Cholesterol Control *by Diet*

In August 2007, after returning from a 10-day Mediterranean cruise, I had my annual physical—the results were not encouraging. For many years my total cholesterol ranged from 260 to 330 with an LDL of about 100 less; in 2007 total was 361 (ideal <200) and LDL was 255 (ideal <100)—I had to start taking better care of myself. My doctor again suggested drug control, but my philosophy was that "if my body produced that much cholesterol, then I probably needed it—I was right—and wrong. As my research has shown, the body does control cholesterol, up to a point, but I'm getting ahead of myself.

In 1996 I started using a DOS program to keep accurate account of everything I ate—I still use it daily. The program is called "Food Analysis, the complete nutritional analysis software" and it contains the entire USDA food composition database. Back in the 90's I used it to keep track of my calories and a few other nutrients. I enter the *date* and my *meals* (breakfast or lunch or dinner or snack), which consists of *recipes* that are built from the USDA database of about 6,000 foods. After 12 years of data collection I have created over three hundred recipes that I use to keep track of my daily meals. I preplan all of my meals and accurately measure all of the foods I eat, usually to the gram.

The study was to determine how body and diet controlled cholesterol. It took 10 months, about 1,500 hours of planning, preparation, measuring and analysis, at a cost of about $2,000 in equipment and supplies. Throughout this study I planned every meal, every day and accurately measure all of the foods I ate. Out of the 85 available nutritional assessments I only needed to keep track of six; they are alphabetically (with abbreviations): grams alcohol (gm AL), milligrams cholesterol (mg diet-CHOL), grams of monounsaturated fat (gm MonoFat), milligrams phytosterols (mg PhytoS), grams saturated fat (gm SatFat), and grams soluble fiber (gm SolFib). I also used a "CardioCheck" meter to measure total blood cholesterol (blood-CHOL). My blood samples were collected with a 15 micro-liter glass pipette and plunger, following the instructions for an accurate draw.

When embarking on the study I looked up "cholesterol" articles on the Internet and on the SUNY @ Buffalo on-line library, getting some useful insight into what affected blood-CHOL. The first four months I measured blood-CHOL *weekly*, plotting blood-CHOL, diet-CHOL, SatFat and SolFib, trying to see patterns, which I did. Blood CHOL of course rose with increased SatFat and diet-CHOL and fell with increased SolFib, but I needed to better *quantify* the effect of each on blood-CHOL. In the final analysis it seems that: 10 grams of SolFib decreases blood-CHOL by 30 points; 10 grams of SatFat increases blood-chol by 6 points; and, 100 mg of diet-CHOL increases blood-CHOL by 3 points.

In months six through ten, I measured my blood-CHOL *daily*, taking two successive measurements and averaging them. If the two measurements were more than 10 points apart, I took a third measurement and averaged the three—lots of finger pain. I plotted the average blood-CHOL against planned increases and decreases in diet-CHOL, SatFat and SolFib, holding two constant and increasing and decreasing the third to see how much it affected blood-CHOL—the results were informative, but not consistent. At month six my wife Cindy (a registered dietitian) suggested that I also consider the affects of monounsaturated fats and phytosterols. I looked up monounsaturated fat and phytosterols on the Internet and on-line library to see what *useful* research had been done—not much I was sad to see. Since my computerized diary can assess MonoFats and PhytoS at any point in time for the last 12 years I simply determined and plotted their daily values along with diet-CHOL, SatFat, SolFib and blood-CHOL. I held diet-CHOL, SatFat, SolFib and MonoFat constant and varied dietary PhytoS to see its effect on blood-CHOL. I did the same with MonoFats to see its effect on blood-CHOL. The results were that PhytoS had the same but opposite effect as diet-CHOL, 100 mg of PhytoS *decreased* blood-CHOL by 3 points. MonoFats had one-tenth and the opposite effect of SatFat; 10 grams of MonoFats *decreased* blood-CHOL by 0.6 points (as compared to increasing it 6 points with 10 gm of SatFat).

