SOUTHWESTERN NEWS

Media contact: Jennifer Haigh
214/648-3404
email: jhaigh@mednet.swmed.edu

RESEARCHERS DISCOVER WHY SOME ATHLETES' PERFORMANCES FAIL TO IMPROVE ON A LIVE-HIGH, TRAIN-LOW REGIMEN

DALLAS – December 30, 1998 – Exercise physiology researchers at UT Southwestern Medical Center at Dallas have learned why certain athletes don't respond to the internationally accepted "live-high, train-low" paradigm. The regimen – essentially living in the thin mountain air while training at lower altitudes to increase athletic endurance – is not effective in athletes unable to produce a sustained amount of a crucial red blood cell-increasing hormone.

"We've figured out some of the differences between the athletes who do and don't respond to altitude training. So now we hope to extend this research and predict who will and who won't respond with a screening test," said Dr. Benjamin Levine, associate professor of internal medicine at UT Southwestern and director of the Institute for Exercise and Environmental Medicine (IEEM) – a collaboration between UT Southwestern and Presbyterian Hospital of Dallas.

Exercise physiologists have known for years that, in most cases, the body responds to high altitude by producing more red blood cells to boost oxygen levels. That formed the basis of Levine's original 1997 study performed in collaboration with Dr. James Stray-Gundersen, a former assistant professor of surgery at UT Southwestern who now works with Norway's Olympic ski team.

The new study was published in the October issue of *Journal of Applied Physiology.* Levine's team, including Stray-Gundersen and UT Southwestern postdoctoral fellow Dr. Robert Chapman, looked at data from previous altitude studies, specifically, erythropoietin (EPO) concentrations in 39 collegiate runners living at high altitudes. Those who responded to the live-high, train-low regimen showed a significantly larger increase in EPO concentration than the nonresponders. The researchers theorized that this increased EPO concentration allows the body to make more red cells while at high altitudes and that, in turn, increases maximal oxygen uptake, which was shown through higher scores in a laboratory test that measured ability to do aerobic work. To confirm the hypothesis, the researchers looked at the responses of 22 competitive distance runners who completed four weeks of altitude training.

"As we showed with the collegiate-level athletes, the responders among the elite athletes also had a significantly larger increase in mean EPO concentration compared with the nonresponders," Levine said. "After 14 days at high altitude, responders still had a significantly higher mean EPO concentration than at

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prealtitude. However, there was no significant difference between the mean EPO concentration prealtitude and after 14 days in the nonresponders."

Furthermore, the researchers tabulated an increase of 8 percent in total red blood cell volume in the responders, with no change in the nonresponders after four weeks at high altitude.

Levine said the athletes didn't get better simply because they thought they got better. "There is a clear, strong physiological mechanism that is related to sufficiently large and sustained increases in EPO, the production of more red blood cells, and consequently greater aerobic power, which translates into increased speed on the track," he said.

Levine hypothesizes that EPO production is a genetically determined capability: People either can't make enough EPO generally, or they can't sustain the increased levels long enough to produce new red blood cells at high altitudes.

The study may have profound implications for gung-ho elite athletes who relocate to Utah or other high-altitude states to obtain that perfect altitude-living prescription. Essentially, researchers say that nonresponders usually don't benefit from a move.

The researchers now aim to fine tune the high-low prescription. Some people classified as nonresponders may respond when training at altitudes higher than what's considered moderate-high altitude.

In a new study funded by the United States Olympic Committee, Levine will study 24 athletes this summer, placing them in an altitude chamber one night a week for four weeks at simulated altitudes of 6,000 feet, 7,000 feet, 8,000 feet and 9,000 feet to try to determine what the optimal altitude is for each person. The athletes will then be randomly assigned to live at 6,000 feet, the altitude of the United States Olympic Committee's training center in Utah, and at 7,000 feet, 8,000 feet and 9,000 feet.

"What we expect to see is the bigger the increase in EPO, the more red blood cells you'll make at a given altitude," Levine said. "It's a dose-response relationship. Think of altitude like a medicine: Get the dose right, and without bad side effects, the patient gets better."

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