



OLYMPIC COACH SPORT PERFORMANCE DIVISION



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Angela Stanford of the United States (l) and Pat Hurst one of the vice-captains of the United States Team with the Solheim Cup trophy after the closing ceremony during the final day singles matches in the 2015 Solheim Cup. (Photo by David Cannon/Getty Images)

Message from the
Chief of Sport Performance
Alan Ashley



Welcome back Olympic Coach readers. We're excited to share the latest issue with you with some great information related to coach training and performance.

In late September we held the Olympic and Paralympic Assembly which is the annual gathering of the Olympic and Paralympic family to learn, inspire, and recognize outstanding accomplishments. We're also looking forward to Los Angeles being a strong bid city for the 2026 Summer Games. During the National Governing Council meetings the National Coach of the Year award winners were recognized – congratulations to this years recipients!

As we look toward Rio, we continue to focus on qualifying athletes and quota spots for our Team USA athletes. Our world championship season for summer sports are winding down, while our winter sports ramp up for what we hope will be a great year of competition.

Exciting news from our coaching education department – as we continue to identify best practices and resources for our athletes and coaches to use to improve performance, we've released the first online course from the USOC – "Mental Skills Training". This course was developed in conjunction with sport psychologists who work with Team USA top athletes in the areas of goal setting, self-talk, and energy management. The course provides practical ways to implement training programs for each of these topical areas, and also provides resources that you can use with athletes immediately. Visit the Team USA Prep Center to learn more about the course.

We continue to enjoy the feedback we receive on Olympic Coach. Please keep in touch and let us know how we can deliver information that is relevant to your coaching and training programs. See you along the Road to Rio - Go Team USA!

Technology Decision-Making Considerations for Coaches: Brain Training

Lindsay Thornton, Senior Sport Psychophysiology, United States Olympic Committee

“So, have you heard about this product that does X? The website looks good and they have a number of testimonials from Olympians on there. Is this something you are using with teams? The company reached out to me to see if I want to learn more.”

This is how an increasing number of my conversations are starting off with coaches. With a rising tide of sport-based apps, online mental assessment and training programs, and other technology-based sport applications, coaches and athletes are flooded with new products and often want guidance for separating out the high and low-value offerings. (Knowing time, money, and energy resources are limited in a busy season, and my passion for sleep as a recovery tool, I often respond to coaches that the research literature says you should bet on your athletes getting more – or higher quality – sleep rather than using a certain brain training device for cognitive, mood and physical improvements that can lead to athletic performance gains.)

I’ve developed a guide specifically for brain training products, and hope that it can provide a structure for coaches as they consider technology decisions. The Psychophysiology Training Lab (aka the Mind-Body Training Center) at the Colorado Springs Olympic Training Center has medical-grade technology for assessing and training brain waves. Looking at brain waves allows the athlete to see the objective aspect of the mental skills that we are training. Recently, a number of consumer brain training products have hit the market. They are well-marketed, often directly to athletes, and increasingly affordable as competition forces down the purchase and/or subscription price.

Before making a purchase, coaches (and athletes) should inquire about the following topics with the product manufacturer or scientific team.

Hardware: Equipment

1. In the world of brain training (often referred to as neurofeedback or brain-computer-interface, BCI), the equipment has to be powerful enough to record and amplify the electric activity of the brain, as it is recorded on the surface of the scalp. Check to see if the company has published **signal validation** work. Typically, a company will compare their EEG (electroencephalograph, or brain wave) signal quality from their new sensors against conventional/accepted sensors. This is even more important as “dry sensors” hit the market, as opposed to traditional sensors that use conductive gel to amplify the signal. Dry sensors are typically very expensive, and to have a system with multiple dry sensors available for a low cost of a few hundred dollars is an anomaly on the market right now.
2. If the sensors have the capacity to provide a valid EEG signal, are there checks in the system that allows the user to know if the signal has a **low level of resistance** during assessment and training? When a practitioner is doing neurofeedback with an athlete, he checks impedance levels

(resistance to the flow of electricity). Dead skin cells, hair gel, scar tissue, etc., between the sensor and the scalp can interfere with the EEG signal, and the skin needs to be appropriately prepped, or the sensor shifted slightly to maximize signal quality. There are some high quality amplifiers in EEG systems, but again, these are typically very expensive, and the “garbage in-garbage out” principle applies, where if the recorded signal has a lot of interference/artifacts, the feedback to the athlete will have similar levels of interference/artifacts making training less reliable.

Assuming the hardware has the capacity to produce a valid signal, and there are precautions in the system to ensure there is minimal interference with the signal, then we get to the issue of software and training.

Software: Training Concerns

1. **What is being trained during brain training?** In the clinical world, there are reasonably well-established norms for the brain wave patterns of certain disorders. As an example, with ADHD the FDA approved the use of the theta/beta power ratio to aid the diagnosis of the disorder. The theta/beta power ratio is a ratio of slow waves to fast waves, typically measured over the attentional networks in the brain. The higher the value, the more likely it is that the individual will have trouble paying attention on command. Norms are published by age groups and an individual's value can be compared against a published database that includes those with and without attentional issues.

Neurofeedback training is targeted towards teaching the individual to decrease slow wave content and boost some faster wave content in the attention networks. There have been publications of research studies that have followed participants for years after completing neurofeedback training, and attentional gains have been maintained in ADHD populations without ongoing training, which makes neurofeedback the gold standard treatment of ADHD (assuming the individual has access to training and can afford it).

In the optimal performance world, there is less agreement about what we should train, why, how training should unfold, etc. The example of a ratio to guide training like in ADHD doesn't necessarily work for athletes. Often an athlete is interested in training because they have heard that it can improve their performance. There is not a clear problem to address in training. There are still a number of mental skills that can be assessed and built upon, but there is a lower degree of certainty of what type of training might help that athlete and why. Additionally, there are different skills that are important in different sports. Diving requires a different prep than a sprint relay, which requires a different prep than soccer.

While there have been a number of publications examining the benefits of biofeedback and neurofeedback interventions with healthy populations, there have not been very many with collegiate athletes, or more elite athletes. Typically, the reason for this is that these populations are difficult to access, and once a researcher builds a relationship with a team, they have to find time around training to conduct their study. This type of data collection is subject to statistical analysis, peer review and – ideally – publication in a peer reviewed journal. When product manufacturers conduct their own research on their product, it is obviously different. They have different motivations – ideally, good ones including establishing scientific validity, but this is not always the case – and might

be looking to develop marketing material along the way. Athletes might be offered training at no cost in exchange for a quote. This should lead coaches, athletes and consumers to use a discriminating eye when reading athlete testimonials on a product website.

