for every 3-4 oz. These are foods where five to ten servings a day are needed. This tier includes most other meats not mentioned in tier 3, and it includes milk.
- Tier 5 is all the foods that are safe to bulk up on *if* they don't come at the expense of top-tier foods. These have little bits of riboflavin (0.1-0.3 mg) that are meaningful in high volumes, but eating them doesn't really help you out unless it's displacing sugar and fat. This tier includes whole grains, nuts, seeds, and vegetables (including beans and other starches).

Enriched flours tend to fall into tier 3 or 4.

A lot of people think nutritional yeast is a good source of riboflavin. It isn't naturally, but many products are enriched with riboflavin, just like refined flours are.

The foods that contain ZERO riboflavin are sugar and fat. These hurt your riboflavin status by displacing foods that have riboflavin.

Let's talk about three dietary patterns!

VEGANS

Vegans have fewer superfoods available. They have almonds in tier 2; mushrooms, seaweed, sesame, and wheat germ/bran in tier 3, but nothing in tier 1. They need to emphasize the vegan tier 2/3 foods, to avoid sugar and fat more strictly, and to bulk up on tier 5 foods.

HIGH-FAT

Burning fat requires more riboflavin, yet fat doesn't have any riboflavin! Since fat takes up room in the diet and displaces foods that contain riboflavin, it's a double-whammy against riboflavin status. The solution? Double-down on the riboflavin superfoods in tiers 1 and 2. Bulk up on the tier 3 foods.

For vegans, the problem is they don't have access to the top foods. But if they avoid sugar and fat, they can bulk up on the tier 4 foods. For high-fat, the problem is they don't have room to bulk up on the tier 4 foods. But they *do* have access to all the superfoods. So, leverage your strengths to make up for your weaknesses. 💪

MINDLESSLY ALL-NATURAL

Doing things the natural way is great, but when you take control of your own nutrition, you take responsibility to learn proper planning. Refined flour is fortified with B2 by edict of the public health authorities. Cut it out and start eating more fat, and your riboflavin status will tank unless you start emphasizing the superfoods.

Other Causes of Deficiency

Riboflavin deficiency isn't all about diet. Here are some other causes of deficiency:

❌ Low stomach acid hurts protein digestion, which is needed to release riboflavin from the proteins in food.

❌ Exposure of YOU to sunlight or tanning beds destroys riboflavin inside of you.

❌ Exposure of your FOOD to light kills riboflavin. For example, putting milk in sunlight for two hours destroys half the riboflavin.

❌ Alcohol hurts your ability to absorb and use riboflavin. Alcoholics often have low intake too.

❌ Low thyroid or adrenal hormones hurt your ability to activate riboflavin and cause you to lose more in your pee.

❌ Poor magnesium status acts just like low thyroid and adrenal hormones.

❌ Intestinal inflammation hurts your ability to absorb riboflavin.

❌ Bad gut bugs may make riboflavin antagonists.

❌ Diabetes, stress, trauma, and kidney dialysis (a treatment for people with poor kidney function) cause you to lose riboflavin in your pee.

❌ As noted earlier, weight loss, cardio, MTFHR genes, and high-fat diets increase your needs.

❌ Diabetes, heart disease, and cancer often provoke or exacerbate a riboflavin deficiency.

❌ Anorexics are at high risk because of low intake.

Riboflavin Supplements

Good news! Like thiamin, riboflavin has no known toxicity! 😀

There are two supplements on the market. Free riboflavin, plain old' normal cheapo riboflavin, is the first form. Riboflavin 5'-phosphate is the other form. It's often called FMN or "activated" or "coenzymated" riboflavin. There is NO EVIDENCE that the second form is EVER better than the first! Why? Because you cannot absorb it until you convert it into the cheap stuff. And if you have intestinal damage, you might not be able to convert it to the cheap stuff, and it might actually be *less effective.*

Although riboflavin is not a "fat-soluble vitamin," it mixes quite a bit with both water and fat. So it's *a little* like vitamin A. It's better absorbed with a meal, and the meal should have some fat. The natural fats in your foods are fine -- no need for gobs and gobs of added fat. Although you can absorb a lot

of riboflavin at once, you will always hold on to the riboflavin and put it to use better if you spread the doses evenly across your meals. So if you take a supplement, the ideal thing is to take it at each meal.

Most people would benefit from a low-dose supplement of 2-5 mg/d on days where they can't meet the requirement from food. You can find liquid supplements that offer these doses, or you can find them in some B complexes and multivitamins.

I don't recommend using high doses unless you have a good reason to. However, there is no evidence that doing so is unsafe. 100 mg per meal would be an example. These are the doses effective against migraines! A number of rare genetic disorders are treatable with high-dose riboflavin. 10 mg per kilogram bodyweight for children, and up to 1500 mg/d in one case. Right now these are all genetic defects in riboflavin absorption or use. But there is a fascinating possibility that high-dose riboflavin can correct other genetic disorders that have nothing to do with riboflavin. Again, I don't recommend using high-dose riboflavin with no specific purpose, but trying it for strange, unexplained health problems just to see if they do anything is a reasonable idea.

Riboflavin supplements will turn your pee neon yellow. 😳This isn't bad. It's riboflavin leaving your body when you couldn't activate it and start using it right away. It doesn't mean your dose was too high. It doesn't mean you're wasting riboflavin. You might need the high dose to ram it into your metabolism by force. 👊

Wrapping Up

So let's wrap up!

- ✔️ Ideally, eat a half ounce to an ounce of liver every day, or 3-8 oz per week; eat a few foods from tier 2 or 3 every day, and minimize sugar.
- ✔️ Vegans avoid sugar *and* fat, and emphasize the tier 2 and 3 foods available to them.
- ✔️ High-fat diets, cardio, weight loss, tanning, and low-MTHFR genes require doubling or tripling down on the superfoods.

✔️ Various disease states, alcoholism, anorexia, and thyroid and adrenal problems are all red flags.

✔️ When foods won't cut it, supplement. Free riboflavin is best, taken with meals and spread out evenly across those meals.

✔️ Low doses of 2-5 mg/d are best for most people, but some people require high doses, especially for migraines (common) and genetic disorders (rare).

Ok, we're done with riboflavin! 😁

I'll see you in class tomorrow for niacin.

Class dismissed,

Chris