

Nepalese porters do it the hard way

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If you've ever found yourself struggling under a heavy pile of suitcases at the end of a holiday, spare a thought for the porters in some of the planet's most remote locations.

"When you start looking around, professional porters all around the world carry loads supported by their heads", says Norman Heglund, from the Université catholique de Louvain, Belgium, who is fascinated by the techniques that allow people to carry heavy burdens for lengthy periods. Previously, Heglund had investigated how the Kikuyu and Luo women in Kenya carry water on their heads, and he discovered that they have a unique trick where they transfer their weight from one foot to the other extremely effectively. This allows them to conserve up to 80% of the energy from the previous step, enabling them to carry loads of up to 20% of their body weight with no additional effort. "Then we were thinking, who are the most famous porters in the world... and the Nepalese are reputed to be the best load carriers", says Heglund, adding, 'so we decided to go look at them". The team realised that unlike the African women, Nepalese porters do not use any energy conserving mechanisms to ease their burdens. The porters' superhuman load bearing marathons are powered by extreme exertion alone and the team of scientists publishes this discovery in *Journal of Experimental Biology*.

Shipping one tonne of equipment from Belgium to Nepal and selecting Phakding in the Everest valley as his base, Heglund recalls hiring about 30 porters and a dozen yaks to haul the equipment half a day's hike up to the settlement. As Phakding is on the path to Namche - which hosts a weekly bazaar that supplies the local population - Heglund knew that

there would be a steady stream of male and female porters hauling cargo on the 10-day trek from which he could recruit volunteers. "The first thing we did was put a bathroom scale out with the equivalent of a lemonade stand and we said, "If you stop, let us weight you, weigh your loads, we will give you a glass of lemonade", and virtually everybody did", recalls Heglund. Then he and his colleagues Guillaume Bastien, Patrick Willems and Benedicte Schepens asked some of the volunteers to walk back and forth across a force plate at various speeds, carrying loads ranging from 0 to 154% of their weight in baskets suspended from straps across their foreheads. The team also filmed the porters' movements, and Bastien later used the footage to calculate the amount of mechanical work performed by each of the participants' limbs as they carried their burdens.

However, when the team compared the energy transferred between steps when the Nepalese porters were loaded and unloaded with the steps of European volunteers, they were surprised that the Nepalese were not using any energy-conserving tricks to help them carry their extraordinary loads. "They are doing nothing special", says Heglund. Instead, they found that the porters were moving at a relatively slow speed of around 3-4km/h and took frequent breaks, walking sometimes for as little as 15s before resting for another 45s, to ensure that they never had to revert to costly anaerobic metabolism. Even when the porters were in danger of missing their Saturday market deadline, they never walked faster, preferring instead to walk late into the night to make up time.

Admitting that he was initially disappointed that the Nepalese porters did not use any special adaptations to conserve energy, Heglund explains that in retrospect this may not be so surprising. "These guys don't ever take two steps on the same level", he says, which prevents them from moving economically. And he concludes that this makes it 'all the more awe-inspiring that they carry these heavy loads up and down hills at high altitude as they do it the hard way".

More information: Bastien, G. J., Willems, P. A., Schepens, B. and Heglund, N. C. (2016). The mechanics of head-supported load carriage by Nepalese porters. *J. Exp. Biol.* 219, 3626-3634. [DOI: 10.1242/jeb.143875](https://doi.org/10.1242/jeb.143875)

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