



TRAINING STRATEGY

“There is an important benefit of training at altitude, an element you can not achieve by spending rest time in an artificial altitude environment”

How You’re Affected by Altitude Training

by Dr. Jack Daniels - NCAA “Coach of the Century”

There has been some recent discussion about whether various devices that simulate spending time in an “altitude” environment (breathing masks, altitude tents, altitude rooms, altitude chambers and even entire altitude houses) should be added to the list of banned substances in running. Some argue that sleeping in a reduced-oxygen pressure (simulated altitude) environment is providing a performance advantage without having to train for that advantage. Others counter that any “gain-while-resting” benefit is no different than taking vitamin or iron supplements. In both cases the idea is to increase the oxygen-carrying capacity of your blood so that your aerobic capacity improves.

Some say that a big advantage of simulated altitude environments is they allow you to train at sea level, while you live and sleep at altitude. Advocates of this type of training, “living high – training low,” believe that you’ll be able to gain all the benefits of altitude, while you complete your sea level training at a faster pace, ultimately improving your performance. Personally I have a problem with this “live high – train low” approach, and it is more from a coaching point of view than a scientist’s point of view. I prefer the altitude training method of “living high – training high”, for reasons which will be explained to you in detail below.

“Many distance runners truly believe they will not reach the same level of performance without (simulated or real) altitude training”

A RESEARCHERS PERSPECTIVE

If I’m not mistaken, the idea that training at altitude, “living high – training high”, may result in a LOSS of speed back at sea level was first put forth by Dr. Bruno Balke, with whom I studied and conducted altitude research for many years. Dr. Balke’s published claim, that you may lose speed as a result of training at altitude, followed a study we completed alongside researchers at Penn State. The Penn State subjects spent about 2 months at an altitude of about 13,000 feet, “living high – training high” in the Andes mountains, in Peru, which is quite different from the more moderate altitudes, typically 5000 to 8000 feet, where most runners train. I remember discussing the issue with one of the Penn State subjects, a guy who had run 4:08 for the mile and claimed that a good rep session for him at sea level would be 16X400 at 64 seconds, each with 1 minute recoveries. He said he was sick a fair number of days during his first couple weeks in Peru, and that by the end of his 8 weeks his best set of 400s were 8 repeats at 74 seconds each. Now one could easily conclude that 8 weeks of running no quicker than 74 second 400s may lead to a loss of feeling comfortable at a 64- or 62-second pace. This, along with the fact that in time trials at 7500 feet altitude, to which these subjects returned prior to going to sea level, they did not fare as well as another group who spent a few weeks training at 7500 feet. The higher-altitude subjects reported feeling great in these time trials, but they just weren’t going very fast – they felt they had lost some speed as a result of their high-altitude sojourn.

I have always felt it is necessary to

function both as a researcher and as a coach; and as a researcher, what was found during this study certainly suggests that speed is lost when you “live high – train high”. However, as a coach, I can’t buy into this theory.

A COACHES PERSPECTIVE

First of all, the East Africans followed such a routine to achieve the success that they’ve enjoyed in distance-running events – they live and train at their homes, at altitude. Certainly, the more successful ones make trips to compete at sea level and often spend considerable time at sea level, but their alternate altitude/sea-level exposures have been quite different from daily or several weekly trips to lower elevations for training purposes. In effect, these elite distance runners have long demonstrated that living and training at altitude is not detrimental to sea-level performance. However, one must also take into consideration that others who live and train at altitude, as is common in several South American countries, have not demonstrated the same degree of distance-running success as have the East Africans. It may be that the argument for altitude being the key to East-African running success is, in fact, inconsequential.

Yet as we explore Dr. Balke’s claims as a coach, it’s hard to swallow the notion that regular trips to lower elevations are necessary to avoid “losing your speed”. Especially since it is well known that you can run FASTER at altitude than you can at sea level! Sprint times are faster at altitude because the air is less dense and offers less resistance while pushing through it. So, we must not take for granted that you *can* practice, mechanically, running fast when at altitude.

