Medical Xpress

Regular exercise could reduce complications of sickle cell trait

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Sickle cell disease (SCD), an inherited condition that causes red blood cells to sometimes deform into a crescent shape, affects an estimated 100,000 Americans, typically those of African descent. However, far more have sickle cell trait (SCT), caused when individuals carry just a single copy of the disease-causing mutation in their genes. Rather than all their red blood cells being affected, those with SCT carry a mix of affected red blood cells and normal ones. Previously, researchers and physicians had assumed that those with SCT were immune from the increased burden of sickness and death that those with SCD carry. However, recent research suggests that the same morbidity and mortality that follow SCD patients at an increased rate also affect those with SCT to a lesser extent.

Nearly all these adverse effects are consequences of oxidative stress, a condition in which free radicals overwhelm the body's natural antioxidants. In healthy individuals, oxidative stress has been linked with conditions including cancer, heart disease, and simply aging; in sickle cell disease patients, oxidative stress is thought to play a role in causing the inflammation, problem with the linings of blood vessels, and blood cell blockages that cause complications from this disease.

However, scientists have long known that exercise increases the level of antioxidants present in the body, defending against oxidative stress. In a new study, researchers compare the effects of exhaustive exercise on people with SCT who exercise regularly with those who don't. They found that training regularly seems to offset the burden of exhaustive

exercise by lowering the levels of molecules associated with oxidative stress, increasing antioxidant molecules, and increasing nitric oxide, a molecule important for opening blood vessels which could play a role in preventing the blood vessel occlusion that sometimes occurs in SCD and SCT.

The study is the result of efforts undertaken by Vincent Pialoux, Erica N. Chirico, Camille Faes, Emeline Aufradet, and Cyril Martin of the University Lyon I, Leonard Feasson of the University of Saint-Etienne, and Laurent Messonnier of the University of Savoie. An abstract of their study entitled, "Physical Activity Blunts Oxidative Stress Reponse to Exercise in Sickle Cell Trait Carriers," will be discussed at the meeting Experimental Biology 2012, being held April 21-25 at the San Diego Convention Center. The abstract is sponsored by the American Physiological Society (APS), one of six scientific societies sponsoring the conference which last year attracted some 14,000 attendees.

Training Reduces Oxidative Stress

Dr. Pialoux, who led the study, and his French colleagues collaborated with colleagues at the University of Yaounde I in Yaounde, Cameroon, where the rate of SCD and SCT is significantly higher than in France. The researchers recruited 18 volunteers with SCT and 22 others without this trait. Each group was further subdivided into those who had exercised consistently for several years by playing soccer for at least eight hours per week and those who considered themselves sedentary for at least the last two years.

Each volunteer's blood was tested for the presence of molecules that signal oxidative stress, others that act as antioxidants, and nitric oxide metabolites. These volunteers then pedaled on a stationary bicycle, with the researchers ratcheting up the workout's intensity every few minutes until the volunteers bowed out from exhaustion. After the workout, the

researchers tested the volunteers' blood again at regular intervals to assess the same molecules.

Results showed that well-trained volunteers with SCT had significantly lower levels of molecules associated with oxidative stress, higher levels of antioxidant molecules, and higher levels of nitric oxide metabolites than untrained volunteers with SCT.

Results Could Apply to SCD

These results suggest that regular exercise might help combat the problems likely caused by oxidative stress that increase morbidity and mortality in people with SCT, Pialoux says. "In this population, regular physical activity might be seen as a treatment," he adds.

The findings could hold promise for patients with SCD as well, he says. Since exercise is known to trigger the painful and damaging episodes known as sickle cell crisis, in which large red blood cells become sickled and block blood vessels, doctors often advise SCD patients to avoid exercise. However, if these patients exercise regularly and become trained over time, the associated reduction in oxidative stress might improve their condition, Pialoux explains.

"We think that regular physical exercise that's controlled by a physician and performed at low intensity could be a strategy to limit the disease burden in SCD patients," he says. He and his colleagues are currently testing this strategy in animal models of the disease, with plans to eventually test human subjects.

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