The difference in our knowledge of training benefits in clinical (like ADHD) populations versus athletic populations does not mean that neurofeedback training should not be done. In my case, this is what I spend a good deal of my time doing with the USOC. When a new athlete starts working in the psychophysiology lab in Colorado Springs, or in Chula Vista, I do a comprehensive assessment of their resting state brain waves with 19 sensors on the head, a task assessment to look at the way certain networks in the brain process information, behavioral performance on the task, and a semi-structured interview to better understand what their current strengths and areas for improvement are, and what things should be trained first. Training is carefully structured to match their sport demands and we (me or students from a graduate level sport psychology program that I have trained) simulate transferring the self-regulation skills we are training in the lab to the sport setting from day one. There is an ongoing conversation about whether what we do during training feels like what they need to do in competition and under pressure. We recreate distractions, using noise, video, recruiting teammates, etc., to push the athlete to develop skills that are suitable for his real world demands. No two athletes have the same training.

To flesh the concern of what is being trained out more, in neurofeedback training, you can train a whole host of things. There are many places on the scalp that you could place the sensor. A head-set that uses standard placements along the sensory midline (this is the middle of the head, from the nose to the back of the head) seems well designed. Some products use a sensor on the forehead, which is subject to a number of issues, like blinks and tension in the forehead. Unless there was a powerful processor built into the sensor that could filter out artifacts in real time, the data being shown to the athlete would lead to ineffective training, or the training goal would be achieved by reducing artifacts, specifically by blinking less or by reducing muscle tension in the forehead. While relaxing the facial muscles may have benefits for an athlete, it is not brain training.

The next issue would be which brain waves are being targeted. Are slow, fast and very fast (these have names like theta, alpha, beta, gamma and can be looked at in different ways like in amplitude or in percent of total power of the spectra, etc.) brain wave bands being inhibited or enhanced? During training, feedback is provided to an individual to either produce more or produce less of targeted brain wave speeds.

In my opinion, we should be very confident in why we are asking an athlete to increase or decrease certain brain waves at certain sites on the scalp. We have this confidence from publications where healthy or optimal performance populations were used, and performance gains were observed. We should check for the subjective report of the athlete that we are allowing him to recreate the state in the brain during neurofeedback training as it feels during sport performance.

This leads to an additional concern:

2. **Who is deciding the training parameters?** In theory, a company that has been around for a while may have a database of athlete brain wave assessments they have collected over the years, and they compare each new athlete to this database. The database highlights areas of similarity and difference between the two and would point to training goals for the individual athlete. This seems logical, and works in the clinical world. The concern I have is that unless the database is separated by sport and level, perhaps gender, how do we know if the suggested training parameters are appropriate? Consider the mental/cognitive demands of golf vs. basketball. The focus-refocus demands have different time structures built into the game, there are different opportunities, too, for the use of routines, etc. The training should look different for athletes in these two sports, just as sport psychologists would structure mental skill training for these athletes differently, and just as coaches would run practices differently.

Are training parameters set automatically? Do all athletes go through the same steps? Coaches wouldn't likely subscribe to an automated service to run their practices – even if they get ideas from books or the web, they tailor drills to their athletes. The intensity of what is expected at practice is modified according to where the team is in the season, how much recovery the athletes have had, and so forth. Automated systems may not take the current state of the athlete into account when training is being conducted. I am uncomfortable with an automated product/program that assesses brain wave self-regulation skills and trains skills without understanding the athlete, their sport demands generally and specifically, and structures training in a way that is too 'black box' for me to make sense of at the moment.

In terms of level of expertise, there are cortical patterns that are associated with novices and patterns associated with experts. This has been established in shooting and golf studies. Let's assume that there are some hockey players in the database. Just as there are different levels of skills between first and fourth line guys, there will be different levels in how refined their cortical self-regulation skills are. Are the higher and lower skilled athletes averaged together in the database? Are they separated and trend lines are used to develop a model of what is most appropriate to train based on the various skill levels?

There is another concern of using database comparisons with elite athletes. Elite athletes have atypical physical abilities, and these might be matched by atypical brainwave patterns either at rest or during task states. What if the database suggests training away these patterns? Will that reduce the athlete's ability to perform? I'm very cautious during training with athletes. We continuously check in to see if what we are doing in the lab "feels like" what happens when they are performing their best. Without a practitioner there, I am not sure how training would unfold, be modified, be transferred, and so on.

I think that what a number of new companies are doing is potentially exciting. A mobile platform for mind-body training could allow athletes to train their self-regulation skills on the road or away from a training center. In the current form of training we are doing at the USOC, the neurofeedback equipment is too expensive and cumbersome to send on the road with an athlete. The consumer market should have products that could supplement the training we do in the near future (years, not months away). I have the concerns as described above because of the confidence I have in the use of psychophysiology (biofeedback, neurofeedback) as a tool to train self-regulation skills

in athletes. I would like to make sure the cart is not put before the horse in the field and psycho-physiology training gets a bad name for having a low level of face validity or efficacy, or worse, unintended negative effects on an athlete.

One final note on training systems that have a ‘black box’ presentation: while simple feedback – a number or a red/yellow/green assessment output – may seem to be user friendly, there are limitations to overly simplistic approaches. Let’s say the number or color changes on today’s assessment or during training. The coach and the athlete are going to wonder what has changed. If you can’t peek under the hood of the box, and if you don’t have a basic understanding of self-regulation skills in the brain, you don’t know. If you can’t look at what is being measured, where, how the goal for the day was set or why that goal was selected for that day, how can the different output be made sense of? Over time, the data becomes less valuable, when in fact it might have been very valuable, but the black box output was being examined and it wasn’t useful. Automated neurofeedback training has a similar feel to me. Feedback to the athlete should be straightforward, meaning that he should be able to quickly make sense of what the feedback means and develop a strategy to meet the training parameters, then get ongoing feedback about the success of that strategy. However, when the feedback is made too simple, the athlete may lose the chance to effectively experiment with or develop his skills.

If you are approached about having your athletes test out a new brain training product, you might want to consider asking the manufacturer the following questions:

Do you have data to show the improvements made by athletes who are similar (in skill level) to mine?

- The company should be able to show you some data that was collected from a group of athletes before their product was used (pre) and then again after a certain period of time using the product (post). The pre/post comparison should show some gains. These gains shouldn’t simply be doing better at the game. They should translate to something in the real world, ideally an improvement in execution of sport skill, change in performance stats, etc. Carefully think about whether the improvements are relevant to your sport. An improvement in the ability to track more moving objects at once, or to track at faster speeds sounds great, unless you are a running coach and there is little need for your athletes to track others. If you are a soccer coach, then tracking improvements might be appealing.
- If the manufacturer responds with anything that sounds too good to be true, then be cautious as it just may be too good to be true. If lower level athletes make gains of 20 percent, think about how much of a gain your athletes might be able to make with training, and if that is worth the time and effort.

