Muscle development in childhood may alter how the body uses fat, helping prevent adult obesity.

In a wild-type mouse with normal levels of the protein myostatin (left), a high-fat diet leads to obesity and loss of insulin sensitivity. On the same diet, a transgenic mouse that produces less myostatin (right) stays lean and retains its insulin sensitivity. Adults who participate in muscle-building exercises during youth (far right) may get the same health benefit that the transgenic mice receive from diminished levels of myostatin.

Of Mice and Muscles

The 2005 Hawai‘i Health Survey found that more than half of our state’s adults are obese or overweight. This population is at elevated risk for many health conditions, including type II diabetes, high blood pressure, heart disease, stroke, and some cancers. Obesity-related medical expenses in Hawai‘i are estimated to cost more than $290 million per year.

A recent finding by Dr. Jinzeng Yang and Baoping Zhao of CTAHR and Dr. Robert Wall of the U.S. Department of Agriculture suggests that muscle development in childhood may alter how the body uses fat, helping prevent adult obesity. The study used transgenic mice that have been genetically engineered to produce less myostatin, a protein that limits the development of skeletal muscles. In comparison to mice from the same litter that lack the added gene, the transgenic mice grow faster, have larger muscle cells, and show increased muscle development.

When adult transgenic mice and their non-transgenic (or “wild-type”) littermates are fed a high-fat diet, the wild-type mice store the excess calories as fat and become obese, while the transgenic mice remain fit despite eating a larger amount of food. The wild-type mice on a high-fat diet also become less sensitive to insulin, a symptom of pre-diabetes. In contrast, the transgenic mice fed a fatty diet maintain normal insulin sensitivity.

Muscle tissue burns more energy than fat tissue. Building extra skeletal muscle early in life appears to shield the transgenic mice from the effects of a high-fat diet by shifting their metabolism away from storing fat and toward using fat as a fuel to maintain muscle.

The study has exciting implications for human weight management. Exercise during childhood and adolescence should offer the same advantages that the muscled mice have: effective fat utilization for muscle growth and maintenance rather than fat storage. Through physical activities that build their muscle mass, young people may be able to achieve a measure of protection against future obesity and its harmful health effects on adults.