There were also some interesting findings relating to metabolism timing. Diet-CHOL, SatFat, SolFib, and PhytoS effected blood-CHOL *three* days later; for example, their consumption on Monday affected the blood-CHOL reading on Thursday. MonoFats seems to have a two-day metabolism; for example, their consumption on Monday affected the blood-CHOL reading on Wednesday. Thus, we can predict the effect of diet on blood-CHOL using that timing and the following equation:

Blood-CHOL ***change*** = 0.6x(gm SatFat) + 0.03x(mg diet-CHOL) – 3x(gm SolFib) – 0.03x(mg PhytoS) – 0.06x(mg MonoFat)

Example: for 20 gm SatFat, 300 mg of diet-CHOL, 20 gm SolFib, 100 mg PhytoS and 30 gm MonoFat

Blood-CHOL ***change*** = 0.6x(20 g) + 0.03x(300 mg) – 3x(20 gm) – 0.03x(100 mg) – 0.06x(30 gm) = **44 point decrease**

Another way of writing this formula shows the *relationship* between the five nutrients:

Blood-CHOL ***change*** = 0.3x{2x(gm SatFat) + 0.1x(mg diet-CHOL) – 10x(gm SolFib) – 0.1x(mg PhytoS) – 0.2x(mg MonoFat)}

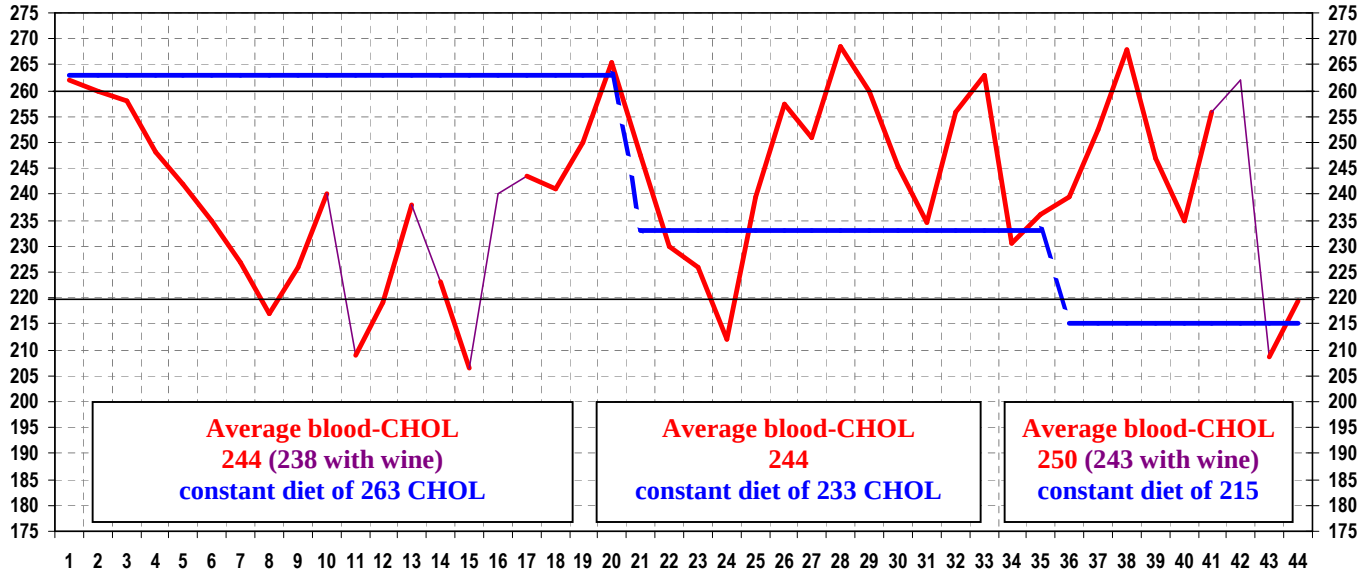
There is also a *constant* factor for the above equation; for me it's 300. Thus, for the above equation to calculate my *actual* blood cholesterol, not just increases and decreases; I would add 300, giving a *calculated* blood-CHOL here of 256. For those with low total cholesterol the constant might be 200 or 150 or whatever. For those with very high total cholesterol the constant might be 350 or 400 or whatever.

