Weighing In: February 2013

Cholesterol

Recently, I have been inundated with people asking about their cholesterol and triglycerides. It has become clear that many have a huge misconception when it comes to what their numbers really mean. For example, today I had a lady bring her cholesterol labs that indicated a slight raise from her last reading. She was in tears thinking she was going to die instantly of a heart attack. Unfortunately, this belief comes from outdated information that is still taught in many medical practices. This belief is that high cholesterol has a direct correlation with mortality from heart disease. I've been planning to write at length about this topic for a few months, but I've been hesitant to do so for several reasons:

1. To discuss it properly requires great care and attention (mine and yours, respectively).
2. My own education on this topic only really began about 3 years ago, and I'm still learning from my mentors at a geometric pace.

3. This topic can't be covered in one post, even a Chuck Shaffer who-can't-seem-to-say-anything-under-2,000-word post.

I feel a bit like an imposter writing about lipidology because my mentors on this topic (below) have already addressed this topic so well, I'm not sure I have anything to add.

But here's the thing. I am absolutely, perhaps even pathologically obsessed with lipidology (the science and study of lipids). Furthermore, I'm getting countless questions from you on this topic. Hence, despite my reservations above, I'm going to give this a shot.

A few thoughts before we begin:

1. I'm not even going to attempt to cover this topic entirely in this post, so please hold off on asking questions beyond the scope of this post.
2. Please resist the urge to send me your cholesterol numbers. I get about 30 such requests per day, and I cannot practice medicine over the internet. By all means, share your story with me and others, but understand that I can't really comment other than to say what I pretty much say to everyone: standard cholesterol testing (including vertical auto profile test (VAP) is largely irrelevant and you should have a lipoprotein analysis using Nuclear Magnetic Resonance or NMR spectroscopy (if you don't know what I mean by this, that's ok… you will soon).

This topic bears an upsettingly parallel reality to that of nutrition "science" in that virtually all health care providers have no understanding of it and seem to only reiterate conventional wisdom (e.g., "LDL is bad," "HDL is good"). We'll be blowing the doors off this fallacious logic.

By the end of this series, should you choose to internalize this content (and pick up a few homework assignments along the way), you will understand the field of lipidology and advanced lipid testing better than 95% of physicians in the United States. I am not being hyperbolic.

One last thing before jumping in: Everything I have learned and continue to learn on this topic has been patiently taught to me by the words and writings of my mentors on this subject: Dr. Rob Dums ,Dr. Eric Westman, Dr. Mary Vernon, Dr. Art Roberson, Dr. Peter Attia and our dietitian Tricia Foley.