Have you conducted any studies to show how many sessions of training are required to see benefits?

- Large gains reported in a few number of sessions should sound suspicious. Just like you wouldn’t expect large gains in a short period of time from a change in coaching technique, you shouldn’t expect the same out of a brain training product.

What type of information will be given back to me and the athlete? How have other teams similar to ours used this information?

- The manufacturer should be able to show you what the feedback looks like, what it means, describe different scenarios for how the feedback has been used by athletes and coaches, etc. If the information is very difficult to make sense of, you can imagine that a user would become frustrated. If the information is overly simple and it claims to train something that is complex, then you should wonder how useful it is. With anything that comes across as a 'black box' where multiple pieces of data are put in, some mysterious analysis is performed, and a high-medium-low or green-yellow-red output comes out, you should ask questions like "how will the athlete know what to do to get from yellow to green? How do we make sense of high one day and medium the next?"

Do you have references I can call to learn more about the experience of a team like mine with your product?

- If a manufacturer is making claims about improvements in athletes, they should have a number of references that you could speak with to find out how the product is used, if they feel athletes are benefitting, if they think it's worth the money and time invested in training. If the company won't connect you with any other customers, that should sound suspicious.

Any language that emphasizes the company's database or algorithms are "proprietary," or other similarly exclusive sounding terms, should be considered carefully. Obviously companies want to make money on the products they sell, however if they cannot discuss how they are doing their brain training, what is being trained, why they are training that specific thing, what athletes are in their database and which athletes specifically your athlete will be compared to, and so forth, coaches should wonder why the company is being secretive. A product manufacturer should be able to describe the foundation of and the processes used in their product offering in language that can be made sense of by consumers. When a company ducks behind terms like "secret" and "confidential" (with no attempt to help the consumer understand concepts) that should be a cue for you to close your check book and use the time you would have devoted to the product on what we know to produce performance gains – high quality, timely feedback in practice and, to promote recovery one final time, additional physical rest and sleep.

Lindsay Thornton, EdD, is a Senior Sport Psychophysiologicalist at the United States Olympic Committee. She has her Ed.M and Ed.D from Boston University in Counseling Psychology, with a specialization in sport performance. Dr. Thornton trained under Dr. Len Zaichkowsky and Dr. Vietta Wilson for her focus in applied psychophysiology in elite sport. Dr. Thornton's doctoral work examined the application of biofeedback and neurofeedback training program to create an optimal pre-performance state and improve competitive performance. She received her neurofeedback training from Michael and Lynda Thompson in assessment and application for functional cognitive deficits. She has also received QEEG training from Jay Gunkleman and ERP training from Juri Kropotov. She is licensed as a psychologist, and is board certified in biofeedback and neurofeedback by BCIA. Dr. Thornton has developed, advised and provided training for psychophysiology labs in elite athlete training centers domestically and abroad. She has spoken at various national conferences on the influence of the mind and brain on performance and health, and reciprocally, the neurocognitive influence of exercise on cognition and emotion. She is intrigued by the prospect of identifying psychophysiological markers for elite performance and using technology to enhance recovery and performance.



In this handout image provided by the World Archery Federation, team USA celebrate in the recurve mens team gold final at the Archery World Cup on August 16, 2015 in Wroclaw, Poland. (Photo by Dean Alberga/World Archery Federation via Getty Images)

Tart Cherry Juice in Olympic and Paralympic Athletes

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Summary: Main Points for Coaches

- Tart cherry juice has many antioxidant and anti-inflammatory polyphenolic compounds, most notably a high concentration of anthocyanins.
- Cherry juice appears to improve pain and muscle strength recovery after intense exercise compared to placebo in preliminary studies, and may decrease blood markers of inflammation and oxidative stress.
- These improvements occurred in both **strength and endurance** exercise events.
- Inhibiting the body's natural oxidative/inflammatory stress response during exercise may ultimately blunt the body's adaptation response and potentially impair progress during training, therefore cherry juice may not be appropriate in this stage.
- However, the excessive oxidative/inflammatory stress occurring during single day intense training sessions, competition, and multi-day tournaments may delay return to peak form. In this stage, where **recovery (not adaptation)** is the priority, tart cherry juice may be beneficial. The additional positive effects of tart cherry juice on sleep (via melatonin) may also provide value here during this intense stage of competition.
- Timing and dosage varies widely, but most studies utilized 8-12oz (1oz if taking concentrate), twice a day, with a four to five day loading phase prior to event, and an additional two to three days after event to promote recovery.
- Therefore, if an athlete who has already peaked in training, and is looking to improve recovery and faster ability to return to competition, taking 8-12 oz. of tart cherry juice, twice a day, for at least four days before and two days after competition, may be beneficial; research suggests it may help regardless of exercise type, whether strength or endurance.

Introduction

The use of tart cherry juice has been rapidly increasing in both elite athletes and the general population, although until recently there has been a lack of formal study on its potential benefits. In the last 10 years, researchers have investigated cherry juice use on various outcomes, ranging from muscle damage, pain and recovery, to arthritis and sleep. The following outlines and summarizes the current research on tart cherry juice, and makes recommendations on its use in Olympic and Paralympic athletes.

Montmorency tart cherry juice

Montmorency, or tart cherry juice, *Prunus cerasus*, has been found to contain numerous phytochemi-

cals including anthocyanins (cyanidin-3- glucosylrutinoside, cyanidin- 3- rutinoside, peonidin- 3- glucoside), gallic acid equivalents, and other flavonoids such as the flavonols quercetin, kaempferol, isoramnetin; flavanols including catechin, epicatechin and procyanidins; and phenolic acids including neochlorogenic acid, 3-coumaroylquinic acid, chlorogenic acid and ellagic acid (Seeram, Aviram, Zhang, Henning, Feng, Dreher, Heber, 2008; Seeram, Mormin, Nair, Bourquin, 2001). Sweet (Bing) cherries and tart cherries both contain these compounds, however they are present in higher concentrations in tart cherries (both the Balaton tart cherry and Montmorency tart cherry have been studied, however most research uses the Montmorency variety). These polyphenolic compounds, via their antioxidant and anti-inflammatory effects, have been proposed to lessen muscle damage, reduce levels of pain and improve recovery in elite athletes undergoing repeated intense exercise training, likely overloading the body's natural antioxidant capacity. Exercise is well known to lead to oxidative stress, inflammation and decreased muscle force production. Multiple prior studies have looked at traditional antioxidants such as vitamin C and E, as well as the anti-inflammatory drug ibuprofen on recovery from intense exercise, with mixed results. Initial studies with cherries have shown that consumption of high amounts of cherries (45-50 per day) does reduce inflammatory markers in the blood (Kelley, Rasooly, Jacob, et al, 2006; Jacob, Spinozzi, Simon, 2003), however little has been known of its effects on athletes. Tart cherry juice represents a more convenient way to ingest a large quantity of the polyphenolic compounds in cherries.