Thus it seems, that a prudent diet can decrease blood-CHOL significantly. My high-soluble-fiber diet is set to decrease my blood-CHOL by an average of about 55 points daily, giving me an average total blood-CHOL of about 245 and an LDL of about 145 (which were verified by lab blood tests at my annual physicals). The values are still a little high, but both are about 115 points lower than they were before I began this study. You too can choose to decrease your blood-CHOL significantly as long as you are not on cholesterol-reducing drugs with their side effects, which seems to negate control by diet.

There is more to the cholesterol story than just the mathematical relationship of saturated fats, diet cholesterol, soluble fiber, phytosterols and monounsaturated fats noted above. Besides *dietary* control there's *body* control—your body actually has upper and lower limits of cholesterol control. For example, when my blood-CHOL drops below 220, my body starts producing cholesterol at a much higher rate; this shuts off when my blood cholesterol reaches 260. Once above 260, blood-CHOL varies as predicted by the above equation. My range is 220 to 260, but your body's range might be 120 to 160 if you have low cholesterol readings or it may be 300 to 340 if you have very high cholesterol readings; it's whatever your range happens to be. Because of this body control of blood-CHOL, you are limited in the degree to which you can control blood-CHOL by diet alone. There is though, something that helps lower blood-CHOL—the *prudent* use of alcohol, especially red wine. If you have one-half to five alcoholic drinks tonight it can lower *tomorrow's* blood alcohol by as much as 30 points, but, you cannot have alcohol again for another three days. If you drink alcohol again after only one or two days there is a reverse effect, increasing blood-CHOL. I did an interesting 44-day study to verify my 220 to 260 cholesterol range and the effect of alcohol on it—see the graph below. As shown by the blue line, I set my diet at a constant calculated 263 for 20 days, then at 233 for 15 days and then at 215 for 9 days; this isn't difficult to do if you eat the same exact meals each day—but it certainly is boring.

As the graph shows, when the *calculated* (using the above formula and 300) blood cholesterol is 263, my body uses up about 6/day until total blood-CHOL drops below 220 (by day-8) when my body rapidly increases it by 12/day for two days. On day-10 I had alcohol, which dropped it 33 points on day-11. Three days later on day 13, I had alcohol, which dropped it 15 points on day 14 (no AL) and another 18 points on day-15. On day-15 when my blood-CHOL was at 207, I had alcohol, but my body control increased blood-CHOL 33 points on day-16. I had alcohol on day-16, but body control still increased it by another 3 points, although it dropped 2 points by day-17, but increased 10 points by day-18 and finally increased 15 points by day-20 taking it over 260. Once over 260 my body control shut off and blood-CHOL dropped 18 points by day-21 and another 30 points by day-24, making it under 220 (the rapid decrease to 207 was probably due to a calculated dietary drop from 263 to 233). Now we have an interesting phenomenon. Due to body control, blood-CHOL quickly rose 57 points from day-24 to day-28,

Dr. Dean C. Bellavia: Range of Blood-CHOL,
for Constant Diets of 263, 233 & 215 CHOL



with body control shutting off above 260 on day-28. But, due to a low dietary CHOL of 233, the body control wouldn't allow it to drop below 235; this was also the case when the dietary CHOL was set at 215. It seems that if the body is constantly deprived of enough diet-CHOL and SatFat that the body control wouldn't allow it to drop below 235, indicating that setting our calculated CHOL (diet controlled CHOL) too low has a reverse affect. I have found that if I set my calculated CHOL between 230 and 280 that with alcohol every three days or so, I can keep my *average* blood-CHOL around 245, ranging anywhere from 200 to 300. It is interesting to note that having alcohol on day-41 (with blood-CHOL below 260) had no reducing effect, but once blood-CHOL was over 260 on day-42, having alcohol dropped it 53 points by day-43; probably due to the body using up much of its diet-CHOL and SatFat since getting too little from a 215 diet. On day-43, being below 220 it started rising again on day-44.

