Blood Pressure Control *by Diet*

In August 2007 I had my annual physical and had a high blood pressure (145/95) for the third year in a row. All my life my blood pressure was 102/72 with a resting pulse of 55—something was wrong! My doctor suggested drug control, which I rejected for the third year in a row. Along with my need to reduce my cholesterol (which was 361; see the article "Cholesterol Control *by Diet*") I needed to resolve what was called *secondary* hypertension, which has a sudden onset of years vs. decades for *primary* hypertension. Secondary hypertension is usually caused by some body dysfunction such as liver or kidney disease, which caused me much concern considering my fine wine drinking history.

I went "on-line" and gathered as much data on hypertension I could find, which was significant. In general, I realized that my secondary hypertension was not cause by organ dysfunction; it was *diet* dysfunction caused by *moderate* dehydration. The term "moderate" is misleading since moderate dehydration is debilitating (constant headaches, lassitude, hypertension, etc.)—Symptoms of *severe* dehydration include death. After going over the list of symptoms it was obvious that I was moderately dehydrated. I determined on-line the dietary nutrients involved in dehydration, which include potassium, sodium (salt) and daily fluid intake. Supposedly we need about 3,800 mg of potassium, 2,400 mg of sodium, and 2,800 gm (100 oz) of fluids/day. Probably 70-75% of daily fluids come from fluid drinks and 25-30% from the water in the foods we eat (for example 10 ounces of potatoes contains 7 ounces of water).

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 1990'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 measure all of the foods I eat, usually to the gram (…sounds compulsive).

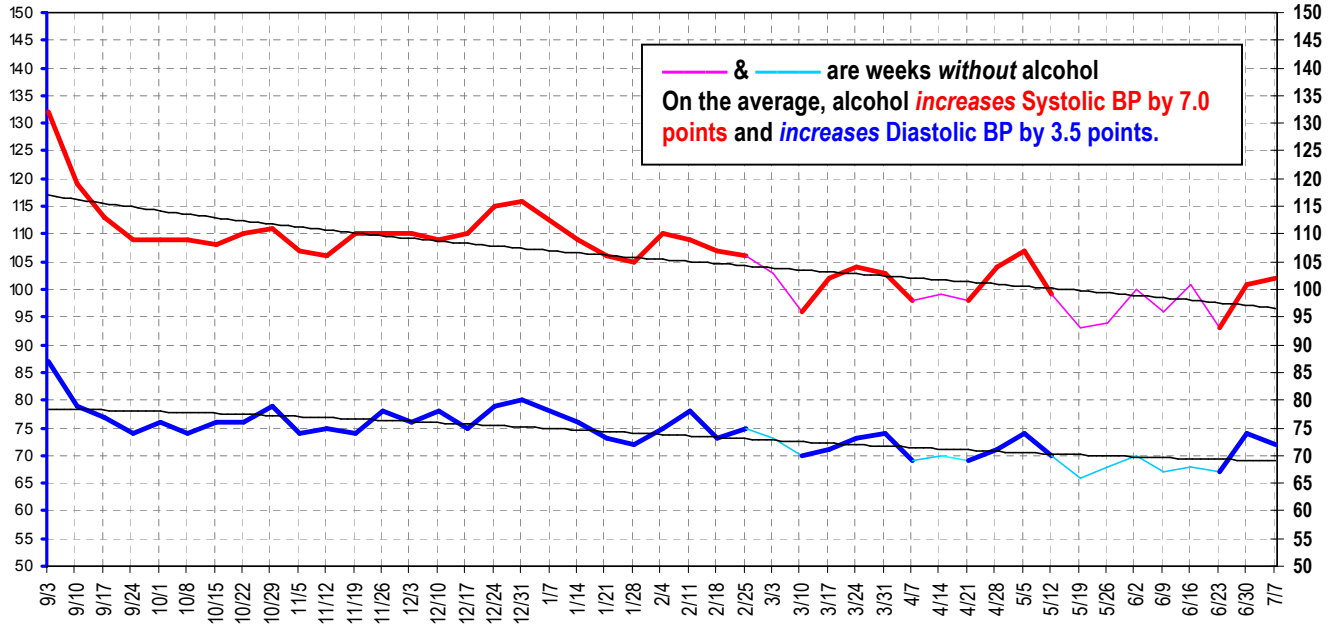
Using this food analysis program, I tracked back many years to determine my daily intake of potassium, sodium, and fluids. Up to a few years ago my potassium was 3,000 mg/day, sodium was 2,250 mg/day and fluids were 2,300 gm/day. I tracked back my numbers the two years preceding the 2007 annual checkup and the numbers were: potassium (2,800 mg), sodium (3,300 mg) and fluids (1,500gm).