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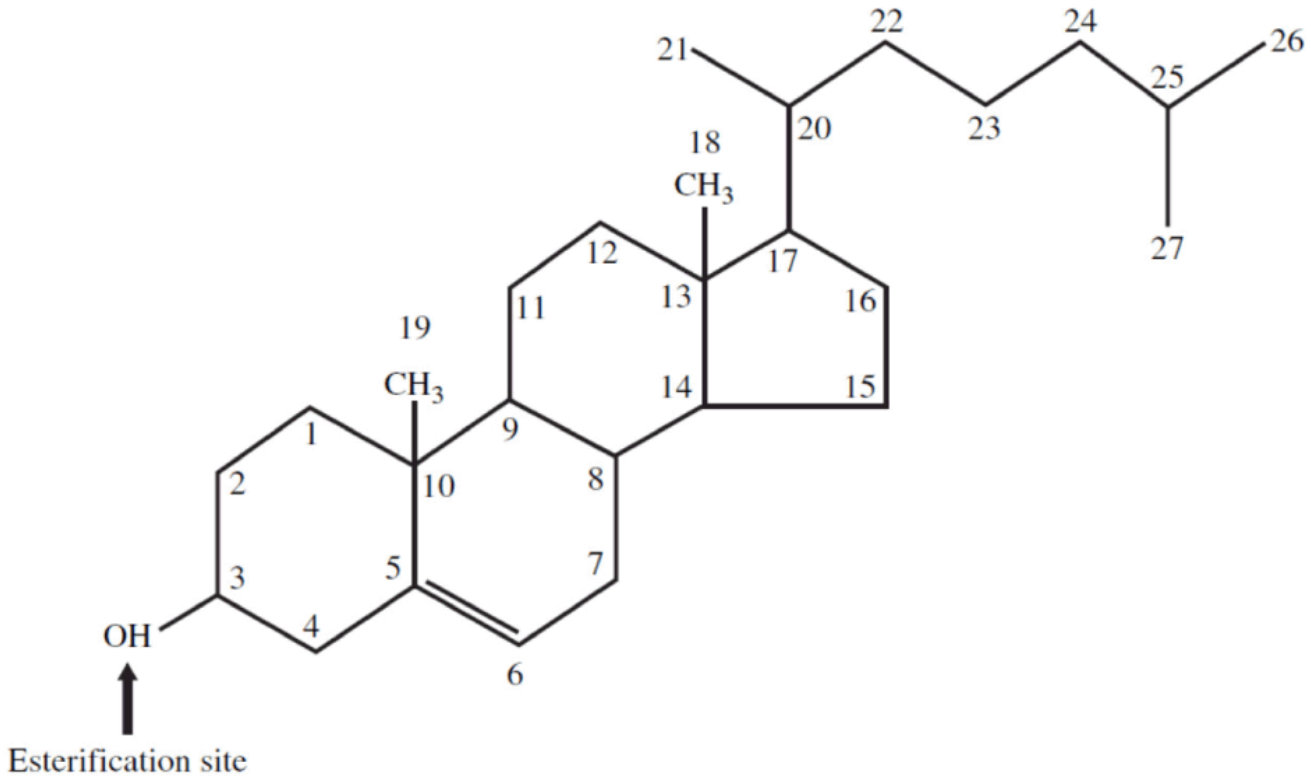
I am eternally in their debt and see it as my duty to pass this information on to everyone interested.
Are you ready to start an exciting journey?
Concept #1 – What is cholesterol?

Cholesterol is just another organic molecule in our body made up of a 27-carbon molecule shown in the figure below. Each line in this figure represents a bond between two carbon atoms. Sorry, I've got to get it out there. That's it. Mystery over.

