



## Genes, nutrition, disease

Human health is the result of constant interaction between genes and environmental factors. The most significant environmental factors in this respect are the foods we eat and the lifestyle we practice daily.

Out of the over 3 billion base pairs of the human genome, 97 to 99% are identical among any two given individuals. Therefore, the fundamental processes of food metabolism in every human body are pretty much the same. This is why some general practices, such as eating healthy and staying active, are beneficial to everyone. However, the 1 to 3% genome difference among human individuals makes us respond differently to different types of food. For example, the genetic makeup of descendants of hunting tribes are more compatible with high-protein diets while descendants of farming tribes can better handle high-carbohydrate. This is why personalized diets are necessary.

A mismatch between genes and diet would inevitably lead to detrimental effects on our health. Accumulation of such detrimental effects eventually manifest as chronic diseases such as cardiovascular disease, diabetes, cancer, obesity, autoimmune diseases, rheumatoid arthritis, asthma and depression.

The genetic variations responsible for food metabolism are the result of millions of years of evolution during which there have been several major dietary transitions. During each transition, human genes were subject to natural selection to better suit the foods available for survival.

About 2.5 million years ago, our human ancestors began to use stone tools, which led to increased hunting and meat consumption. During these hunter-gatherer years, food resources were limited and the human genome developed so-called "thrifty genes." These genes promoted more efficient food utilization, fat deposition, and rapid weight gain during times of food surplus in order to give carriers a higher chance of survival during food shortage.

Around 100 to 200 thousand years ago, modern humans began to domesticate plants and animals. As a result, diets became comprised mostly of a few main domesticated plants and animals. This transition made food more available but nutrient sources less diverse. Plants and animals cultivated varied by region and, in response, genetic variations that suited regional diets were preferentially selected.

The last 50 to 100 years saw the most dramatic transition in the human diet. Industrialized food production made all kinds of food available in excess at extremely low prices. Since then, overeating has become an epidemic, especially in affluent Western countries. The advance of modern technology has also led to sedentary lifestyles and lower energy expenditure. This combination has resulted in rapid accumulation of energy and weight gain in the human population.

Regardless of these dietary changes, the human genome has remained almost the same over the last 100 years. The 200 or so “thrifty genes” that used to be advantageous in the hunter-gatherer era have become incompatible with modern diets, causing the “diseases of civilization” — chronic conditions including obesity, diabetes, cardiovascular disease, metabolic syndrome, cancer, autoimmune diseases, rheumatoid arthritis, asthma and depression.

Equipped with the latest advances in nutrigenetics and nutrigenomics, scientists at GB HealthWatch are working diligently to better understand gene-nutrition-disease interactions. Our goal is to develop personalized, gene-based diets and fitness programs to combat overweight, obesity and said “diseases of civilization” for people of any genetic makeup.

<http://www.gbhealthwatch.com>