For those interested in the research, the last section presents a chronological summary on the results of the latest research in the last 10 years. Please take note, studies varied in terms of duration of cherry juice intake (days before/after exercise event), exercise type (resistance vs. endurance), athlete type (recreational athletes vs. well-trained), and age/sex. To help coaches apply the results of research to their athlete profiles/demographics, cherry juice differences and athlete/sport differences are bulleted below, in categories of soreness, strength, inflammation and oxidative damage. There are also "Science side notes" with further information.

Summary of Research

There are well-known risks and side effects with traditional pain relievers and anti-inflammatory drugs used by athletes. A natural, food-based alternative certainly appears to represent a safer potential alternative. While there have been studies done on a variety of health conditions regarding tart cherry juice, only four studies on its exercise effects were initially published in six years from 2006-2012. In the last two years alone, there have been four more research papers. Clearly, this is a growing area of research and our knowledge of tart cherry juice's effects have not yet reached a consensus.

Thus far, most of the studies on cherry juice drinks or blends utilized 8-12 oz. (each containing the equivalent of approximately 45-50 cherries), and typically were given twice a day. Some studies also utilized a more concentrated form in 30 ml. (1oz.) doses. Both formulations are available commercially, typically in 8 oz. single serving buyable sizes or a 32 oz. (four servings) container, versus a 16 oz. concentrate version (16 servings of 1 oz. concentrate). The loading phase typically is four to seven days prior, day of competition (two hours prior to race), and two to four days after. It is not known how many days before/after exercise is optimal. Endurance athletes may also object to intake two hours prior to a race due to GI distress.

Most subjects in the studies were at least recreationally active and some were well-trained athletes. Connolly and Bowtell found improvements during strength training (elbow flexion and knee extension exercises), while Kuehl and Howatson showed improvements with distance running. Bell showed strength recovery even without eccentric exercise, and also found improvements in performance. Average ages in the studies ranged from 22-37 years old, with approximately a 2:1 male to female ratio. While this may not be generalizable to the entire U.S. population, this demographic may be closer to the high-level athlete community and therefore the results may be applicable to Olympic and Paralympic athletes currently in training and competition.

In the athlete looking to improve training adaptations, tart cherry juice (along with other anti-inflammatory and antioxidant foods, supplements, and drugs) may potentially inhibit the body's natural adaptation response and delay full training adaptations. This may not be the best timing for tart cherry juice.

However, after the base and build phases of training and periodization, when the athlete is in peak of their conditioning, further adaptations may not be the priority (perhaps not even possible). If the focus is now on improving recovery, getting back into full race/competition form, and possibly improving performance, then tart cherries may have a beneficial role. This would also clearly be of value during multi-day events and tournaments when the ability to recover and perform at a high level day to day is the main priority. This role of tart cherry juice may sound somewhat similar to the current trend of ingesting beet juice for a number of days prior to a major endurance event, and there may be some overlap in mechanisms of action (nitrates and polyphenol's vascular, oxygen consumption, and muscle homeostasis effects).

Returning to the training adaptation phase, however, there may be some value to tart cherry juice's intermittent role. Namely, to help recover after very long runs or the very exhausting high-intensity interval training sessions that would otherwise leave an athlete overly fatigued, tired and feeling weak (if traditional recovery methods are not working). It would not be recommended to take regularly during training, due to the above concerns of possibly inhibiting the adaptation response via "supra-physiologic" antioxidant ingestion. And let's be clear, drinking cherry juice containing the equivalent of 45-50 cherries twice a day, basically 100 cherries a day, for 7 days, would seem to qualify as "above normal" intake. This precisely may be why it can help after very exhaustive, "above normal" exercise, but would not be recommended as a daily routine supplement.

Conclusion

Supplementation with drugs or high doses of antioxidant pills have been shown to blunt the training adaptation response, however natural foods and food-based product ingestion may not result in blunting, and may even improve performance. From a naturalist's point of view, any food product would certainly not seem harmful, and inherently should be beneficial to the exercising athlete. As a physician, it is my opinion that if a high-level athlete wants to try a product to improve his or her chances, but not expose their body to risks and side effects, tart cherry juice is a natural food that may help, if taken during the right timing of training. It may not help all that much, but it likely doesn't hurt. Furthermore, tart cherry juice may have some pleiotropic effects on of areas of the body, benefiting more body systems than just the musculoskeletal system. Who knows, it may someday become another vitamin D, or omega 3 fish oil, with a growing body of evidence and newly discovered, wide-ranging potential effects on the body. Future research should shed more light if this "tart" juice truly is a "sweet" success.



Table 1: Summary of Tart Cherry Juice Research over the Last 10 Years

Study	Tart Cherry Juice Amount	Before/ After Protocol	Exercise Type	Athlete Type	Results	Comments
Connolly 2006	12 oz twice/day	4 days before, 4 days after	Eccentric elbow flexion resistance exercise	Recreationally active young college men	Reduced pain in less strength loss after exercise	Strength exercise
Kuehl 2010	10.5 oz twice/day	7 days before, day of exercise	26.3km mountain running race	Well-trained males and females average age 35.8 years	Less pain and more satisfaction with their pain	Distance running race
Howatson 2010	8 oz twice/day	5 days before, 2 days after	London Marathon	Recreational male and female runners average age 37 years	Faster isometric knee extensor strength recovery, reduced inflammatory markers IL-6, CRP, and uric acid, 10% greater total antioxidant status, and lower thiobarbituric acid reactive species (a measure of oxidative stress)	Marathon race
Bowtell 2011	30ml (~1oz) of cherry juice concentrate twice/day	7 days before, 2 days after	10x10 rep/set 80% 1 rep max knee extensor exercise	Well-trained male rugby, football and taekwondo athletes regularly performing resistance training	Faster recovery of maximal knee extensor strength, percentage increase and absolute increase in protein carbonyls (a measure of oxidative stress) was less	Strength exercise; used cherry juice concentrate
Bell 2015	1 oz concentrate twice/day	4 days before, 3 days after	109 minute cycling time trial	30 year old male, well-trained cyclist	Strength loss after exercise, measured as maximum isometric quadriceps strength, was not reduced with cherry juice, even 72 hours after exercise (compared to a 14% drop in placebo). Plasma IL-6 and hsCRP (markers of inflammation) levels were lower with cherry juice; First study showing improved performance in cycling efficiency (measured by oxygen consumption) after 24hr was also noted, in the form of a 4% lower VO2 requirement with cherry juice	First study that did not include a significant eccentric exercise component