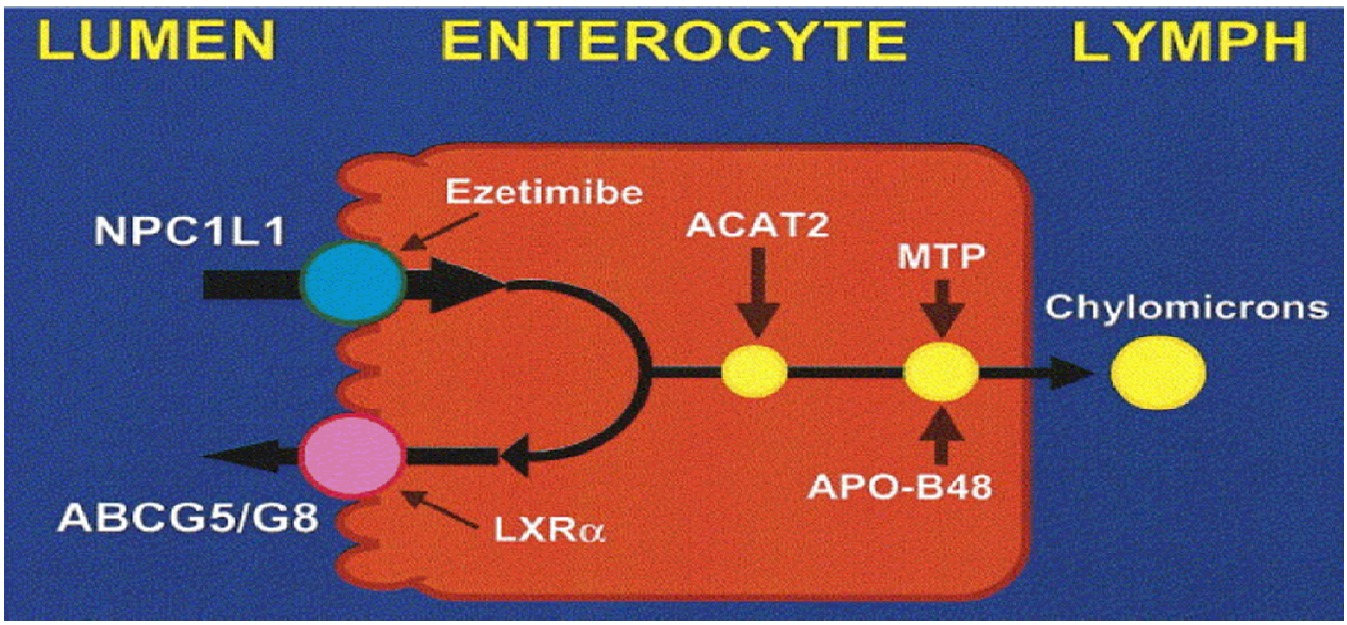


I need to make one important distinction that will be very important later. Cholesterol, a steroid alcohol, can be "free" or "unesterified" ("UC", which stands for unesterified cholesterol) this is the active form. Cholesterol can also exist in an "esterified" or storage form ("CE"). The diagram above shows a free (i.e., UC) molecule of cholesterol. An esterified variant (i.e., CE) would have an "attachment" where the arrow is pointing to the hydroxyl group "OH" on carbon #3, aptly named the "esterification site." Since cholesterol can only be produced by organisms in the Animal Kingdom, it is called a zoosterol. In a subsequent post I will write about a cousin of cholesterol called phytosterol, but at this time I think the introduction would only confuse matters. So, if you have a question about phytosterols, please hang on.
Concept #2 – What is the relationship between the cholesterol we eat and the cholesterol in our body? Cholesterol is in many of the foods we eat but our body also produces ("synthesizes") cholesterol from various precursors. About 25% of our daily "intake" of cholesterol – roughly 300 to 500 mg comes from what we eat (called exogenous cholesterol), the remaining 75% of our cholesterol (roughly 800 to 1,200 mg) is made by our body (called endogenous production).

To put these amounts in context, consider that the body can store about 30 to 40 gm (i.e., 30,000 to 40,000 mg) of cholesterol total and most of this resides within our cell membranes. Every cell in the body can produce cholesterol and thus very few cells actually require a delivery of cholesterol. Cholesterol is needed by all cell membranes and is also used to produce steroid hormones and bile acids.
Of this "made" or "synthesized" cholesterol, our liver synthesizes about 20% of it and the remaining 80% is synthesized by other cells. The synthesis of cholesterol is a complex four-step process (with 37 individual steps) that I will not cover here (though I will revisit). I want to point out how tightly regulated this process is, with multiple feedback loops. In other words, the body works very hard (and very "smart") to ensure cellular cholesterol levels are within a pretty narrow band (the overall process is called cholesterol homeostasis). Excess cellular cholesterol will crystalize and cause cellular apoptosis (programmed cell death).

Plasma cholesterol levels (which is what clinicians measure with standard cholesterol tests) **often have little to do with cellular cholesterol, especially artery cholesterol, which is what we really care about**. For example, when the cholesterol we eat is decreased, the body will make more cholesterol and/or absorb (i.e., recycle) more cholesterol from our gut. This regulation is quite amazing so I want to spend a bit of time discussing it.
In medical school, whenever we had to study physiology or pathology I always had a tendency to want to anthropomorphize everything. It's just how my brain works and understanding cholesterol absorption is a great example of this sort of thinking. The figure below shows a cross-section of a cell in our small intestine (our "gut") called an enterocyte that governs how stuff in our gut actually gets absorbed. The left side with the fuzzy border is the side facing the "lumen" (the inside of the intestinal "tube" that makes up our gut). You'll notice two circles on that side of the cell, a blue one and a pink one.