The study was to determine how diet helped the body to control blood pressure. It took 3 months of planning, preparation, measuring and analysis to reduce my blood pressure from 135/87 to 110/77 and another 6 months to reduce it to 101/72. My dehydration disappeared as my blood pressure dropped; no more constant headaches, etc. It was also interesting to find the disappearance of my "dry-eye" problem, which I had been seeing an ophthalmologist for over the years of dehydration. I use to put six drops in my eyes throughout the day, now I just do it once in the morning. At the last ophthalmic visit the doctor determined that my dry-eye was gone (even after six months of just one eye drop per day)—it was obvious to me that the dry eye problem was caused by dehydration.

Throughout this blood pressure study I planned every meal, every day and accurately measured all of the foods I ate. Besides tracking saturated fat, dietary cholesterol, soluble fiber, monounsaturated fats, and phytosterols for my cholesterol study (see "Cholesterol Control *by Diet*" article), I kept track of and analyzed the effect of potassium, sodium and fluids. I had a morning routine of awakening, cleaning up, resting for five minutes and then taking three blood pressures with an "American Diagnostic Corp." electronic blood pressure measuring system, choosing the lowest reading. I chose the lowest reading because any exciting thought or emotion, instantly changes systolic BP by as much as 20 points. It's interesting to note that blood pressure is naturally regulated by the body in seconds, blood glucose is naturally regulated by the body in minutes, cholesterol is naturally regulated by the body in days, and weight is naturally regulated by the body in weeks.

I plotted every range and combination of potassium and sodium vs. systolic, diastolic blood pressure and pulse rate on scores of graphs with many hundreds of data points. The bottom line is that I needed more than 2,800 gm of fluids/day (I now average 3,450), more than 3,800 mg of potassium/day (I now average 4,850), and less than 2,400 mm of sodium/day (I now average 2,350). Of course, these numbers are an average over many months, what happens daily is another story. Daily potassium can range from 2,800 to 8,000 mg and daily sodium from 250 to 6,500 mg depending on my meals. In general I have found another quantity that is more meaningful, especially on a weekly basis—the potassium/sodium ratio. As long as my potassium/sodium ratio is between 1.5 and 2.5 over a week I'm happy. For example, on a day I eat yams my potassium is usually over 6,000 and my sodium around 1,500, giving a ratio of about 4.0, which is OK as long as I average between 1.5 and 2.5 over the week. When I was dehydrated, my ratio averaged 0.8—way too low. The low sodium is achieved by simply not adding salt to my food; I use to add 1,000 to 1,500 mg per day to food, now I *average* less than 300 mg per day ((I just got out of the habit of using it). Getting enough potassium is difficult; supplements don't seem to work, you need to get it from food. Good sources of potassium are: yams (1,900 mg in 10 oz); acorn squash (1,250 mg in 10 oz); potato (1,200 mg in 10 oz); orange juice (550 mg in 10 oz); red kidney beans [chili] (1,150 mg in 10 oz); 1 large banana (550 mg); dried apricots (400 mg in **1** oz)—look for potassium content on the nutritional labels. The graph below shows my weekly progress over the year I eliminated my secondary hypertension through diet.

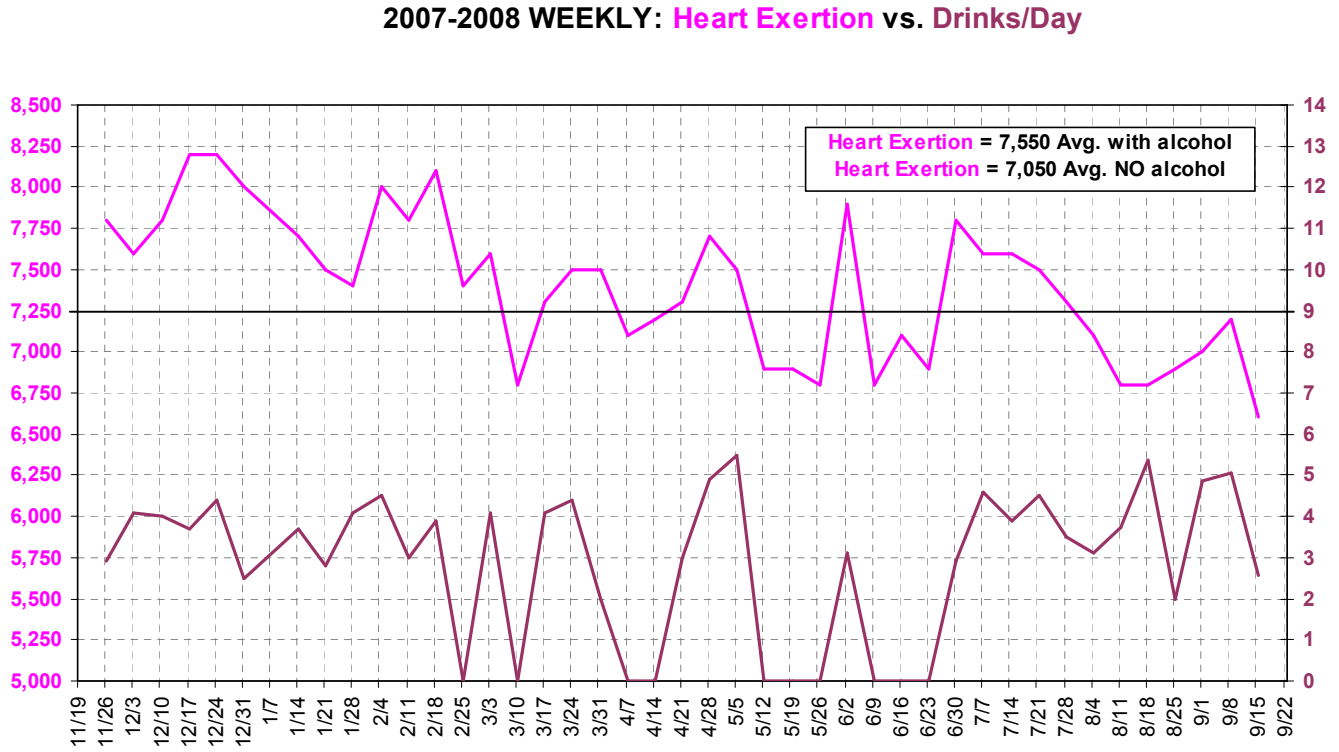
2007-2008 WEEKLY: Systolic BP & Diastolic BP



