

Turn up the heat to increase altitude tolerance

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Altitude training is a popular method for athletes wanting to improve their physical performance. At high altitudes oxygen levels are low and blood cells compensate by increasing the number of red blood cells. This enables an enhanced performance at lower altitudes because more oxygen can be delivered to the muscles.

Many companies now offer [altitude training](#) in specialist chambers (often referred to as normobaric [training](#)) as an alternative to lowered so our bodies compensate by increasing the number of red blood cells traveling to a high altitude country (hypobaric training), which is costly in terms of both time and money.

New research reported in the open-access journal *Frontiers in Physiology*, suggests that heat-based exercise can offer a more efficient means of improving altitude tolerance and [physical performance](#) than normobaric altitude training can provide.

"We show that when the duration and frequency of training performed in heat or at altitude are the same, the heat-based training can offer a more obtainable and time-efficient method to improving tolerance to altitude," says Dr. Ben J. Lee, who completed this study as part of his PhD research at the University of Coventry. This is the first investigation that compares the effects of heat and low-oxygen training side by side.

Dr. Lee and his co-authors asked a number of male cyclists to perform a time trial and tested their tolerance to low-oxygen levels before and after

a series of ten daily 60 minute training sessions in either low-oxygen or hot conditions. In addition, blood samples were taken to see how their cells responded to the different training methods experienced by the cyclists.

The results were very interesting. Heat-based training reduced the physical strain experienced by the cyclists, as measured by their temperature and heart rates, as well as improved their time-trial performance. These positive effects matched those experienced by the cyclists that undertook low-oxygen training. The blood analysis showed that the stress response at a cellular level was also the same, indicating that there was little difference between the two exercise methods.

"There are many companies that provide normobaric altitude training and acclimation sessions prior to completing mountainous treks. However, the evidence that this form of training offers any enhanced adaptation to 'real world' altitude is limited. Therefore people preparing for an altitude trek may be better off training with a heat stimulus rather than paying for expensive altitude sessions," suggests Dr. Lee.

The authors of the study stress there are some limitations to their findings, with the results only relevant to the recreational, rather than high-performance, athlete. In addition, the cyclists were not tested for their performance at high altitudes. "Our results have only been tested using artificial [altitude oxygen levels](#) and not real-world altitudes," explains Dr Lee.

While further research is needed, this study clearly indicates that heat-based training may be relevant to athletes and military personnel requiring a time- and cost-efficient way of preparing for [high altitudes](#).

More information: Ben J. Lee et al. Cross Acclimation between Heat and Hypoxia: Heat Acclimation Improves Cellular Tolerance and

Exercise Performance in Acute Normobaric Hypoxia, *Frontiers in Physiology* (2016). [DOI: 10.3389/fphys.2016.00078](https://doi.org/10.3389/fphys.2016.00078)

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