Dimitrou 2015	8oz twice/day	5 days before, 2 days after	London Marathon	Recreational male and female runners average age 37yrs	Unique to this study, frequency of upper respiratory tract symptoms (URTS) during 44°F (7°C) marathon race conditions were measured. Not surprisingly, 50% of the placebo group experienced URTS 1-2 days after the marathon, but no subjects reported symptoms in the cherry juice group. Also found significantly lower levels of serum CRP with tart cherry juice	Marathon race
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BULLETED SUMMARY OF TART CHERRY JUICE STUDIES OVER THE LAST 10 YEARS

2006-2010: Muscle soreness and strength after eccentric exercise

Connolly 2006 (Connolly, McHugh, Padilla-Zakour, Carlson, Sayers, 2006):

- 12 oz. of tart cherry juice twice a day
- Four days before and four days after exercise
- Exercise type: elbow flexion eccentric resistance exercise
- Athlete type: recreationally active young college men
- Results: reduced pain and less strength loss after exercise (compared to placebo)

Kuehl 2010 (Kuehl, Perrier, Elliot, Chesnutt, 2010):

- 10.5 oz. of tart cherry juice twice a day
- Seven days before and day of exercise
- Exercise type: 26.3 km. mountain running race
- Athlete type: well-trained males and females average age 35.8 yr.
- Results: less pain and more satisfaction with their pain (compared to placebo)

Science side note: From these studies, it is theorized that the antioxidant and anti-inflammatory effects of cherry juice may be blunting the inflammation-induced damage after myofibrillar disruption from eccentric exercise, stabilizing calcium homeostasis in muscle, and limiting the further cascade of vascular permeability, neutrophil infiltration and oxidative stress that exceeds the body's natural antioxidant capacity.

2009-2011: Blood markers of inflammation and muscle damage

Howatson 2010 (Howatson, et al, 2010):

- 8 oz. of tart cherry juice twice a day
- Five days before, day of, two days after exercise
- Exercise type: London marathon
- Athlete type: 37 yr.-old recreational male and female runners
- Results: faster isometric knee extensor strength recovery, reduced inflammatory markers IL-6, CRP, and uric acid, 10% greater total antioxidant status, and lower thiobarbituric acid reactive species (a measure of oxidative stress) compared to placebo



Bowtell 2011 (Bowtell, Sumners, Dyer, Fox, Mileva, 2011):

- 30 ml. (~1 oz.) of cherry juice concentrate twice a day
- Seven days before, day of, two days after exercise
- Exercise type: 10x10 rep/set 80% 1 rep max knee extensor exercise program
- Athlete type: well-trained male rugby, football, and taekwondo athletes regularly performing resistance training
- Results: Maximal knee extensor strength recovery was faster, and the percentage increase and absolute increase in protein carbonyls (a measure of oxidative stress) was less compared to placebo

Science side note: Regarding inflammation and muscle damage, there has even been a study done in race horses, showing that cherry juice given to horses for 2 weeks prior to a short-term strenuous exercise resulted in less rise in blood aspartate aminotransferase and somewhat less creatine kinase (a markers of muscle damage) compared to placebo (Ducharme, Fortier, Hobo, Mohammed, McHugh, Hackett, Soderholm, Mitchell, 2009).

2013-2014: Literature Reviews

Kuehl 2013 (Kuehl, 2012):

- Review on multiple effects of tart cherry juice
- Reviewed tart cherry juice's antioxidant capacity primarily via its anthocyanins
- Reviewed cherry juice's anti-inflammatory effects via flavanoid inhibition of cyclooxygenase-1 and cyclooxygenase-2 enzymes
- Reviewed potential role in management of fibromyalgia and osteoarthritis

Science side note: Thus far it appears that tart cherry juice may have significant anti-inflammatory, anti-oxidant affects, with promising results for athletes. However, the now well-known studies of Gomez-Cabrera (Gomez-Cabrera, et al 2005; Gomez-Cabrera et al 2006; Gomez-Cabrera 2008; Gomez Cabrera et al 2008) have recently brought into question the use of antioxidants in athletes, as there may be a blunting of the training adaptation response in those taking significant amounts of antioxidants prior to and during exhaustive training. Interestingly, these and other studies used supplements such as vitamin C and E in nonphysiologic high doses (e.g. 1000mg vitamin C, 235mg vitamin E which are common doses used by athletes), or drugs such as allopurinol (a drug used in the management of gout which inhibits xanthine oxidase). These compounds inhibit and the body's natural antioxidant enzymes superoxide dismutase and glutathione peroxidase and the pathways involved in new mitochondrial biogenesis. Other studies have shown no clear effect however, and some studies further do not show any significant decrease in performance in athletes (Yfanti, et al 2010; Strobel, et al 2011; Nikolaidis, et al 2012; Paulsen, et al 2014).

As a result of these conflicting, contradictory studies, it does not seem logical to recommend supra-physiologic, "unnatural" doses of antioxidant supplements to athletes at this time. It has been theorized, however (and some preliminary animal research supporting) that use of "natural," food-based products (e.g. tart cherry juice, resveratrol in grapes) do not necessarily inhibit the adaptation response and furthermore, the polyphenolic compounds present in these foods may possibly



even improve performance. Studies have not yet been published in humans thus far (other than one study, mentioned later).

Bell 2014 (Bell, et al 2014):

- Comprehensive review on cherry juice's potential role in four specific categories: muscle function, pain, inflammation, and oxidative stress.
- **Muscle function:** supplementation with tart cherry juice may reduce subsequent strength loss after exercise, reduce blood markers of muscle damage, and may promote faster recovery, both in strength training and endurance exercise.
- **Oxidative stress:** Tart cherry juice, whether in endurance activity or strength training/eccentric exercise, does seem to lower certain blood markers of oxidative stress.
- **Inflammation:** In terms of tart cherry juice's role in sports, if the priority is not adaptation but recovery after intense training, then the anti-inflammatory effects of tart cherry juice may be beneficial. The high anthocyanin content in tart cherries, which inhibits cyclo-oxygenase-2 in the inflammatory pathway, appears to be the main factor in tart cherries' anti-inflammatory effects.
- **Pain:** The pain from delayed-onset muscle soreness is well known, while the reason for it is still not. Inflammation may play a role. Anthocyanins present in tart cherries have been shown to inhibit inflammation-induced pain, to a similar degree as the NSAID indomethacin in preliminary studies in animals
- **Dose and Timing:** The loading phase in most studies were four to seven days prior to the race/ exercise, and two to four days following. Anthocyanins appear to peak in the blood approximately two hours post ingestion, and clear by eight hours. Timing in athletes therefore would naturally suggest multiple doses per day, with the pre-race dose two hours prior to competition.
- The importance of restful sleep cannot be understated in the high-level athlete at risk for overreaching and overtraining; tart cherries contain significant levels of melatonin, which has been extensively studied in sleep and may be of value to athletes undergoing intense training.