YOUR SPEED AT ALTITUDE

Let’s further examine this idea of

losing speed as a result of training at altitude by inspecting a distance runner who trains a total of 100 miles a week. This runner is most likely running 80 to 85 of his 100 miles at an easy pace, and under no circumstance is easy running associated with speed. In fact, many runners and coaches say that easy runs should be performed at very slow paces; certainly within a rather wide range of easy paces. If, for example, a 6:20 per mile pace is 65% of a runner's max VO_2 or heart rate, then that same runner could still run an "easy" 6:20 pace at altitude using 72% of max VO_2 or heart rate (an intensity level that is still well in the range of easy running.) In any case, there doesn't seem to be a loss of speed during 80-85% of all training.

Now let's take a look at threshold pace runs, which are done at about 85-90% of VO_2 max. There is no question that the same relative intensity in your effort will be associated with a slower running speed when at altitude. For instance, running at 85% VO_2 max while at sea level will leave you with a faster time than running at 85% VO_2 max while at altitude. However, a major reason for performing threshold running is so that your body will learn to do a better job of clearing lactic acid (converting it and using it as fuel) as it's being produced. If that process happens to be accomplished at a somewhat slower absolute running speed, then so be it; it's still being done and it's hard to conclude that you are losing speed while doing so. In fact, it's hard to make the argument that threshold pace running is even "speed" running.

When you look at even faster paces of training, those associated with repetition workouts, there is little reason to believe speed will be sacrificed when at altitude. Most repetition workouts involve repeat runs lasting less than two minutes, a duration of time not really affected by being at altitude. Further, if repeat 400s demand a little longer recovery time between work bouts, nothing is lost here because the rest time associated with this type of running is of less importance

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than is the pace at which you are running. In fact, if you want to keep relatively short recoveries, just switch 400s to 300s. There is no doubt that 16X300 in 45 sec each is the same total work at the same absolute speed as are 12X400 at 60 sec each.

So, we are left with longer intervals, things like 8X1000 or 5X1mile at VO_2 max pace. In this case (as with threshold runs) the absolute pace will be a bit slower at altitude than at sea level, because your max is not as high at altitude. Still, the purpose of the workout is to stress your cardiovascular system, push the aerobic function of your exercising muscle cells to their limits, and all the while learn to deal with this fairly demanding stress. During this type of training, your heart and circulatory system are definitely challenged to their limit. There is not as much oxygen being delivered to your running muscles so they are not functioning at their absolute (sea-level) capability, but you certainly feel as bad (or often worse) than when doing the same type of training at sea level. If this is where speed is being lost, then maybe the simple answer is to not schedule this type of training during time at altitude.

One of the most important benefits of training at altitude is the "learn to hurt" benefit. One study we completed, which compared altitude-trained swimmers with swimmers who stayed at sea level, resulted in no differences in any blood parameters (for either group) and equal improvements in VO_2 max (in both groups). There were some small physiological differences (not statistically significant), but the real difference was in performance, in which the altitude-trained swimmers were clearly superior. You definitely learn to hurt during altitude workouts, and that same degree of discomfort when placed back at sea level is often associated with a faster-than-previous sea-level pace. So, if this is true, living at altitude, but training at sea level cheats you of this benefit.

YOUR TRAINING ENVIRONMENT – IT MAKES A DIFFERENCE

Consider what athletes want available to them during serious training. Most want comfortable living conditions, good food, a friendly and healthy environment, good facilities and support services, sound medical attention, and weather that is conducive to optimal training. It's tough to find a training environment with all of these ideal conditions, but if you can find one with most of them, your training will be much improved. Sometimes an athlete will move away from home to be with other athletes involved in the same pursuits, but that may not work out because home was more comfortable and included friends and familiar surroundings. If altitude is a desirable environment for athletic success, it is better to be at an altitude site that also offers many or all of the desirable characteristics mentioned above, rather than to be isolated on the top of a mountain, far from any social life or friendly faces.

"The idea that training at altitude, 'living high – training high', may result in a LOSS of speed back at sea level was first put forth by Dr. Bruno Balke"

Many distance runners truly believe they will not reach the same level of performance without (simulated or real) altitude training. We are doing a disservice to our runners if we are sending that message. Too few athletes consider all the factors involved when they think about altitude training; they may be seeking only an opportunity to be in the more-challenging environment of a lower oxygen pressure. However, if achieving that demands sacrificing other desirable characteristics of a training venue, then the overall result may not be beneficial. In the end, the individual who has a negative altitude training experience is likely to say that there is no need for altitude training; this person might even spread his belief to others. Maybe these athletes even become

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tagged as “non-responders,” those who do not benefit from altitude training. Possibly, they’ll resort to using the types of altitude-simulating devices that recent running articles refer to, with the idea that they can get the benefits of spending time in “altitude air” while still training at home.