It is interesting to note the effect of alcohol on blood pressure. Alcohol ingested with the previous days dinner causes an *increase* in blood pressure the next morning of about 7 points systolic and 3.5 points diastolic. Thus, my morning blood pressure averages about 97/69 without alcohol and averages about 104/72 with alcohol. As noted in the article on cholesterol control by diet, prudent use of alcohol can decrease blood cholesterol, but here it increases blood pressure. Thus, if your blood pressure is high, reduce your alcohol consumption—just have it one to three times a week, not every day.

If you might or do have heart problems, you should minimize the amount your heart exerts itself pumping blood through your body. A relative measure of this *exertion* is "Systolic Pressure multiplied by Pulse Rate", for example, for a systolic pressure of 100 and a pulse rate of 65 the exertion is 6,500. I try to keep it under 7,000, but it can go as low as 5,600 or as high as 10,000. If you have an

electronic blood pressure meter it will tell you your systolic and diastolic pressure and pulse rate. Your *diastolic* pressure is mainly determined by the resistance to blood flow of your small arteries and arterioles, whose muscles dilate to decrease and constrict to increase blood pressure. Alcohol has a marked effect on heart exertion. Even though alcohol increases vasodilatation and thus, decreases blood pressure over hours, it stresses the body for days and increases blood pressure and heart exertion. As you can see from the chart below, alcohol increases heart exertion *by an average* of 500 points, although, there seems to be some adaptation (reducing of heart exertion) over weeks of alcohol as shown in weeks 12/24 to 1/-28 and weeks 6/30 to 8/11 in the chart below. It is also obvious that the sudden use of alcohol for a week after having none for three weeks can elevate the heart effort 1,100 points from 6,800 to 7,900 (see week 6/2 and week 6/30). The chart below also indicates that to stay below my goal of 7,100 I have to either lay off the alcohol totally (and average <7,100) or just have it one to three times a week, which helps to reduce my cholesterol—ideally, having alcohol every third day seems to work best.



Bottom line on secondary hypertension; drink enough liquids, especially fruit juices containing potassium, and don't add *extra* salt to foods to reverse or avoid dehydration, to keep your heart and circulatory system healthy.

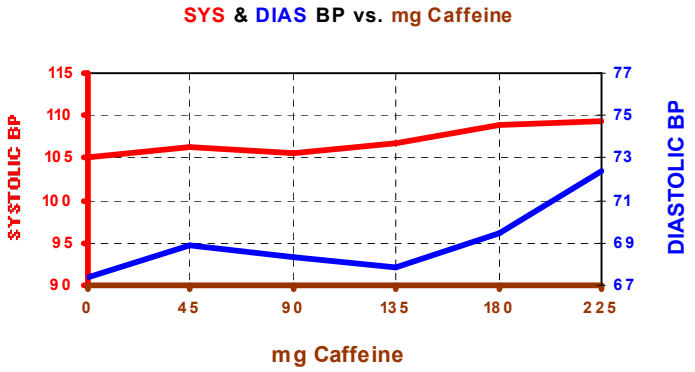
You might be wondering why I wrote this article on secondary hypertension. It's because many people have it and don't realize it; I surely didn't and neither did my clients or friends. In most cases it is caused by dehydration caused by a lack of fluids and a poor potassium/sodium ratio. If you have had a sudden unset of hypertension over the past few years it would do you well to look to your diet as the cause.