These numbers are based on my body, which is naturally high in cholesterol (my constant is 300), but health-wise my numbers aren't that far off, and my total-CHOL/HDL ratio is very good at 3.5 (ideal <4.0), making my high numbers less of a threat. Notwithstanding, too much blood cholesterol is not healthy and the more we can *naturally* reduce it the better off we are. With that in mind I have worked out a chart of common foods and the degree to which they increase or decrease your total blood cholesterol for whatever *your* constant is (probably less than 300), for *your* body's range of cholesterol. Wise use of this chart can help you to reduce your cholesterol significantly, but like all things of significance it takes "way of life" changes and habits to work—your health is not a fad, your diet shouldn't be either.

To use the table below to evaluate your daily meals, or better yet *to plan healthy meals*, just look up the foods you are having today and add them up to see if they are increasing or decreasing your blood cholesterol. For example, if you have 2 portions of "All-Brand and 2% milk" (-10.0) for breakfast, a "Taco Salad" (-2.7) for lunch, 2 portions of "Atlantic Salmon" (+3.6), 2 portions of green beans (-7.4) and 2 portions of potatoes (-1.2) for dinner, and one portion of "Dry-Roasted Almonds (-4.7) for a snack you will *reduce* your blood cholesterol by about 22 points. If instead of salmon and almonds you had 2 portions of "Rib Eye" (+9.0) and one cup of "Regular Ice Cream" (+7.0) you will only *reduce* it by 5 points. Not all foods are included, but there is enough to evaluate your diet's effect on your blood cholesterol. The fact is, daily use of psyllium* (soluble fiber) is the **key** to lowering blood cholesterol.