It is possible that the thinner air at altitude isn’t beneficial for some athletes; maybe it doesn’t do anything for anyone. However, I’ve seen athletes spend time at altitude and have incredible breakthroughs in performance; these were new levels of achievement that were not temporary, even though they didn’t return to altitude for months at a time. I have also found positive changes in various physiological parameters among athletes who spent time training at altitude. Yet, was altitude the true cause of these positive changes? Or was it the fact that the subjects had just left a stressful semester of college, in a warm, humid environment, and traveled to altitude where they had nothing to do but train, eat and sleep, in cool and dry weather?

It is also important to discuss the concept that you have only a couple weeks back at sea level during which you can take advantage of any benefits you may have reaped from training at altitude. Simply put, you can forget that concern. Too many athletes, who have seen an improvement in performance following altitude training, have continued to set personal bests for weeks, months, and even years after their last visit to altitude. Certainly, if you use altitude training to prepare for a major competition, chances are that once your competition is over, you’ll back off on your training for the season, which will surely lead to a drop in performance. You’ll always experience a decline in execution if you back off in training.

YOU’RE A UNIQUE RUNNER – TRAIN THAT WAY

I look at altitude training as a type of training, something just about anyone can try. It’s like putting more mileage in your running program. Or, maybe it’s like adding more stressful speed work to your training, something you’ve always avoided doing before. After changing your training you may see positive results, or you may not. You may find that you don’t benefit from more speed work, or from more mileage, or from training at altitude. That doesn’t mean another athlete would have the same response. In fact, it doesn’t even prove that you would have the same response should you make those same training changes under different circumstances (with different training partners, better living conditions, more free time for rest, more familiar surroundings, etc.)

It’s easy to look at a champion and assume that if you train exactly as they do, you’ll become as good, or better, of a champion. It would be sad if everyone responded the same to the same set of circumstances. Fortunately, we are all individuals and free to respond to a particular set of conditions in a variety of ways. Of course, that is an important purpose of a coach – to understand how much of what type of training is sufficient for each individual runner. What develops one champion may not be the answer for any other would-be champion.

So, when you consider engaging in altitude training, know it’s not just about altitude. Training at altitude can hurt, often more than similar training at sea level. There is an important benefit of training at altitude, an element you can not achieve by spending rest time in an artificial altitude environment. Learning to hurt and carry on is part of running, and if altitude training helps you learn that, then maybe it doesn’t matter if your blood changes its makeup. Maybe

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artificially boosting the oxygen carrying capacity of your blood doesn’t teach you what being in true altitude conditions can. Maybe it doesn’t matter if hypoxic devices are banned or found legal. After all, dealing with adversity, mental stress, and physical stress are all important lessons to learn on the way to championship athletic performances.

IT WON’T MAKE YOU WORSE

As a result of the altitude research I’ve conducted with endurance athletes, I have avoided a declaration that altitude training leads to improved physiological and performance parameters; but I have concluded that training at altitude does not make you a worse performer. I have never found a subject (in all of my altitude research) that believes his or her time with us was a negative experience. The subjects never complained of losing fitness abilities or becoming a lesser athlete; on the contrary, many said they were happy they participated. That’s good enough for me.



Dr. Jack Daniels is arguably the world’s leading authority on the application of exercise physiology to training distance runners. The head distance coach at the Center for High Altitude Training at Northern Arizona, Daniels has been the NCAA “National Coach of the Year” 3 times and was also named the “NCAA Coach of the Century.”

A two-time Olympian and medalist in the modern pentathlon, Daniels turned his attention from competition to research in the early sixties. In the years that followed, he worked with a number of elite athletes, from milers Jim Ruyn and Mary Slaney, to marathoners Joan Benoit and Jerry Lawson.

Daniels has published numerous articles and books on physiology and running including the bestseller: Daniels’ Running Formula.