

IRON ANEMIA

Young women with low body iron, but who are not quite anemic, must use more effort to do the same amount of physical work or exercise than women who are not iron-deficient, according to several new Cornell University studies.

In some of the first studies to look at iron-depleted women who are not anemic, about 16 percent of U.S. women and 40 to 80 percent of women in developing countries . Cornell nutritionists have determined that work capacity and physical performance are significantly impaired compared with women with normal iron levels. Worse, women usually are unaware of their iron depletion, and physically active women and vegetarians are at particularly high risk for iron depletion, the researchers point out.

"This suggests that millions of women are impaired and working harder than they need to for the same amount of exercise or physical work," said Jere Haas, Ph.D., the Nancy Schlegel Meinig Professor of Maternal and Child Nutrition at Cornell and co-director of the Cornell Program in International Nutrition.

"In developing countries, where about 40 percent of women are anemic and another 40 percent are iron-depleted without anemia, low iron stores can have dramatic consequences on a woman's ability to do physical work and make a living," said Haas, who studies the functional consequences of mild to moderate forms of malnutrition worldwide.

Studies provide mounting evidence that iron depletion without anemia should be a concern. Other researchers have recently reported that moderate iron deficiency also compromises memory and verbal learning in teen-agers. Iron is an essential component of hemoglobin in the blood and plays an important role in oxygen transport and utilization. When people consume iron-deficient diets, they first deplete their iron stores in the liver; at the final stage, they become anemic due to insufficient iron to produce new red blood cells. Haas and Zhu focus on the first stage, while most medical practitioners are interested in the final stage.

Iron deficiency is the leading micronutrient deficiency in the world, in both developed and developing countries. Women are 10 times more likely to be iron-deficient than men, yet low iron status among men is fairly common in developing nations.

Although the health and functional consequences of anemia, including fatigue and impaired endurance and more health problems during and after pregnancy -- are well- documented, few researchers have looked at the functional consequences of iron depletion without anemia. They do know from previous studies, however, that iron-deficient but non-anemic rats have impaired endurance capacity when compared with normal rats.

Researchers set out to determine whether mild iron deficiencies affect work. Since studying women working in fields would be too difficult, they assessed the physical performance of women working out on exercise bikes.

First, they compared 15 normal women with 15 iron-depleted non-anemic women exercising at their maximum level of effort. They found that iron-depleted women had lower physical work capacity, and their performance was related to the amount of stored body iron. Women who are not anemic but iron-depleted are impaired in oxygen utilization.

Next, the researchers assessed iron-depleted women at more normal exercising or work levels, about 70 percent of maximum effort. In a double-blind trial, half the women were given daily 135 mg. iron supplements and the other half a placebo for eight weeks. The body iron stores of the women without supplementation remained constant while that of the supplemented group improved even though these women were not anemic. Further, the supplemented group was about 5 percent more efficient in their use of energy to perform the same amount of work.

Only one woman became anemic during the study, but in the rest of the placebo group, saw a significant reduction in their physical performance compared with the supplemented group. This suggests that iron depletion not severe enough to cause anemia reduces performance potential at submaximum work levels as well.

Currently, the researchers are assessing whether iron-depleted women reap the same physical benefits from physical training as women with higher iron status. It is suspected that iron-deficient women will not benefit from the training as much as women with higher iron status because their metabolic responses to exercise are impaired.

Now that the researchers have established some physical markers that reflect work performance and iron status, they hope to quantify physical effort expended to do work under field conditions. Haas is now testing his methodology among agricultural workers in Bolivia.

To improve iron status through diet, it is recommended eating red meat. For vegetarians, they recommend consuming orange juice (vitamin C) with meals to improve absorption from iron-rich foods such as legumes, whole grains and green vegetables.