[What follows is a bit more technical than I would have liked, but I think it's very important to understand how this process of cholesterol absorption works. It's certainly worth reading this a few times to make sure it sinks in.]



- The blue circle represents something called a NPC1L1 protein. It sits at the top surface of gut cells and promotes active influx (bringing in) of unesterified (active) cholesterol, (UC) as well as unesterified phytosterols into the cell. Think of NPC1L1 as the ticket-taker at the door of the bar (where the cell is the "bar"); he lets most cholesterol ("people") in. However, NPC1L1 cannot distinguish between cholesterol ("good people") and phytosterol ("bad people" – I will discuss these guys later, so no need to worry about it now) or even too much cholesterol ("too many people"). [I can't take any credit for this anthropomorphization – this is how Dr Eric Westman explained it to me!]

The pink circle represents ATP-binding protein transporters called ABCG5 and ABCG8. This complex promotes active efflux (i.e., kicking out) of unesterified sterols (cholesterol and plant sterols, of which over 40 exist) from the cells in the gut back into the intestine for excretion. Think of ABCG5 and G8 as the bouncers at the bar; they get rid of the really bad people (phytosterols as they serve no purpose in humans) who snuck past the ticket-taker (NPC1L1). Of course in cases of hyperabsorption (where the gut absorbs too much of a good thing) they can also efflux out un-needed cholesterol. Along with this analogy, once too many "good people" get in the bar, fire laws are violated and some have to go. The cell has "sterol-excess sensors" (a nuclear transcription factor called LXR) that do the monitoring and these sensors activate the genes that regulate NPC1L1 and ABCG5,G8).

There is another nuance to this, which is where the CE versus UC distinction comes in:

- Only free or unesterified cholesterol (UC) can be absorbed through gut cells (enterocytes). In other words, cholesterol esters (CE) cannot be absorbed because of the bulky side chains they carry.
- Much (> 50%) of the cholesterol we ingest from food is esterified (CE), hence we don't actually absorb much, if any, exogenous cholesterol (cholesterol in food). CE can be de-esterified by pancreatic lipases and esterolases (enzymes) that break off the side branches and convert CE back to UC. This means that it is possible for some ingested CE to be converted to UC but not much.
- Furthermore, most of the free, UC in our gut (about 85%) is actually of endogenous origin (meaning it was made in our cells and returned to the liver). These end up in the gut through biliary secretion and ultimately get re-absorbed by the gut cells (enterocytes). The liver is only able to send out UC via bile into the gut but not CE. The Liver CE cannot be excreted into bile. So, if the liver is going to excrete CE into bile and ultimately the gut, it needs to de-esterify it using enzymes called cholesterol esterolases which can convert liver CE to UC.

The number one way for the liver to rid itself of cholesterol is to convert the cholesterol into a bile acid and excrete the bile acids in the stool (typically most bile acids are reabsorbed at the ileum (small intestine)).

Concept #3 – Is cholesterol bad? One of the biggest misconceptions out there (maybe second only to the idea that eating fat makes you fat) is that cholesterol is "bad." This could not be further from the truth. Cholesterol is very good! In fact, there are (fortunately rare) genetic disorders in which people cannot properly synthesize cholesterol. One such disease is Smith-Lemli-Opitz syndrome (also called "SLOS," or 7-dehydrocholesterol reductase deficiency) which is a metabolic and congenital disorder leading to a number of problems including autism, mental retardation, lack of muscle, and many others.