How Much Foods *Decrease* or *Increase* Blood Cholesterol Daily

FOOD (Single Serving Size)	Blood CHOL DECREASE or INCREASE	Soluble Fiber	Phyto-sterols	Monoun-saturated Fat	Saturated Fat	*Diet* Choles-terol
Psyllium* (1 TSP)	-9.3	3.0	0	0.0	0.0	0
Hot Cereal, McCann's Irish Oatmeal (1/2 C dry)	-12.5	4.0	0	2.2	0.0	0
Hot Cereal, Regular Oatmeal (1/2 C dry)	-1.8	0.7	0	0.9	0.5	0
Cereal, "All Bran" (1 oz) with 5 oz, Skim milk	-6.0	2.0	0	0.0	0.3	0
Cereal, "All Bran" (1 oz) with 5 oz, 2% milk	-5.0	2.0	0	0.8	2.0	0
Cereal, "Raisin Bran" (1 oz) with 5 oz, Skim milk	-1.4	0.5	0	0.0	0.3	0
Cereal, "Raisin Bran" (1 oz) with 5 oz, 2% milk	-0.4	0.5	0	0.8	2.0	0
Wheaties (1 oz) with 5 oz, Skim milk	-1.5	0.5	0	0.1	0.1	0
Wheaties (1 oz) with 5 oz, 2% milk	-0.5	0.5	0	0.9	1.8	0
Cheerios (1 oz) with 5 oz, Skim milk	-1.1	0.4	0	0.6	0.3	0
Cheerios (1 oz) with 5 oz, 2% milk	-0.1	0.4	0	1.4	2.0	0
"Nature Valley, Granola" (1 oz) with 5 oz, Skim milk	-0.6	0.9	0	0.7	3.6	0
"Nature Valley, Granola" (1 oz) with 5 oz, 2% milk	0.4	0.9	0	1.5	5.3	0
Corn Flakes (1 oz) with 5 oz, Skim milk	-0.3	0.1	0	0.0	0.0	0
Corn Flakes (1 oz) with 5 oz, 2% milk	0.7	0.1	0	0.8	1.7	0
Rice Krispies (1 oz) with 5 oz, Skim milk	-0.3	0.1	0	0.0	0.0	0
Rice Krispies (1 oz) with 5 oz, 2% milk	0.7	0.1	0	0.8	1.7	0
Blackberries (1 cup, 144 g)	-20.2	6.5	0	0.0	0.0	0
Raspberries (1 Cup, 123 g)	-11.4	3.7	0	0.2	0.0	0
Prunes Dried/Stewed (1 Cup, 161 g)	-10.2	3.3	0	0.6	0.1	0
Greek Olives (100 g)	-9.3	3.8	0	0.0	3.9	0
Pears (1 Cup, 165 g)	-7.5	2.3	13	0.0	0.0	0
Blueberries (1 cup, 145 g)	-5.9	1.9	0	0.0	0.0	0
Raisins (1 cup, 145 g)	-5.6	1.9	0	0.03	.22	0
Apricots, Dehydrated (1/2 cup, 60 g)	-5.6	1.8	0	0.1	0.0	0
Apple with skin (1 fruit, 140 g)	-3.9	1.1	17	0.0	0.1	0
Peaches (1 Cup, 170 g)	-3.9	1.1	17	0.0	0.0	0
Mango (1 Cup of slices, 165 g)	-3.4	1.1	0	0.2	0.1	0
Plum (1 Cup, 165 g)	-3.4	1.0	12	0.8	0.1	0
Honeydew Melon (1 Cup, 170 g)	-3.2	1.0	0	0.0	0.0	0
Blackberry Jam (1 TBSP)	-3.1	1.0	0	0.0	0.1	0
Kiwifruit (1 fruit, 91 g)	-3.1	1.0	0	0.0	0.1	0
Strawberries (1 cup, 150 g)	-3.0	0.8	18	0.0	0.0	0
Pineapple (1 cup, 155 g)	-2.9	0.8	9	0.1	0.1	0
Banana (1 fruit, 115 g)	-2.3	0.6	18	0.0	0.2	0
Cantaloupe Melon (1 Cup, 160 g)	-2.3	0.6	16	0.0	0.1	0
Grapes (1 Cup, 92 g)	-2.1	0.7	0	0.0	0.1	0
Tangerines (1 Cup, 195 g)	-2.0	0.7	0	0.1	0.0	0
Orange (1 fruit, 120 g)	-2.0	0.6	0	0.1	0.0	0
Nectarines (1 fruit, 138 g)	-1.7	0.6	0	0.0	0.0	0