2015: Latest update

Bell 2015 (Bell, et al 2015):

- 1 oz. tart cherry juice concentrate twice a day
- Four days before, day of, three days after exercise
- Exercise type: 109 minute cycling time trial
- Athlete type: 30 yr.-old male well-trained cyclists
- Results: Strength loss after exercise, measured as maximum isometric quadriceps strength, was not reduced with cherry juice, even 72 hours after exercise (compared to a 14 percent drop in placebo). Plasma IL-6 and hsCRP (markers of inflammation) levels were lower with cherry juice compared to placebo.
- First study that did not include a significant eccentric exercise component as part of the test.
- First study showing improved performance in cycling efficiency (measured by oxygen consumption) after 24 hours was also noted, in the form of a four percent lower VO₂ requirement with cherry juice compared to placebo



Dimitrou 2015 (Dimitrou, et al 2015):

- 8 oz. tart cherry juice twice a day
- Five days before, day of, and two days after exercise
- Exercise type: the London Marathon
- Athlete type: 37 yr.-old recreational male and female runners
- Results: Unique to this study, frequency of upper respiratory tract symptoms during 44°F (7°C) marathon race conditions were measured. Not surprisingly, 50 percent of the placebo group experienced URTS one to two days after the marathon, but no subjects reported symptoms in the cherry juice group. Also found significantly lower levels of serum CRP with tart cherry juice.

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Leadership: Your First 30 Days

René Vidal and Steve Finkelstein

Most of us in the business of sport are quite familiar with the work of John Wooden and the success he achieved as men's basketball coach at UCLA – including winning ten NCAA national championships and an unprecedented seven consecutive national championships, as well as setting a men's basketball record of 88 consecutive wins. What you may not know however is that in his first season at UCLA, Wooden led a team that posted a losing record the year prior and revolutionized the program with the Pacific Coast Conference championship. How's that for building momentum quickly?

This is an article about successful leadership transitions, or more specifically, the shift or transition into a distinct leadership role. Whether you've just been promoted, are making a lateral move, relocated geographically, and/or have been recruited "into the fold" from the outside, you will face several extraordinary tests from 'el primer día.'

Furthermore, in your first 30 days, your leadership challenges will include, yet not be limited to, getting up to speed on the *language and culture* of the organization; identifying key influencers within the organization; building rapport quickly throughout the organization and realizing that what's worked for you in the past likely won't work for you today. Albert Einstein said, "You have to learn the rules of the game. And then you have to play the game better than anyone else." For leaders seeking early success, we suggest learning expeditiously the rules of the game in your *new environment*. By doing so, you will find yourself much better positioned to *change the game*.

In our research on transformational leadership and through our work with hundreds of business teams, executives, sports programs, and elite athletes, we've identified three questions that when answered affirmatively, will build a formidable platform for leading change. Ironically, these questions are framed from the perspective of the employee or team member, not the leader. These are the foremost thoughts (and worries) running through your team members' minds. These are the deepest concerns residing in your team members' hearts. Help your new colleagues "get to yes" quickly around these questions and you will not only fast track your own professional growth and development – you will build a team and organization that consistently achieves sustainable success.

Here are the three questions that your new team players ask of you:

1. Do I matter?
2. Can I trust you?
3. Will I follow you?

"If you hope to put in place the right strategies, structures and systems, you must first secure victory on the relationship front," writes Michael D. Watkins, author of "The First 90 Days: Proven Strategies for Getting Up to Speed Faster and Smarter." As a leader, *your primary focus is always*



on people, not game plans, processes, and to-do lists. Focus on understanding your people and you will:

- Better understand your new organization's culture and habits.
- Create value quickly in areas of high-potential and growth.
- Develop a cohesive team that successfully works through challenges.
- Encourage your team members to take more chances and prudent risks.
- Establish trust throughout core areas of the organization.
- Gain greater insight into what makes your team tick.
- Increase your ability to focus on the leadership challenges at hand.
- Influence your team members to embrace change more rapidly.
- Make better decisions and earn credibility fast.

The Caring Question: Do I Matter?

People don't care how much you know until they know how much they matter. It's imperative that leaders understand that behind every professional objective is a personal objective. Your goal is to discover both the internal and external drivers of your new teammates. The common advice is to ask questions. Yet, we've found that the *uncommon solution* is to actually listen, learn, and customize your assistance.

"It is important that a new leader comes into the environment with the intention to listen and learn," says Paul Lubbers, USTA Player Development Senior Director of Coaching Education and Performance. "If the intention is to gain insight and listen, then trust can be established. This is the beginning of creating an effective team."

Mini-Exercise: Three actions I can take today to demonstrate to my team that they matter are...

The Comfort Question: Can I Trust You?

People won't be completely candid with you until they know that they can implicitly trust you. The bottom line is that true sustainable success can only occur in a positive, open learning environment. It's not so much about having an open-door policy as it is about displaying an "open-mind policy." As a leader, *perhaps the leader*, you are on "center court" all the time. Everything you do and say matters: your body language, your tone of voice, your immediate response to pushback — to a virtual stranger, no less. It all matters. There's a reason Under Armour Chairman Kevin Plank encourages his employees to *walk with a purpose*. We propose that you think and speak with a purpose, as well.

According to Paul Kowalczyk, University of Illinois senior associate athletics director, "You have to be consistent in your message and in the execution of your message. Your actions have to back up your words. To do otherwise leads to mistrust, doubt and the undermining of your authority."

Mini-Exercise: The most important message I want to convey in the next 30 days is...



The Credibility Question: Will I Follow You?

People won't follow you unless they believe that they will become better because of you. American football coach Don Shula once referred to credibility as "something your players can hang their hats on." Essentially, this is your first 30-day mission as a new leader: to create an atmosphere of unfettered, unreserved dedication to a specific greater cause. While running for the Presidency in 1980, Ronald Reagan asked the people, "Are you better off today than you were four years ago?" It's a sensational question that leaders can apply and adapt to multiple scenarios.

The fact of the matter is that nobody really cares about your past accomplishments. And with the explosion of social media on a global scale, "What are doing for me right now?" is the new "What have you done for me lately?" The only success that matters is the success you create today.