Cholesterol is absolutely vital for our existence. Let me repeat: Cholesterol is absolutely vital for our existence. Every cell in our body is surrounded by a membrane. These membranes are largely responsible for fluidity and permeability, which essentially control how a cell moves, how it interacts with other cells, and how it transports "important" things in and out. Cholesterol is one of the main building blocks used to make cell membranes (in particular, the ever-important "lipid bilayer" of the cell membrane).

Beyond cholesterol's role in allowing cells to even exist, it also serves an important role in the synthesis of vitamins and steroid hormones, including sex hormones and bile acids. Make sure you take a look at the picture of steroid hormones synthesis and compare it to that of cholesterol (above). If this comparison doesn't convince you of the vital importance of cholesterol, nothing I say will.

One of the unfortunate results of the eternal need to simplify everything is that we (i.e., the medical establishment) have done the public a disservice by failing to communicate that there is no such thing as "bad" cholesterol or "good" cholesterol. All cholesterol is good!

The only "bad" outcome is when cholesterol ends up inside of the wall of an artery, most famously the inside of a coronary artery or a carotid artery, AND leads to an inflammatory cascade which results in the obstruction of that artery (make sure you check out the pictures in the links, above). When one measures cholesterol in the blood we really do not know the final destination of those cholesterol molecules!

And that's where we'll pick it up next time – how does "good" cholesterol end up in places it doesn't belong and cause "bad" problems?

To summarize this somewhat complex issue

1. Cholesterol is "just" another fancy organic molecule in our body, but with an interesting distinction: we eat it, we make it, we store it, and we excrete it – all in different amounts.
2. The pool of cholesterol in our body is essential for life. No cholesterol = no life.
3. Cholesterol exists in 2 forms, UC and CE. These forms determines if we can absorb it or not, or store it or not (among other things).
4. Most of the cholesterol we eat is not absorbed and is excreted by our gut (i.e., leaves our body in stool). The reason is it that it needs to be de-esterified, but it also competes for absorption with the vastly larger amounts of UC supplied by the biliary route.
5. Re-absorption of the cholesterol we synthesize in our body is the dominant source of the cholesterol in our body. That is, most of the cholesterol in our body was made by our body.
6. The process of regulating cholesterol is very complex and multifaceted with multiple layers of control. I've only touched on the absorption side, but the synthesis side is also complex and highly regulated. You will discover that synthesis and absorption are very interrelated.
7. Eating cholesterol has very little impact on the cholesterol levels in your body. This is a fact, not my opinion. Anyone who tells you different is, at best, ignorant of this topic. At worst, they are a deliberate charlatan. Years ago the Canadian Guidelines removed the limitation of dietary cholesterol. The rest of the world, especially the United States, needs to catch up.

Thanks for listening...Chuck Shaffer MD

Chicken w/ Cilantro Lime Sauce Recipe

Ingredients:

- 4 boneless, skinless chicken breast halves
- ½ Tsp paprika
- Salt and pepper to taste
- 2 tbsp olive oil
- 2 C cilantro leaves
- 1 tbsp fresh lime juice
- 1 tbsp white wine vinegar
- ½ tsp Stevia
- 1 C peppers and onions combined
- 1 tsp turmeric

Methods:

Sprinkle chicken with paprika, salt and pepper. In a large pan, heat 1 tbsp oil over medium heat and cook chicken until brown throughout. In a blender, combine 1 tbsp oil, cilantro, ginger, lime juice, vinegar and stevia plus 2 tbsp of water. Blend until smooth, set aside. Add onion and pepper mix to chicken with turmeric spice. Cook until tender. Top chicken with sauce.

