

Malnutrition of Affluence

How our search for plenty has left us with less

By Peter Leighton

Hippocrates famously stated, "Let your food be your medicine, and your medicine be your food". His prophetic words must act as a guiding light as we are now suffering from Malnutrition of Affluence, the devastating health results of our nutritional "success".

Before I identify the treatment for what ails us, a bit of history is required.



Traditionally, nutritional science has focused its attention on preventing malnutrition and deficiency diseases through the discovery and application of vitamins, minerals and other important micro nutrients. But as the western diet, hailed for its abundance of nutrition, migrated throughout the developed world, nutritional science has had to apply its ever evolving tools towards a greater problem; over-nutrition. As Paul Roberts, author of *The End of Food* notes, " ...the ironic prospect that the most serious threat to health would very soon be...food."

Early humans relied on calories for survival. From foraging to hunting, man's diet was extremely diverse and relatively unpredictable. We ate from hundreds of crops and wild animals, offering exceptional biodiversity in our diet, and our bodies adapted to the inconsistent intake of nutrients with an amazing ability to maximize their efficiency. Soon man was domesticating animals and mastering agricultural practices, which resulted in incredible benefits in health and mortality, as well as facilitating changes in lifestyle. In a relative short order,

man was eating for taste and satiety as our modern agricultural and food practices were born.

Today, two key factors dramatically affect our health as it relates to our evolutionary process. First, rapid lifestyle changes have occurred which include diminished physical activity, increased mental stress, dramatic physical relocations and more cross-cultural interactions. Second, our diet has radically changed (knowingly or not), as we consume a far less diverse diet, depleted of many bioactive nutrients. Since these changes have occurred so dramatically and quickly, our evolutionary process of adaptive response has not been able to keep pace.

As food processing and lifestyle changes took root in the 20th century, nutrition has played an increasing role in public health. The concept that disease could be caused by an excessive intake or imbalance of nutrients, as opposed to a lack of them, has begun to receive much attention. It seems that the more affluent we have become, the less nutritious is our diet.

Dietary changes and processed foods



Post-industrial agricultural and food processing has removed phytonutrients heretofore thought “inactive” or useless. These compounds are routinely removed from plants through selective breeding and modern processing. Furthermore, we used to eat from over 800 plant foods; now most Americans eat only three, namely French fries, ketchup and iceberg lettuce. Modern practices are also introducing many chemicals to the plants and animals we eat, in efforts to increase yield and profitability. Studies are demonstrating a relationship between our (Western) diet and chronic diseases.

Diet is a big factor in chronic disease, responsible, some say, for a third of most types of cancer. And our western diet, featuring large amounts of red meat and highly processed foods are often packed with large quantities of salt, fat, and sweeteners, not to mention hundreds of chemical additives.

The incidence of acute and chronic diseases is increasing worldwide, linked to the expansion of the western diet. This development is strongly associated with Western lifestyle, not just lack of physical exercise, mental stress, use of tobacco and alcohol, but also with consumption of refined and calorie-condensed foods, of which most create

systemic inflammation that “paralyzes” the innate immune system and reduces resistance to disease.

The journal *Atherosclerosis* reported that volunteers eating a typical Western diet, consisting of 35 per cent saturated fats, experienced increases in tumor necrosis factor-alpha (TNF-a) and interleukin-6 (IL-6): two cytokines actively involved in the inflammatory response. Chronic inflammation has been linked to range of conditions such as heart disease, osteoporosis, cognitive decline and Alzheimer's, type-2 diabetes, and arthritis.

Researchers from the US' National Cancer Institute (NCI) report that increased consumption of red and processed meat may produce an increased risk of death from cancer or heart disease. This study follows years of research suggesting red and processed meats are linked to a host of ills. A previous study from the NCI reported high intakes of red and processed meats may raise the risk of lung and colorectal cancer by up to 20 per cent. The World Cancer Research Fund published a report in 2007 that directly linked diet to cancer, with alcohol and red and processed meats posing particular risks.

It's important to note that our ancestors ate meat, which was naturally lean because the wild animals fed on grass, which is one of the few natural sources of omega-3 fatty acids. Hence, their body fat had a higher proportion of the “good” mono-saturated and polyunsaturated fats, and less of the “bad” saturated fats.

Today's grain-fed livestock is specially bred not only to put on lots of fat, but to partition that fat inside the muscle so as to produce a well marbled piece of meat. By raising these animals in controlled and confined spaces on rations computer-designed to produce rapid weight gain and marbling, companies can maximize profits. In only about four months we can transform a six-month-old five hundred pound calf into a 1,350-pound, slaughter-ready steer. By comparison, a grass fed steer takes two years to reach a slaughter weight of barely 1,100 pounds.



Lest you think red meat is the only culprit, our agricultural processes have been affecting us in many ways. Today's scientifically bred produce grows so quickly that it contains measurably fewer micronutrients. Research done at the University of Texas at Austin concluded that recently grown crops have shown decreases of up to 38 percent in protein, calcium, vitamin C, phosphorus, iron and riboflavin when compared with produce from past decades. Of the 13 major nutrients found in fruits and vegetables, six have declined substantially.