Again, it goes back to the importance of gaining trust and building relationships. "Focus on successes, not failures," advises Lubbers. "Create an environment where feedback is positive and the team is comfortable with taking risks and has room to grow and improve."

Mini-Exercise: This week, we've shown tangible improvement in the following three areas...



At the end of the day, the difference between leadership success and failure is one of perspective. If you fail to see that your new leadership role requires different skills, abilities, and approaches, then you will likely fail to gain traction quickly and achieve ultimate success. If you believe that you'll be successful by doing what has made you successful in the past, then you will likely fail, and quickly.

As the new leader, understand that the questions you ask are important, but not as important as the questions your latest colleagues have of you. Know that the answers you provide have significant value, but not as much value as the answers your new team members deliver to the vital three questions: Do I matter? Can I trust you? Will I follow you?

"You have one chance to be new," says Lubbers. To be sure, new challenges demand new practices. In your first 30 days, everyone is expecting change. Why not set the example?

René Vidal and Steve Finkelstein are co-authors of Play Smart to Win in Business: Leadership Lessons from Center Court to Corner Office." To learn more, visit www.playsmart-towin.net.



Luis Gil #10 of the USA scores on a penalty kick past goalkeeper Max Crepeau #1 of Canada in the 92nd minute of the 2015 CONCACAF Olympic Qualifying match at Sporting Park on October 1, 2015 in Kansas City, Kansas. (Photo by Jamie Squire/Getty Images)

Boosting Performance Under Pressure with Discomfort Training

Marc Schoen, Assistant Clinical Professor, UCLA's Geffen School of Medicine

Boosting athletes' performance under pressure and competitive conditions can be accomplished by rewiring the region of the brain that is primarily responsible for performance under these conditions. Recent neuroscience advances make it possible to directly retrain this region of the brain, as opposed to historical methods that have relied on indirect interventions. Results can be expedient and have wide application to a number of athletes than traditional methods alone.

The Problem

Although there is a small subset of athletes that instinctively excels under pressure, the majority of athletes find that their performance suffers under these conditions. In most cases, learning to perform under pressure and in competitive conditions is akin to on-the-job training or essentially survival of the fittest. Survival of the fittest may have worked for evolution that evolved over thousands of years, but it is an imprecise and wasteful method of discovering and grooming elite athletes – not to mention, a tremendously misguided use of talent.

Most of our performance under pressure (PUP) reactions were initially forged in our youth. Often the most formative PUP experiences have been childhood sports, such as Little League baseball, Pop Warner football, as well as club basketball, volleyball or soccer. Although it might seem counterintuitive, non-sport related experiences such as giving oral reports and taking standardized tests under time constraints in school can also profoundly influence our PUP ability as an adult. Even though many years have passed, they can continue to influence our PUP in the future – whether we are aware of them or not. Martin (fictitious name) is a real life example of how this can happen.

In his senior year, Martin had aspirations to be drafted into the NBA. Although never a high-percentage free throw shooter, the pressure he felt to perform at a high level led to a significant deterioration of his shooting percentage. The higher the stakes, the worse it became. Adding insult to injury was the crowd's reaction to Martin approaching the free-throw line. The crowd would let out a heavy sigh and groan in anticipation of him missing his free throws at key points during the game. He had been advised by his coaches to think positive, ignore the crowd's reaction and take deep breaths, but it did little to improve the situation.

What I learned from Martin is that the crowd's negativity reminded him of his early experience in giving oral reports in elementary school. Speaking in front of the class was a source of great fear and humiliation for him. His legs would tremble, while his voice would quiver and shrink as he stumbled from word to word. It wasn't long before his fellow classmates would snicker and make fun of him each time he was called to speak. In a short period of time, he became so overwhelmed with fear that he was barely able to speak.

Now eleven years later, each time he stepped up to make a free throw, it was like he was being called to give an oral report. The pressure was overwhelming, and just like his schoolmates in el-



elementary school, he felt teased, badgered and then humiliated by the crowd. Rather than shooting in a relaxed and fluid manner, he now found himself again freezing and then pushing the ball to the rim. The results were disastrous. There was no amount of positive thinking and deep breaths that could loosen the grip of his childhood PUP experiences.

Despite the fact that many of these PUP experiences lie many years in the past, many athletes and the general public continue to fear these conditions as adults. In fact, the research data indicates that up to 60 percent of us fail to live up to our potential in test conditions, while another 35 percent see our performance significantly deteriorate under these conditions (Beilock, 2010).

The Cause of Poor Performance under Pressure

Poor performance under pressure is due to fear. If the fear center of the brain is overly reactive, athletes will cave under pressure conditions. Competition and pressure lead to physical and emotional discomfort, which at high levels is interpreted as a threat by the brain's fear center. In short, poorly managed levels of pressure lead to fear driven performance, thereby overriding well-honed physical skills and mental focus. Fear driven performance results in a loss of concentration, unraveling under pressure, tightening up under pressure, playing it safe as opposed to playing to win, feeling intimidated by your opponent, choking in key game situations while perceiving negative outcomes even when positive outcomes may be more likely (Schoen, 2014). Vaccaro (2011) examined the role of fear in mixed martial arts competitors and discovered that those fighters who lost their match generally attributed their poor performance to fear – not lack of skill.

Fear and the Brain

Let's examine the source of the problem. The problem actually lies in one of the oldest parts of the brain, a region of the brain called the limbic system. The limbic system is responsible for our visceral and gut responses, such as anger, fear, pain, sleep, hunger and pleasure. Its primary goal is to keep us out of danger. It is absolute — with no gray areas in its perceptions and reactions. In other words, you are either in danger or not in danger, or either safe or unsafe. But when the limbic system, particularly the amygdala, detects high levels of discomfort related to pressure, it interprets it as a sign of danger. When it senses danger, it triggers the survival instinct or fear response, which instantaneously reacts by slamming on the brakes of higher-order processing. Higher-order processing is housed in the cerebral cortex part of the brain, and is responsible for decision making and problem-solving. When engaged, the survival instinct essentially cuts off the power supply to our higher-order processing, and we lose our ability to concentrate and draw on well-honed skills and knowledge.

The Biochemistry of Fear

There is abundant scientific literature documenting the biochemical and physiological consequences of fear. In the sports literature, fear has been found to influence testosterone and cortisol – but the results are not consistent (see Salvador and Costa, 2009 for an extensive review of these studies). Robazza et al. (2012) in their investigation found α -amylase, and chromogranin A, in addition to testosterone and cortisol, to be influenced by PUP. Outside the sports literature, fear has been



found to significantly affect the inflammatory response and therefore the ultimate deterioration of the body's organs (see Schoen and Nowack 2013 for a review on this topic) and the aging of cells in the body (Epel and Blackburn, 2004). What is clearly evident from the research on fear is that long term athletic performance is seriously at stake when fear is poorly managed.