Exercise and The Weigh Station:

One of the most common questions we hear from new patients is “Should I exercise?” Our response is that we do not recommend exercise the first week of the program due to a drastic change in diet and the time it takes for your body to adapt but after the first week, exercise is okay. Unfortunately, many only hear the first part of the answer, no exercise. This is not at all what we had in mind. Exercise has many benefits. Regardless of your ability level, we believe that you can and should partake in some form of activity once you are in the second stage of our program. The key is to not overdo it! Of course we wouldn’t suggest running marathons or spending hours at the gym, but you don’t want to be so sore the next day that you can’t even walk much less workout! Walking and small group fitness classes like the ones we have available at Body Fit are perfect. Body Fit offers tons of class options like Zumba, Pilates mix, Cardio and Healthy Backs to name a few. These classes are designed with our patients in mind. The atmosphere is non-intimidating and you should feel at ease as soon as you enter the door. If you have never exercised before have no fear. Our instructors are there to help you through each class and can tailor the exercises to your fitness ability. If you have limitations they can also help you work around them and give alternative exercises to try. Our goal is not to make you sore or uncomfortable, the old motto “no pain no gain” is not one used in our studio. We thrive on building confidence and overtime we know you will also achieve better weight loss results and a stronger body and self image. Check out the Body Fit schedule on the website or ask our staff at your next visit!

Cooking Classes

Cooking classes are held once a month at the Weigh Station in Christiansburg. Classes are $10.00 and include lunch. Can’t make it? Not a problem, all our classes are filmed. Simply visit our website: www.weighstation.net and click on the red youtube icon at the top right of the page. If you need the recipes to the video’s they can be found by clicking the orange icon next to the youtube icon. Check them out today!

Oh My, How Did That Happen?

Many on the program do great the first several months but eventually come across "oh my" moments when they did not lose weight because of some small changes in what they are eating or other reasons. Here is a list of some common reasons and explanations. I also have included some ways to help when losing becomes more difficult. Starting out doing these and continuing to do them will help greatly in preventing issues. So here are some sneaky ways that food and drink and exercise may work against you. The most common issue is eating "low-fat." Fat-free or low-fat usually means low taste and for most companies that means low profit. Typically, they make up for this lack of taste by adding in carbs in the form of sugar. This means a sugar rush and then rebound hunger fairly quickly. Sometimes the carbs are not obvious and are present even in low-carb foods. One product brought in to me says it has 15 grams of carbohydrates per serving but only 1 gram of sugar. But, is it really low carb? Since that leaves 14 grams of carbs, I had to look further and found it had 1 gram of fiber (which is a safe carb). What happened to the other 13?!?!?! They are there but no documentation of what they are. These are usually carbs that your body will break down into sugars but are not required by the FDA to be reported as sugars. Thus, they make you store body fat and keep you from losing. Small amounts of fat can help you feel full faster and thus, help you eat less. I do not advocate all fat or high fat meals by any means but our bodies need some fat and fatty acids to survive and thrive. So be sensible and watch for hidden carbs and know it is ok to eat healthy fats.

We also see poor sleeping habits commonly. This is especially true around the holidays. Lack of sleep has proven to be a cause of weight gain and lack of weight loss in many studies. Research at Wake Forest University showed that people who spend 5 hours or less in sleep put on 2.5 times more belly fat than those who sleep 6-7 hours per night. Strangely, those who sleep more than 8 hours also gain about 2 times as much fat. So get adequate sleep but don't sleep too much. Like many things in life, more is not necessarily better.

Another common issue is drinking soda. Many people have had diet sodas while at parties over the holidays because that was the safest liquid there to drink. I think that is ok if water is not available and is much better than regular soda or just about all other choices. Water should be the drink of choice and should always be available. However, if it is not, your diet soda choice can have consequences as well. Research in San Antonio, The SALSA studies reported that people who drank two or more sodas a day watched their waistlines increase five times faster. This is because most diet sodas have aspartame which can trigger hunger and appetite increases and make you unconsciously eat more at meals later in the day or even the next few days. Newer research shows that our bodies have sweet sensors that trigger hunger even from artificial sweeteners such as sucralose and saccharin. For most people these sweeteners will make it difficult to stick with a weight loss plan. Natural non-sugar sweeteners like Stevia seem to be exceptions to this rule and do not trigger increased hunger.

