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Researcher Discovers How Lance Armstrong Keeps On Winning



A marked improvement in muscle efficiency and large reductions in body fat and body weight are keys to Tour de France winner Lance Armstrong's cycling success, according to a seven-year study by University of Texas at Austin professor Ed Coyle.

In his study of the six-time consecutive Grand Champion Tour de France winner, Coyle documented physiological changes in the elite endurance athlete, discovering that, among other things, Armstrong's overall cycling power improved by eight percent through increased muscle efficiency and his cycling power per pound of body weight increased by 18 percent.

Coyle studied physical determinants of Armstrong's endurance, such as oxygen uptake and muscle efficiency, from the time Armstrong was 21 until he was 28 and found that, in addition to gaining muscle efficiency, Armstrong also had significant reductions in body fat and weight in the months before the Tour de France competition.

"Lance has learned how to reduce his body weight and body fat by 10 pounds prior to each of his Tour de France victories," said Coyle, director of the Human Performance Laboratory in the College of Education's Department of Kinesiology and Health Education. "As a result, he's increased his power per kilogram of body weight by a remarkable 18 percent – this is a tremendous benefit when he's cycling up steep mountains in France, for example."

In addition to being of great interest because it is a rare longitudinal examination of a hard-training endurance athlete, Coyle's study is unique because his subject, Armstrong, was diagnosed with and treated for cancer during the seven years of research.

"The fact that Lance was diagnosed with testicular cancer and received chemotherapy and surgery when he was 25 years old did not seem to hamper his long-term progress," said Coyle. "He lost a little bit of training time, but the physical effect on his cardiovascular conditioning was negligible. When tested in our laboratory eight months after cessation of chemotherapy, Lance's results were right in line with measurements expected from highly trained athletes during brief lapses in training."

To document Armstrong's physical performance over the years, Coyle has hooked him up to a machine in the Human Performance Laboratory that reports the amount of cycling power Armstrong generates when he consumes a given amount of oxygen.

"Over the seven years we studied Lance, his maturation as a cyclist has been marked by a steady increase in cycling power," said Coyle. "This increase translates directly into power and velocity when he's racing. Given that only a one to three percent difference separates the winner from the middle of the pack in most Olympic finals, an eight percent improvement in efficiency is absolutely astounding!"

As Coyle points out, the best way to absorb the magnitude of Armstrong's physical power and endurance is to compare him to others. In one hour of bike riding, Armstrong can cover 32 miles as opposed to the 21 miles a top runner could cover on a bike and the 16 miles an average cyclist could cover.

Armstrong possesses a large, strong heart that can beat over 200 times a minute operating at maximum capacity and pump an exceptionally large volume of blood and oxygen to his legs – only around 100 other men on earth, who have been tested, have comparable abilities and only two other competitive cyclists that Coyle has tested in the past 20 years have even come close to Armstrong's 200 heartbeats per minute.

If a normal male college student were to train at a grueling pace for two or more years, the student's maximum oxygen uptake would not increase above 60 ml/kg/min – Coyle estimates that even if Armstrong became a couch potato, his would not dip below 60 ml/kg/min.

"Endurance cycling requires that a number of body parts be exceptional," said Coyle. "We're talking about the size of the heart and its pumping ability, the number of blood vessels that deliver oxygen to leg muscles and

the biochemical proteins in muscle that generate power and resist fatigue, or that 'burn' you feel, for example.

"Lance does indeed have all of these things, but, equally important, he has nurtured his 'natural' talent with a tough-minded, scientific approach to training, mental fortitude and that indefinable something we call 'competitive drive.'"

- Kay Randall, Office of the Vice President for Public Affairs, 512-232-3910

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