

RSNA Press Release

New Study Reports Effects of Endurance Running

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At A Glance

- MRI shows the effects of long-distance running on the body.
- The first tissue affected by running is fat tissue.
- Runners who stop running regularly should reduce their calories and opt for a different aerobic exercise to avoid weight gain.

CHICAGO — Using a mobile MRI unit, researchers followed runners for two months along a 4,500-kilometer course to study how their bodies responded to the high-stress conditions of an ultra-long-distance race, according to a study presented today at the annual meeting of the Radiological Society of North America (RSNA).

"Due to the exceptional setting of this study, we could acquire huge amounts of unique data regarding how endurance running affects the body's muscle and body fat," said Uwe Schütz, M.D., a specialist in orthopedics and trauma surgery in the Department of Diagnostic and Interventional Radiology at the University Hospital of Ulm in Germany. "Much of what we have learned so far can also be applied to the average runner."

The TransEurope-FootRace 2009 took place from April 19 to June 21, 2009. It started in southern Italy and traversed approximately 4,488 kilometers to the North Cape in Norway. Forty-four of the runners (66 percent) agreed to participate in the study.

Urine and blood samples as well as biometric data were collected daily. The runners were also randomly assigned to other exams, including electrocardiograms, during the course of the study. Twenty-two of the runners in the study underwent a

whole-body MRI exam approximately every three or four days during the race, totaling 15 to 17 exams over a period of 64 days. At the close of the race, researchers began to evaluate the data to determine, among other things, stress-induced changes in the legs and feet from running. Whole-body volume, body fat, visceral fat, abdominal subcutaneous adipose tissue (SCAT), and fat and skeletal muscle of the lower extremities were measured. Advanced MRI techniques allowed the researchers to quantify muscle tissue, fat and cartilage changes. According to Dr. Schütz, MRI is the gold standard for the evaluation of the musculoskeletal system of the runner.

The results showed that runners lost an average of 5.4 percent body volume during the course of the race, most of which was in the first 2,000 kilometers. They lost 40 percent of their body fat in the first half of the race and 50 percent over the duration of the race. Loss of muscle volume in the leg averaged 7 percent.

"One of the surprising things we found is that despite the daily running, the leg muscles of the athletes actually degenerated because of the immense energy consumption," Dr. Schütz said.

While most people do not run to this extreme, several of the study's other findings still have implications for the marathon runner and even the recreational runner, according to Dr. Schütz.

For example, the results showed that some leg injuries are safe to "run through." If a runner has intermuscular inflammation in the upper or lower legs, it is usually possible to continue running without risk of further tissue damage. Other overuse injuries, such as joint inflammation, carry more risk of progression, but not always with persistent damage.

"The rule that 'if there is pain, you should stop running' is not always correct," Dr. Schütz said.

Another key finding of the study was that the first tissue affected by running was fat tissue. More importantly, visceral fat loss (mean 70 percent) occurred much earlier in the running process than previously thought. Visceral fat is the most dangerous fat and is linked to cardiovascular disease. The findings also revealed that the greatest amount of overall fat loss appeared early in the process.

"When you just begin running, the effects of fat reduction are more pronounced than in athletes who have been running their whole life," Dr. Schütz said. "But you should do this sport constantly over the years. If you stop running for a long time, you need to reduce your caloric input or opt for other aerobic exercises to avoid experiencing weight gain."

Coauthors are Jürgen Machann, M.D., and Christian Billich, M.D.

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Note: Copies of RSNA 2010 news releases and electronic images will be available online at [RSNA.org/press10](https://www.rsna.org/press10) beginning Monday, Nov. 29.

RSNA is an association of more than 44,000 radiologists, radiation oncologists, medical physicists and related scientists committed to excellence in patient care through education and research. The Society is based in Oak Brook, Ill. (RSNA.org)

Editor's note: The data in these releases may differ from those in the published abstract and those actually presented at the meeting, as researchers continue to update their data right up until the meeting. To ensure you are using the most up-to-date information, please call the RSNA Newsroom at 1-312-949-3233.

For patient-friendly information on MRI, visit RadiologyInfo.org.

Abstract:	<ul style="list-style-type: none">• Longitudinal Follow-up of Changes of Body Tissue Composition in Ultra-Endurance Runners during 4.500 km Trans Europe Foot Race 2009 Measured by Whole-Body MR Imaging on a Mobile MR Imaging Truck-trailer
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[Press conference video](#)

Video clips

- MP4 format
 1. [Video clip](#) (1.41 Mbyte)
31_Trittau_Bernhard_Zach_arrival.mp4: Footage showing runners crossing the finish line on day 31 of 64 of the TransEurope-FootRace.
 2. [Video clip](#) (1.39 Mbyte)
mri_Japanese_runner_2.mp4: Footage showing a runner undergoing a magnetic resonance (MR) exam in the mobile truck unit.
 3. [Video clip](#) (0.8 Mbyte)
mri_Japanese_runner_4.mp4: Footage showing a runner undergoing a magnetic resonance (MR) exam in the mobile truck unit.

Images (.JPG format)

Figure 1: A photograph of the mobile magnetic resonance imaging (MRI) unit.

[High-res \(TIF\) version](#)
(Right-click and Save As)

Figure 2: A patient entering the magnetic resonance imaging (MRI) unit.

[High-res \(TIF\) version](#)
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Figure 3: Magnetic resonance (MR) images showing slices of a patient's upper trunk, pelvis and upper legs that indicate loss of fat tissue.

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Figure 4: Magnetic resonance (MR) images of three slices of a 51-year-old male patient's right upper leg. The thin arrows indicate neurovascular bundles; * indicates fatty tissue

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inflammation; ** indicates intermuscular inflammation; + indicates muscle inflammation

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Figure 4a: Magnetic resonance (MR) image of a slice of a 51-year-old male patient's right upper leg. The thin arrows indicate neurovascular bundles; * indicates fatty tissue inflammation; ** indicates intermuscular inflammation; + indicates muscle inflammation.

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Figure 5: Magnetic resonance (MR) image of the brain showing loss of gray matter volume.
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Figure 5a: A series of magnetic resonance (MR) images of the brain showing loss of gray matter volume.
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Figure 6: Magnetic resonance (MR) images of a 46-year-old male patient's knees. The arrows indicate possible retropatellar arthritis.
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Figure 7: Magnetic resonance (MR) images of slices of a patient's leg. The large arrow indicates a muscle bundle rupture. The thin arrows

Avanto 1: A photograph of a Siemens Avanto MRI machine.
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Avanto 2: A photograph of a Siemens Avanto MRI machine.
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Avanto 3: A photograph of a Siemens Avanto MRI machine.
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