This may be an unintended result of the genetically uniform, mono-cropping systems that now dominates our agricultural industry. American's are increasingly eating a diet that is devoid in essential phytonutrients to gain the advantages of convenience and taste.

Consumption of a high caloric diet lacking bioactive phytonutrients from fruits, vegetables and whole grains has resulted in a 70% increase in obesity in Americans, a problem so profound as to be declared an epidemic and public health issue by the Centers for Disease Control.

The effects of the “western diet” and lifestyle are spreading globally. Almost one third of western Europeans are overweight and 1 in 10 is obese. Male obesity in Japan has doubled since 1982 and the Japan Ministry of Education is recognizing the serious problem with the number of children that are overweight. Cardiovascular disease will soon rein as the world’s leading cause of death and disability, overtaking infectious disease and malnutrition.

With the advent of a highly processed American diet and changes in our eating habits since World War II, the consumption of essential plant-derived nutrients (phytonutrients) is on the decline. Despite consumer and physician awareness about the importance of eating a diverse diet many of the same forces that are contributing to the epidemics of obesity, cardiovascular disease and diabetes contribute to the poor dietary state of Americans today.

Orphaned Phytonutrients

Modern food processing practices have depleted the diversity and quality of several classes of phytonutrients from the American diet; bioactive phytonutrients that are now demonstrating significant health benefit. The fact that these “orphaned phytonutrients” are now depleted from American’s diet may be responsible (in part) for causing or worsening chronic diseases such as diabetes cardiovascular disease and Alzheimer’s.

Our post-industrial agricultural and food processing industry has devoted decades of work to removing certain phytonutrients heretofore thought “inactive” or useless. Most plants produce a host of phytochemicals to perform varying metabolic functions such as coloring agents known as flavonoids to protect against excessive sunlight and other stresses, and Sulforaphane (an astringent in broccoli) to discourage the plant from being eaten by animals. These compounds are routinely removed from plants through selective breeding and modern processing.

Modern science is discovering tremendous value to these “orphaned phytonutrients”. As sensitive and specific biotechnology and pharmaceutical R&D tools are being applied to



nutrition science, more and greater data is confirming the health benefits of these compounds, and epidemiological studies are linking their depletion from the food chain to increases in chronic diseases. For example, the sulforaphane that has been selectively bred out of commercial broccoli because of its bitter taste has been found to stimulate enzymes in the body that detoxify chemical carcinogens. Similarly, while there are hundreds of flavonoids, science has been uncovering a host of exceptional health benefits they confer, most significantly their cardiovascular benefit. In fact, it is the anecdotal data offered by the “French Paradox” (the fact that the

French diet is exceptionally high in fat, yet the French have a disproportionately low incidence of cardiovascular disease) that has led researchers to identify the grape flavonoids (from wine) as the bioactive phytonutrient responsible for such cardiovascular health benefits.

Evidence is mounting as to the benefits of phytonutrients. Time and again rigorous scientific studies document that the more fruits, vegetables and whole grains we eat, the less likely we are to suffer from diseases. In 128 of 156 human studies reviewed in one meta-analysis, there was found a strong relationship between intake of phytonutrients and cancer prevention.

These bioactive phytonutrients-- compounds in dietary fruits, vegetables and whole grains that have heretofore no recognized value in the diet but are now demonstrating an ability to combat and prevent disease-- are no less “valuable” than vitamins.

While it has been well established that insufficient intake of vitamins can result in morbidity and mortality, it should not be surprising that the same is true for orphaned phytonutrients. It strikes one as ironic that at the same time Americans began to supplement and fortify their diet with vitamins, they conversely have depleted whole classes of phytonutrients from the diet.

Diet & Lifestyle

But depletion of the diversity and quality of phytonutrients from the Western diet is only half the dietary setback. Compounding the problem facing Americans in post industrial society is a change in dietary habits and lifestyle that is seriously eroding American’s health. Teenagers drink almost three times the amount of soft drinks than they did in the

1960's. Researchers warn that this trend will leave teenagers at higher risk of heart disease, osteoporosis and diabetes later in life. Twice as many American children today are eating snack foods than did kids 20 years ago, according to the US Department of Agriculture, and 91% of Americans don't get the recommended minimum five servings of fruits and vegetables per day. Sadly, French fries and potato chips account for 25% of kid's vegetable intake, only exacerbated by a sedentary lifestyle. Teenagers are consuming 17% less energy than in the 60's but are still gaining weight, a statement about the poor quality of their diet and lack of exercise.

Paying the Price

Only now are we beginning to reconcile the effects of our "modern" diet and lifestyle. Today in America, 60 million people have cardiovascular disease, 16 million suffer the debilitating effects of type 2 diabetes, 10 million people have cancer and nearly 20% of the population has high cholesterol. National healthcare expenditures exceed \$1 trillion, representing over 14% of GDP, a larger share of GDP than any other industrialized country.