Two-Years Later, Follow-up Studies:

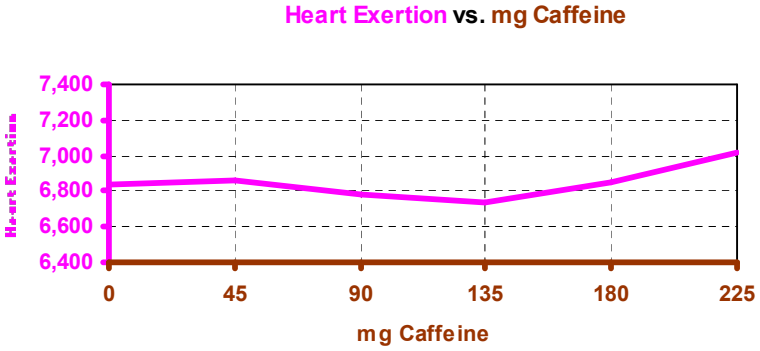
In October 2009, after two years on a controlled diet to reduce blood pressure and heart exertion, I did a study of the dozens of variables that I record on myself at the start of every day. These variables help me to understand the reason for increases and decreases in systolic and diastolic blood pressures, along with pulse rate and heart exertion (Systolic BP *times* Pulse Rate).

K/Na Ratio Results: My average potassium intake is 4,000 mg/day and sodium is 2,000 mg/day, giving a K/Na ratio of 2.0/day; my fluid intake was 3,000 gm/day (3 liters/day). This was my goal and it helped my systolic BP to average of 106, my diastolic BP to average 69 and my heart exertion to average 6,800, surpassing my goal of less than 7,100. Of course, these were morning readings; they are higher during the day, but they provide a consistent basis for study.

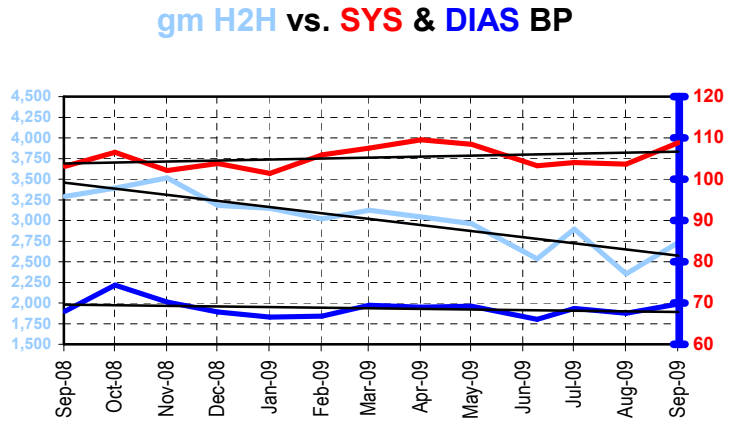
New CAFFEINE Study-1: The chart on the right shows the effect of caffeine on **systolic** and **diastolic** blood pressure. As you can see, as the mg of caffeine increases from 0 mg to 225 mg (a 12-ounce cup of coffee or three 12-ounce cups of tea), the **systolic** BP rises **4** points (**6%**), and the **diastolic** BP rises **5** points (**7%**). For those who drink two to three cups of coffee a day the rise in systolic and diastolic BP might be much greater.



New CAFFEINE Study-2: The chart on the right shows the effect of caffeine on **heart exertion** (the systolic BP times the pulse rate). If you take three consecutive blood pressure readings you will find that the heart exertion stays fairly constant as the systolic BP and pulse rate vary—this is why just following systolic BP alone, is not a good measure of heart exertion. As you can see, as the mg of caffeine increases from 0 mg to 225 mg, the **heart exertion** rises about **200** points or about 3% (this is half the systolic BP rise and is due to the pulse rate *dropping* 3%).



Hydration Study: The chart on the right shows the effect of hydration (grams of fluids/day; gm H2O) on **systolic** and **diastolic** blood pressure over the past 13 months. The graph indicates for about a 20% drop in gm H2O/day, the **diastolic** BP stayed fairly constant while **systolic** BP increased. The point is, it's amazing how a steady decline becomes unnoticeable until blood pressure increases enough to be noticeable. It's not hard to slip back into dehydration—now I make it a point to have more than 3,000 grams (3 liters) per day in food fluids (providing about 30% of daily fluids) and beverages (providing about 70% of daily fluids).



Bottom Line: Caffeine, alcohol and dehydration combined can increase systolic BP by about 15 to 20 points, which is something that can be controlled by diet.