

SIMULATED ALTITUDE: LEGAL AND ETHICAL ISSUES

Recently, the use of simulated altitude by elite athletes has come under review by WADA. The rationale behind the WADA review is related to the fact that WADA officials are concerned that some athletes who are exploiting illegal erythropoietic agents are making use of "utilization of simulated altitude" as a false explanation for their abnormally elevated hemoglobin and hematocrit levels, thereby circumventing WADA's Prohibited Substance/Method List. WADA considers "artificially induced hypoxic conditions" to include hypobaric hypoxia (barometric pressure chamber), normobaric hypoxia via nitrogen dilution (nitrogen apartment; Altitrainer 200 hypoxicator), or normobaric hypoxia via oxygen filtration (hypoxic apartment/tent; Go2Altitude hypoxicator).

For a substance/method to be placed on WADA's prohibited list, it must meet two of the following three criteria (35):

1. Scientific evidence or experience demonstrates that the method or substance has the potential to enhance, or enhances sport performance.
2. Medical evidence or experience suggests that the use of the substance or method represents an actual or potential health risk to the athlete.
3. The use of the substance or method violates the spirit of sport.

The WADA scientific, medical and ethics committees have thoroughly evaluated the evidence regarding "artificially induced hypoxic conditions" and reached the following conclusions in May 2006 (35):

1. Artificially induced hypoxic conditions can significantly enhance performance when properly applied, by increasing the endogenous production of EPO with a subsequent elevation of red blood cell production and a better oxygen transfer to the muscles.
2. Under proper medical supervision, when reliable equipment was used, and when moderate altitude simulation was reproduced, no significant signs of health risk were reported.
3. After consultations with the WADA ethics review panel, it was concluded unanimously that artificially induced hypoxic conditions should be considered as violating the WADA spirit of sport criterion.

Collectively, these conclusions made by the WADA scientific, medical and ethics committees indicated that criteria 1 and 3 had been satisfied, and therefore "artificially induced hypoxic conditions" were to be considered for inclusion on the WADA prohibited list for 2007. In response to these initial conclusions, WADA conducted additional consultations throughout the summer of 2006 with its stakeholders, as well as scientific experts in the area of altitude/hypoxic training. The debate was amplified when several members of the international scientific

community responded collectively in opposition to WADA's consideration of banning simulated altitude devices (<http://altitudeforall.info/index.html>).

The final decision regarding artificially induced hypoxic conditions was made in September 2006 by the WADA executive committee and announced by WADA Chairman Richard Pound as follows:

"In response to our stakeholders who requested that there be full consideration of hypoxic conditions in the context of the prohibited list, WADA performed a scientific and ethical review of the matter, and engaged in a thorough consultation with experts and stakeholders. While we do not deem this method appropriate for inclusion on the list at this time, we still wish to express the concern that, in addition to the results varying individually from case to case, use of this method may pose health risks if not properly implemented and under medical supervision." (<http://altitudeforall.info/index.html>)

This statement indicated that WADA does not prohibit the use of "artificially induced hypoxic conditions" by elite athletes, at least through 2007. However, it should be noted that all "hypobaric/hypoxic practices are [currently] prohibited" in Italy, as mandated by the Italian Health Ministry in June 2005 (Decree of the Italian Ministry of Health 13.04.2005. Section 5, subsection M.1, June 3, 2005) in response to an incident involving professional cyclists competing in the 2005 Giro d'Italia (stage 10; May 18, 2005). The Italian law regarding simulated altitude is totally independent of any current and future WADA rulings, and presently has judicial precedence over any WADA rulings in areas of Italian jurisdiction. Finally, the International Olympic Committee has prohibited the use of simulated altitude devices within the boundaries of the Olympic Village since the 2000 Sydney Olympics, and this mandate is expected to apply to all future summer and winter Olympic Games.

SUMMARY

Many contemporary elite endurance athletes in summer and winter sport incorporate some form of altitude/hypoxic training within their year-round training plan, believing that it will provide the competitive edge to succeed at the Olympic level. This paper has presented both anecdotal and scientific evidence relative to the efficacy of several contemporary altitude/hypoxic training models and devices currently used by Olympic-level athletes for the purpose of legally enhancing performance. "Live high + train low" altitude training is employed by elite athletes using: 1) natural/terrestrial altitude, 2) normobaric hypoxia via nitrogen dilution (e.g., nitrogen apartment) or oxygen filtration

(e.g., hypoxic tent), and 3) hypobaric normoxia via supplemental oxygen. Research regarding several of these LH + TL strategies is either limited or equivocal, particularly regarding optimal LH + TL hypoxic dose, as well as the physiological mechanisms that potentially impact post-altitude performance. Regarding the safety and health aspects of LH + TL, recent evidence suggests that living at a simulated altitude > 3500 m may have an impact on immunocompetence, but this effect may not have physiologically significant consequences.

A somewhat opposite approach to LH + TL is the altitude/hypoxic training strategy of *live low + train high*, in which athletes live in a natural, normobaric normoxic environment, and train for brief intervals using simulated normobaric hypoxia via nitrogen dilution (e.g., Altitrainer 200 hypoxicator), oxygen filtration (e.g., Go2Altitude hypoxicator) or hypobaric hypoxia (barometric pressure chamber). LL + TH is used by athletes in the resting state (IHE) or during formal training sessions (IHT). Collectively, the empirical evidence regarding the efficacy of LL + TH via IHE/IHT on erythropoietic response and endurance performance is not overly persuasive, and additional research is needed in this area, especially among elite athletes. The current literature does suggest, however, that IHE/IHT may be an effective preacclimatization strategy for elite athletes prior to training or competing at altitude.

Recently, several of these altitude/hypoxic training strategies and devices underwent critical review by WADA for the purpose of potentially banning them as an illegal performance-enhancing substance/method. Ultimately, WADA decided to refrain from including artificially induced hypoxic conditions on the 2007 prohibited list. However, it should be noted that use of all hypobaric/hypoxic practices was outlawed in Italy in June 2005, and this Italian law has judicial precedence within the boundaries of Italy over any WADA rulings regarding simulated altitude. In addition, the International Olympic Committee has prohibited the use of simulated altitude devices within the boundaries of the Olympic Village since the 2000 Sydney Olympics, and this mandate is expected to apply to all future summer and winter Olympic Games.

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