Grapefruit (1 Cup of sections, 230 g)	-1.4	0.5	0	0.0	0.0	0
Acorn Squash (1/2 Cup)	-6.2	2.0	0	0.0	0.0	0
Parsnips (1/2 Cup, cooked)	-5.3	1.7	0	0.0	0.0	0
Green Beans (1/2 Cup)	-3.7	1.2	0	0.0	0.0	0
Spinach (1/2 Cup, raw)	-2.9	0.9	3	0.0	0.0	0
Spinach (1/2 Cup, cooked)	-2.5	0.8	0	0.0	0.0	0
Asparagus (1/2 Cup, raw)	-2.4	0.6	16	0.0	0.0	0
Carrots (1/2 Cup, raw)	-2.1	0.6	9	0.0	0.0	0
Yam (1/2 Cup [68 g], cooked)	-2.1	0.7	0	0.0	0.0	0
Pepper, Green (1/2 Cup, raw)	-2.0	0.6	5	0.0	0.0	0
Carrots (1/2 Cup)	-1.9	0.6	0	0.0	0.0	0
Asparagus (1/2 Cup, cooked)	-1.9	0.6	0	0.0	0.0	0
Corn (1/2 Cup, raw)	-1.8	0.6	0	0.3	0.2	0
Broccoli (1/2 Cup, cooked or raw)	-1.6	0.5	0	0.0	0.0	0
Onion (1/2 Cup, cooked)	-1.6	0.5	0	0.0	0.0	0
Onion (1/2 Cup, raw)	-1.6	0.4	12	0.0	0.0	0
Boc-Choy (1/2 Cup, cooked)	-1.6	0.5	0	0.0	0.0	0
Corn (1/2 Cup, cooked)	-1.4	0.5	0	0.3	0.2	0
Potato (1/2 Cup [61 g], cooked)	-0.6	0.2	0	0.0	0.0	0
Pepper, Green (1/2 Cup, cooked)	-0.6	0.2	0	0.0	0.0	0
Peanuts, Dried (1 oz)	-5.5	1.4	62	6.8	1.9	0
Almonds, Dry/Oil Roasted (1 oz)	-4.4	1.4	0	10.6	1.0	0
Peanuts, Oil-Roasted (1 oz)	-3.9	1.5	0	6.8	1.9	0
Almonds, Dried (1 oz)	-3.7	0.8	41	9.6	1.0	0
Pecans, Dried (1 oz)	-2.3	0.5	31	12.0	1.5	0
Filberts, Oil-Roasted (1 oz)	-2.2	0.7	0	14.0	1.3	0
Pistachio, Dried (1 oz)	-2.0	0.5	31	9.3	1.7	0
Pecans, Oil-Roasted (1 oz)	-1.3	0.5	0	12.6	1.6	0
Macadamia, Oil-Roasted (1 oz)	-0.6	0.5	0	17.0	3.3	0
Cashews, Oil-Roasted (1 oz)	-0.1	0.4	0	8.1	2.7	0
Bread, Whole Wheat (1 oz)	-1.2	0.4	0	0.0	0.1	0
Bread, White (1 oz)	-0.9	0.3	0	0.0	0.1	0
Veg. Oil, Corn (1 TBSP)	-3.2	0.0	132	3.3	1.7	0
Safflower Oil (1 TBSP)	-2.2	0.0	66	10.2	0.8	0
Margarine, Corn (1 TBSP)	-1.5	0.0	81	5.4	2.1	0
Canola Oil (1 TBSP)	-1.3	0.0	37	9.0	0.7	0
Olive Oil (1 TBSP)	-0.4	0.0	30	9.9	1.8	0
Veg. Oil, Soy (1 TBSP)	0.0	0.0	34	3.2	2.0	0
Margarine, Soy (1 TBSP)	0.2	0.0	30	5.4	2.4	0
Peanut Oil (1 TBSP)	2.8	0.0	28	2.3	6.2	0
Veg. Oil, Palm (1 TBSP)	3.8	0.0	0	5.0	6.7	0
Butter (1 pat, 5 g)	8.3	0.0	0	1.2	2.5	219
Milk, Skim (1 Cup)	0.1	0.0	0	0.0	0.1	2
Milk, 1% (1 Cup)	1.4	0.0	0	0.8	1.8	10
Milk, 2% (1 Cup)	2.4	0.0	0	1.4	3.0	19
Milk, Whole (1 Cup)	4.0	0.0	0	2.4	5.1	33

