ICU
MANAGEMENT & PRACTICE

Sherpas Have Superhuman Energy Efficiency

New research suggests that Sherpas are superhuman mountain climbers and are extremely efficient at producing energy to power their bodies even when oxygen is scarce. Findings are published in the Proceedings of the National Academy of Sciences (PNAS).

These findings could enable scientists to develop new ways to treat hypoxia in patients. A large number of patients in the ICU experience life-threatening hypoxia and it is a complication that is commonly associated with conditions from haemorrhage to sepsis. When patients suffer from hypoxia, their body is forced to work harder so that their brain and muscles get the essential nutrient. When a person's body suffers from a lack of oxygen, it starts to produce more red blood cells which in turn makes the blood thicker making it flow slowly which in effect leads to clogged blood vessels.

Mountain climbers are often exposed to situations at high altitudes where oxygen is scarce. That is probably why they carry oxygen supplies to supplement the thin air and also take time during long ascents so that their body is able to adapt itself to the new surroundings. Different people respond differently to high altitudes. For example most climbers require additional oxygen to scale Mount Everest whose peak is 8,848m above sea level but there are some who have managed to do so without any additional supplies. Among the most notable are the Sherpas, an ethnic group of people from Nepal, who live at high altitude without any negative consequences to their health. Many of them act as guides for expeditions in the Himalayas and two Sherpas have reached the summit of Mount Everest 21 times.

Studies suggest that there are differences between the Sherpas and lowlanders such as lower blood cells in Sherpas at altitude and higher levels of nitric oxide. Recent DNA studies also confirm clear genetic differences between Sherpa and Tibetan populations and lowlanders.

A team of researchers at the University of Cambridge set out to understand the specific biological differences between the Sherpas and the lowlanders. They followed two groups on a gradual ascent up to Everest Base Camp at an elevation of 5,300m. This study was part of Xtreme Everest, a project that aims to understand how bodies respond to extreme altitudes and how outcomes can be improved in patients who become critically ill.

The lowlanders group included 10 investigators who took blood samples and muscle biopsies at baseline and again when they arrived at Base Camp and a third time after two months at Base Camp. Samples were then compared with those taken from 15 Sherpas who were living in low-lying areas and were not high altitude climbers.

Findings showed that even at baseline, the Sherpas mitochondria were more efficient at using oxygen to produce ATP. In addition, Sherpas had lower levels of fat oxidation which suggested that the Sherpas could generate energy more efficiently. For the Sherpas, measurements at baseline and altitude rarely changed but for lowlanders, measurements changed after time spent at altitude. A key difference between the two groups was in phosphocreatine levels. In lowlanders, phosphocreatine levels crashed after two months while in the Sherpas, the levels increased. Levels of free radicals remained low in Sherpas at high altitude but increased in lowlanders.

Senior author Dr Andrew Murray from the University of Cambridge explains that the Sherpas have spent thousands of years at high altitudes and have become more efficient at using oxygen and generating energy. While lowlanders also adapt and become more "Sherpa-like" at high altitudes, they still cannot match the efficiency of the Sherpas.

Study findings could provide valuable insight for patients suffering from hypoxia as a lack of oxygen in the ICU can be life-threatening for the patient.

Professor Mike Grocott, Chair of Xtreme Everest from the University of Southampton says, ""By understanding how Sherpas are able to survive with low levels of oxygen, we can get clues to help us identify those at greatest risk in ICUs and inform the development of better treatments to help in their recovery."

Source: University of Cambridge
Image Credit: Pixabay

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