

Human Adaptation

Description

The ability to domesticate and cultivate plants close to where humans lived changed how the environment was occupied. As food became more reliable, permanent settlements were established, and the population grew. Early farmers selected the best plant to grow to improve the yield and secure crop production. They continued this process generation after generation until the nature of the plant was modified to a point where many species became unable to survive and compete in the world. While these domesticated plants became dependent on humans, humans had to adapt biochemically. Our genes evolved, changing our metabolism to match our diet and lifestyle.

The effect of a change of diet resulting from increased starch consumption offers the best-documented example of the co-evolution of plants and humans regarding human-specific adaptation. As humans went from being hunters and gatherers to becoming farmers, it became necessary to enhance ways to extract as much nutrition from such starch that comprised a significant portion of the typical diet. The digestive process of breaking down starch starts as soon as its ingestion; under the action of salivary amylase. This enzyme helps explicitly to break down starch into simpler sugars that can be processed by other enzymes or absorbed by the intestine. Salivary amylase comprises a small portion of the total excreted amylase, made mainly by the pancreas. Native starch shows high resistance to enzymatic hydrolysis and must be cooked before consumption to disrupt the granule components since amylase cannot degrade the double-helical constituents.

The amylase genes (AMY), which encode for a starch-digesting enzyme in humans, underwent several evolutions. Humans have multiple copies of the gene, but the exact number of copies varies. Some people have two, others twenty, with an average of six to eight. The researchers found that groups whose ancestors tended to eat more starch had more salivary amylase. The groups that managed to eat more starchy foods were primarily farmers and desert hunter-gatherers.

In contrast, rainforest hunter-gatherers do not, or people of the cold north who primarily relied on fish and fats tend not to have much salivary amylase. Populations with little starch in their diets also have a relatively low copy number of amylase genes (5 per individual). Those eating starch food have more than seven amylase genes per individual. The difference is slight, and the distributions overlap significantly, but the difference is measurable and significant. It implies there may have been some selection for more significant copy numbers in cultures with diets high in starchy plants.

This example of ongoing human evolution raises the question of how this difference might have arisen. Individuals with a high number of copies of the gene may have had an evolutionary advantage in consuming starch. People in the group who were better at handling starchy foods were more successful. Success is associated with getting more out of food, for example, a higher glucose level in the mother's blood during pregnancy and a higher survival level during hard times. Eating starch did not cause more amylase genes to appear. People who produced more salivary amylase did better and had more children. Over time, the group would shift toward having more people with extra amylase genes. This is pretty typical of natural selection at work.

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