Sour Cream (1 TBSP)	1.1	0.0	0	0.7	1.6	5
Cheese, Mazzarella Part Skim Low M (1 oz)	1.4	0.0	0	0.9	1.9	10
Cheese, Mazzarella Whole Milk Low M (1 oz)	2.1	0.0	0	1.2	2.7	16
Cheese, Mazzarella Part Skim (1 oz)	2.3	0.0	0	1.4	3.1	15
Cheese, Mazzarella Whole Milk (1 oz)	2.9	0.0	0	0.7	3.7	22
Cheese, Swiss (1 oz)	3.8	0.0	0	2.1	5.0	26
Cheese, Cheddar (1 oz)	4.5	0.0	0	2.7	6.0	30
Cheese, Cream (1 oz)	4.6	0.0	0	2.8	6.2	31
Egg (1 large)	9.4	0.0	0	2.2	1.7	273
Ice Cream, Regular, 10% fat (1 Cup)	7.1	0.0	0	4.1	8.9	59
Ice Cream, Rich, 16% fat (1 Cup)	11.4	0.0	0	6.8	14.7	88
Sea Scallops (3 oz)	0.9	0.0	0	0.0	0.1	28
Atlantic Salmon (3 oz)	1.8	0.0	0	1.8	0.8	47
Squid, Raw (3 oz)	6.3	0.0	0	0.1	0.3	198
Squid, Fried (3 oz)	7.7	0.0	0	2.3	1.6	221
Chicken Breast 3 oz	1.3	0.0	0	1.1	0.0	45
Turkey White Meat 3 oz	2.4	0.0	0	0.5	0.9	59
Turkey Dark Meat 3 oz	3.4	0.0	0	1.3	2.0	71
Pork, Ham, 3 oz	3.0	0.0	0	3.8	2.7	50
Pork Tenderloin, 3 oz	3.2	0.0	0	1.8	1.4	79
Pork, Bacon, 1 oz	3.3	0.0	0	6.7	4.8	24
Pork Loin (no fat) 3 oz	4.9	0.0	0	9.2	4.0	95
Pork Loin (with fat) 3 oz	7.0	0.0	0	10.0	8.3	81
Beef Eye of Round (no fat) 3 oz	3.0	0.0	0	2.4	2.2	59
Beef Fillet (no fat) 3 oz	4.6	0.0	0	3.6	3.6	84
Beef Rib-Eye (no fat) 3 oz	4.7	0.0	0	4.8	4.6	68
Beef Chuck Roast (no fat) 3 oz	5.7	0.0	0	5.8	5.3	90
Beef Rib-Eye (with fat) 3 oz	6.3	0.0	0	7.8	7.4	70
Kielbasa Sausage 3 oz	5.6	0.0	0	11.7	7.4	57
Italian Sausage 3 oz	6.1	0.0	0	9.9	7.5	65
Enchilada, Beef & Cheese	-2.8	3.0	0	6.2	9.1	40
Taco Salad	-2.5	2.5	0	5.2	6.8	44
Nachos & Cheese	-1.3	2.0	0	8.0	7.8	18
Pizza (Cheese & Pepperoni) 1 slice	-0.3	0.5	0	2.3	1.7	11
French Fries (cooked in Veg. Oil)	-0.1	0.8	0	8.0	5.0	0
Chili Con Carne	0.1	1.9	0	3.4	3.4	134
Battered/Breaded Fried Fish	2.3	0.0	0	2.4	2.6	31
Burrito with Beef	2.5	1.7	0	7.4	10.5	64
Hot Dog (no bun)	3.0	0.3	0	6.9	5.1	44
Onion Rings, Veg. Oil (3 oz)	3.2	0.3	0	6.7	7.0	14
Fried Chicken Fingers	3.9	0.2	0	8.7	5.6	61
Cheeseburger (1/4 lb, etc.)	4.1	0.4	0	7.0	6.9	55
Cheeseburger (1-patty) plain	4.7	0.1	0	5.8	6.5	50
Hamburger (2-patty) plain	7.8	0.2	0	12.1	10.4	99
Cheeseburger (2-patty) plain	10.1	0.1	0	11.0	13.0	110
English Muffin & Butter	1.5	0.1	0	1.5	2.4	13

Hash Brown Potatoes	1.5	0.4	0	3.9	4.3	9
Pancakes & Butter	4.5	0.2	0	5.3	5.9	58
French Toast & Butter	7.7	0.1	0	7.1	7.8	116
Egg Muffin, Cheese & Can. Bacon	11.5	0.3	0	6.8	9.1	234
Biscuit, Egg & Ham	13.4	0.1	0	11.3	8.4	300
Croissant, Cheese, Egg & Ham	16.1	0.2	0	11.4	17.5	213
Bacon, 2 eggs and Buttered Whole Wheat Toast	36.2	0.8	0	13.5	13.4	1008
McCann's Irish Oatmeal, 2-Blackberry Jam, 3-Psyllium	-46.5	15	0	0.4	0.0	0

* Psyllium can be found at: http://www.puritan.com/herbal-supplements-005/colon-care-purified-powdered-psyllium-husk-004741