As the economic forces drive change in the American healthcare system, and advances in science and technology impart greater insight into the health benefits of bioactive phytonutrients, there will likely be a paradigm shift from the treatment-oriented "sick care" system we now have, towards a prevention-based true healthcare system.

As with all revolutionary changes, there is an exponential acceleration of the process whereby at some undefined point, critical mass is achieved and there is no turning back. Signs of acceleration abound in the current marketplace. Genomics research has gained significant insight into disease predisposition and gene expression. Technological advances in assay development and discovery techniques are rapidly delivering the capability to characterize and assess the bioactive health benefits of phytonutrients. The popular movement against GMO has accentuated the interest in and growth of organic and sustainable agricultural practices, and will likely force broader changes in agricultural and food processing procedures. And consumer trends illustrate a growing interest in the diet-disease link and better nutritional habits. For instance, Seventy five percent of Americans surveyed believe food and nutrition play the greatest role in their health. In fact, 54% believe food can treat an ailment and more than 50% of households are currently using food/beverages to treat or manage specific health issues.

New Tools are offering Solutions

Recognizing that many chronic diseases are closely related to diet and lifestyle, scientists are focusing much study towards how nutrition can optimize and maintain cellular health. This requires advanced understanding of nutrient interaction and metabolic processes at a cellular level, specifically the interaction of nutrients and their

relationship with proteins and gene expression. Nutrigenomics is the study of this relationship between gene activity and cell function, and how food, genes and lifestyle interact in human health.

Nutrients from the diet, in relation to lifestyle events, not only nourish the body but send specific signals to the cells through transcript factors, which change gene expression (or how genes behave) and metabolite production. As a result, different nutrients (different diets) affect an individual's gene and protein expression differently. In other words, what we eat changes the way our body acts and reacts. Certain diets, interacting with certain genotypes, can lead towards chronic diseases (or the prevention of them). This helps explain why two people eating the same diet may respond very differently.

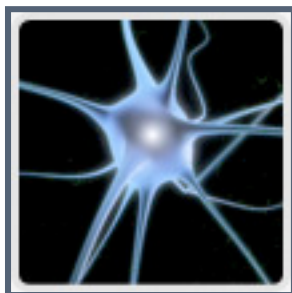
Biotech advances are identifying new compounds and the utility of existing food constituents that can support health & wellness. Through bioinformatics and genomic research, it is becoming increasingly possible to identify and predict the impact of diet on genotypes. For instance, a 3-week nutritional intervention with virgin olive oil may alter the expression of genes related to atherosclerosis. One of the goals of nutrigenomics is to devise genetic-based nutritional interventions to prevent, delay or treat diseases. But on a more practical (and user-friendly) basis, nutrigenomics provides insight into the effects of bioactive compounds and their effect on human health, which is currently aiding in the development of functional foods.

Both scientists and consumers are now recognizing this problem and are moving to take an active role in maintaining health & wellness through nutrition. Integrating the new tools of biotechnology and nutrigenomics, for instance, innovative solutions are being created and applied to a new generation of "wellness" foods. Consumers want lifestyle solutions, where validated science and functional benefit meets pleasure and convenience.

Consumers are increasingly making purchase decisions that support products with proven efficacy toward improving health outside the traditional doctor-based health system. This is one of the reasons that in spite of the current economic crash negatively affecting most consumer market segments, nutritional and nutraceutical product categories continue to grow. To illustrate how these advances are proving to be potentially powerful antidotes to our lifestyle, let's look at the area of cognitive health.

Cognitive Health as an Example

Advancing science now understands the roots to cognitive decline, dementia and Alzheimer's disease. As we age proteins called beta-amyloid begin to aggregate in our



brain. As this occurs, the amyloid protein folds upon itself in a particular way and they bind very tightly together forming fibrils and plaques. These fibrils bind onto each other so tightly that the body's natural immune system cannot break them apart, and they

attack surrounding tissue in the brain. This leads to neuron death and, as the immune system creates an inflammatory response to this “invader”, secondary damage occurs from inflammation. This sequence leads to memory decline and reduced cognitive ability, ultimately diagnosed as Alzheimer’s disease.

With over 1.5 billion people over the age of 45, when dementia symptoms begin to occur, and over 30 million diagnosed Alzheimer patients, this is now the sixth leading cause of death in the U.S. More than \$100 billion a year is spent treating and caring for this disease, not to mention the devastation it causes to families around the world.

New research has applied advanced discovery tools towards the identification of several natural plant based compounds that not only stop the formation of toxic plaques, but also to minimize damage from the body’s inflammatory response. Through these compounds we have the ability to intervene early in at-risk population to prevent deposits and dissolve or disrupt existing beta amyloid deposits.

While the negative effects of our dramatic changes in diet and lifestyle have been inadvertent, so too have been much of the positive discoveries and advances in nutritional research & discovery. As we begin to apply these advanced scientific techniques, heretofore focused primarily on drug therapy development, towards nutrition, we may open the door to a wellness model; a system focused on keeping us healthy as opposed to treating illness. Perhaps Hippocrates had it right all along, and now we have better tools to apply his wisdom.