Was ability to run early man's Achilles heel?

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The earliest humans almost certainly walked upright on two legs but may have struggled to run at even half the speed of modern man, new research suggests.

The University of Manchester study – presented to the BA (British Association for the Advancement of Science) Festival of Science in York on Tuesday – proposes that if early humans lacked an Achilles tendon, as modern chimps and gorillas do, then their ability to run would have been severely compromised.

“Our research supports the belief that the earliest humans used efficient bipedal walking rather than chimp-like ‘Groucho’ walking,” said Dr Bill Sellers, who led the research in the University’s Faculty of Life Sciences.

“But if, as seems likely, early humans lacked an Achilles tendon then whilst their ability to walk would be largely unaffected our work suggests running effectiveness would be greatly reduced with top speeds halved and energy costs more than doubled.

“Efficient running would have been essential to allow our ancestors to move from a largely herbivorous diet to the much more familiar hunting activities associated with later humans. What we need to discover now is when in our evolution did we develop an Achilles tendon as knowing this will help unravel the mystery of our origins.”

Dr Sellers, who recently published research on the running speeds of five meat-eating dinosaurs, used the same computer software to generate a

humanoid bipedal computer model using data from a hominid fossil skeleton called 'Lucy' and hominid footprints preserved in ash at Laetoli in Tanzania.

"The skeletons and footprints from some of the earliest members of the human lineage – the early hominids – provide the best clues we have to how we progressed down the pathway to modern human walking and running," said Dr Sellers.

"We have borrowed techniques from other scientific disciplines - robotics, computer science and biomechanics - in an attempt to 'reverse engineer' fossil skeletons; we use what we know about skeletons and the muscles to build a computer model of the fossil species we are interested in.

"This model is a virtual robot where we can activate muscles and get it to move its legs in a physically realistic fashion; the tricky bit is getting it to actually walk or run without falling over.

"However, if we use big enough computers and let the model fall over enough times it is possible for the simulation to learn which muscles to fire and when in order to get the model to walk properly. Even better we can ask the computer to find ways of minimising fuel cost and maximising top speed since that is what we think animals have to do."

Dr Sellers initially looked at walking and his models suggested that even as early as 3.5 million years ago our human ancestors were able to walk as efficiently as modern humans. His research also showed that they preferred to walk a little slower than we do but only because they were much smaller and had quite short legs.

The team also used the computer model to look at particular parts of the human locomotion system, including the Achilles tendon, which they

showed acts like a big spring to store energy during running; when the tendon was removed from the model the top running speed was greatly reduced.

“We have only just started to look at running and so there are still plenty of questions to answer,” said Dr Sellers. “But whilst these very early fossils could walk well, our initial findings suggest that efficient running came about quite a bit later in the fossil record.

“How we evolved from our common ancestor with chimpanzees six million years ago is a fundamental question. Walking upright seems to be the very first thing that distinguishes our ancestors from other apes, so finding out about this should help us map the evolutionary pathway to modern humans.

“The next really interesting question is to look in more detail at running. It has been suggested that our ability to run for long distances took a lot longer to evolve than our ability to walk and that this is a defining feature of our very close relatives in our genus. Our techniques should let us get to the bottom of this question because it will let us measure the running abilities of our fossil ancestors directly.”

Source: University of Manchester