We also see people who eat too quickly. I am very guilty of this one. My wife is always telling me to slow down when I eat and, as usual, she is right. She can even point to research to back it up. We are all busy and during the holidays, it becomes even busier. After this season, it is hard to slow down. However, not slowing down can have consequences for our weight. Remember, it takes 20 minutes for your stomach to tell your brain that it is full and does not need any more food. A study in the Journal of the American Dietetic Association found that slow eaters took in 66 fewer calories per meal, but compared to their fast-eating peers, they felt like they had eaten more. How much is 66 calories per meal? It is 1,386 calories per week or over 72,000 calories per year (20.5 lbs of fat per year). Yikes!! Combine that with not measuring portion sizes and this can be a major source of lack of weight loss.

Stop skipping meals. Why is this a problem? Skipping meals actually increases your odds of gaining weight especially when you skip breakfast. Skipping meals slows your metabolism and makes you hungrier the rest of the day and puts your body into prime fat-storage mode and increases the likelihood you will overeat at the next meal which means more weight gain or lack of weight loss.

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We also see lack of exercise frequently. When you exercise you help your body lose more weight by shifting calories away from storage form (fat) and into usable forms. This helps fat loss. It is not necessarily burning more calories but it is keeping calories from being stored. Exercise also helps you decrease your stress which improves the chances that you will not eat due to emotional cues. This helps weight loss occur and stops “mindless eating” that can sabotage your efforts.

Lack of water also contributes to a weight plateau. Adequate water intake is essential for your body's functions and the more you get close to the one gallon of requested water intake, the more likely you will lose weight and stay thin. Studies show that drinking enough water can increase your weight loss by 30% more than those who do not drink enough water. So do not let that water decrease at all.

We also see people who stop using physical cues that were helping before. This is a little more complex but basically seeing your body weight decrease on a weekly basis helps reinforce weight loss. So does weighing your protein portions and measuring the vegetable and fruit portions. The act of doing all these reinforces proper nutrition, proper intake of vitamins and minerals, and gives proper feedback in weight loss. Because many people skip coming in during the holidays, it is harder to start back on their own as they get out of many of the good habits of measuring water, food, exercise, and weight status that they did while losing.

So, how do you change the less than good habits back to good habits? If it were easy, we would just wake up and make a change. Some can do that and I congratulate those of you who can. For most, like me, it takes help and accountability. Here are a few hints—taken from advice I cherish. First, know that you are not alone. Many people struggle with good habits. So it is ok to ask for help. Second, make goals and deadlines. Make them weekly or monthly and make them obtainable. For example, I want to lose 3 pounds this week. Or, I want to lose 8 pounds this month. If you do, it is ok to reward yourself (just not with food). If you do not make the goal, go back and look at what you can change to make it happen (and ask for help). Third, be honest with yourself. One of the most common things we run into is that people feel they have to be perfect with habits to make them effective. I'll admit that the Weight Station program reinforces this because the better you stick with it, the better you lose. It is also not a reason to allow yourself to deviate. Make it a challenge and every day that you succeed will make the next day easier and make it a more permanent lifestyle change. You aren't just good at something, you have to practice and that will make perfect. Fourth, spend time with like-minded people. In other words, be careful of people who will distract you from your goals. It is better to be around people who will support your efforts to change the way you eat, drink water, and exercise than around folks who tell you “a little bit won't hurt you.” It may mean a firm conversation with a spouse, friend, or parent but it is important that it be done for your health. Fifth, keep track of what you are doing. Measure your water, measure the vegetables and fruits, weigh your protein, you’re your exercise. Without care in measuring, more food can sneak in or not be adequate enough for weight loss goals without realizing it. Sixth, just so you hear it again, please ask for help. We will help you here.

Dr. Dums