The Dopamine Connection

What is often overlooked with respect to the fear response, is the influence that the Corticotrophin Releasing Factor (CRF) has on the neurotransmitter dopamine. In addition to activating the HPA fight or flight response, CRF leads to a dopamine reduction, which magnifies the amount of discomfort in the body. As the fear response becomes chronic, it leads increasingly to a greater intolerance and sensitivity to discomfort, and a subsequent hair-trigger fear response. Over time it leads to a greater frequency of fear driven behavior, more engrained fear driven responses to PUP, and a greater difficulty in being able to learn from these fear reactions (see Schoen 2014 and Oliver 2007 for a more extensive review and explanation of CRF activation). All of this comes at a time when our world is more comfortable than ever thanks to technology. Yet ironically, it has led to an undesired effect, our tolerance for discomfort is at an all-time low, a result which is particularly evident in the millennial generation.

Rewiring the Fear Response

The Cognitive Approach

There are two main approaches for altering the fear response. The first method, or cognitive approach, is the traditional and most commonly used intervention. It rests on the assumption that the fear response is primarily a function of cognitive attribution or thought patterns. The cognitive method would be considered a top-down approach, where the outer region of the brain, the cerebral cortex, is being used to influence the limbic system beneath it. The athlete is instructed to restructure their thoughts, with the goal of controlling the visceral fear response of the limbic system. Positive thought patterns are employed to replace the negative thought patterns associated with PUP discomfort and the subsequent fear response. There is significant data to support its effectiveness (Mesagno et al 2012, Wang et al 2004a, Wang et al 2004b, Jordet and Hartman 2008, Di Corrado D and Vitali F 2015). Unfortunately, there can be an inadvertent side effect of this type of intervention in that it can amplify players' aversive reaction to negative thoughts and discomfort – *where that which we want to avoid, is that which becomes stronger*.

The Discomfort Training Solution

The discomfort training intervention is directly aimed at the limbic system's fear response, as opposed to indirectly influencing it via the cerebral cortex. In a sense, it is a bottom-top approach. Retraining the fear center is the crux of discomfort training, where the fear center is being trained to react to competitive pressures without fear (Schoen, 2013, Schoen and Nowack 2013, Oudejans and Pijpers' excellent study in 2010). **Since discomfort is inevitable, the goal of this method is not to banish discomfort. Instead, the goal is to train the brain to no longer perceive PUP discomfort as a threat.** In this strategy, the brain is taught to experience increasingly higher



levels of discomfort with less and less fear. The end result of this type of training is that the athlete learns to embrace PUP discomfort rather than fear it and become overwhelmed by it.

How to Use Discomfort Training

Discomfort training can be conducted in a group or individual format. If working with a team, often the best results can be achieved in a group format, which makes the training more intense, powerful and generalizable, while building strong team camaraderie which is strengthened through oxytocin boosting tasks. Substantive results can be achieved in three to six meetings.

Step One: Establishing Duality. At the heart of discomfort training is the concept of duality. Duality is the ability to experience discomfort even as we feel other sensations or feelings other than discomfort (for elaboration see Schoen 2013 pages 168- 172). Once the athlete is trained to experience his world in a non-absolute way, it is now possible for him to feel performance-enhancing reactions, such as strength, confidence, and feeling focused and determination, even as he feels emotional and physical discomfort. Duality provides the foundation for detaching discomfort from the fear response

Step Two: Building the Inner Core. Start by building a profound state of inner absorption in the athlete which I call the *core state*. I have found that a hybrid form of hypnotic suggestion, somatic focus and meditation works the best. But other forms of deep inner focus can be used, as well. In short order and with practice, a very developed inner focus can completely interfere and inhibit the fear response from engaging when provoked. What makes this step so central is that the athlete learns that there is a state within him that is greater than the fear response.

Step Three: Discomfort Exposure. The athlete is now exposed to increasingly greater levels of discomfort while using the core state to inhibit the fear response. In this manner, PUP discomfort becomes associated and conditioned to be part of the core state – as opposed to lying outside of it. By making PUP discomfort part of the core state, it loses its power to serve as a threat. “No pain, no gain” is an everyday example of how discomfort can be experienced without threat. *But unlike exposure therapy or systematic desensitization, the goal of discomfort training is not to extinguish discomfort. Instead, the goal is to separate discomfort from being a threat.*

There are two main ways of inducing discomfort – either through emotional or physical means. Incorporating both renders the best result. Hunger, sleep deprivation, noxious odors work well for inducing physical discomfort. Fears of being judged or rejected by the group, or feelings of inadequacy or intimidation are very powerful means of inducing emotional discomfort. I also have players write down all their fears and negative feelings, and later have them focus on them while in the core state. What is important here is that they ultimately learn that it isn't the presence of these negative patterns that is problematic, but merely the power they attach to them. I also bring in statements that the coach, opposing players, or crowd might yell at them as well.

Step Four: Strength in Numbers: Step four is initiated once the *discomfort exposure* in step three above is fully capable of disengaging the fear response from discomfort. The goal of this step is to fortify the duality and separation between discomfort and fear. It works by activating other regions

of the brain that are not part of the fear response, and conditioning them to be triggered during PUP conditions. The greater the number of brain regions that have no connection to fear, the lesser the influence of the amygdala's fear reaction. I call this *building strength in numbers*. It's comparable to building a team. If you have one risk-averse team member as part of a two-person team, then this team member would exert a strong influence on the team's performance. But if the risk-averse team member is part of a six-person team, then that person's input and influence would be moderated and diluted.

Begin by having the athlete identify a song or piece of music that he associates with success, achievement or strength. Next, have him find a scent that is experienced as positive, such as vanilla, eucalyptus or peppermint. Finally, have the athlete focus on a person, thing or cause that evokes great empathy or appreciation. Each of these sensory triggers is affiliated with a different region of the brain that is separate from the fear region.

Next, while in the *core state*, reintroduce the different stimuli for discomfort (emotional and physical) while at the same time interspersing the sensory triggers of sound, scent, and empathy/appreciation. In this manner, the core state becomes more widely stitched into the brain and empowered, while concomitantly shrinking the fear response.

Step Five: Building in Phrases to Trigger PUP. Once the power of negative attribution and discomfort has been neutralized, it is possible to thread productive cognitive phrases/triggers into the core state. This step represents the "top" aspect of the "bottom-top" of the discomfort training approach. Phrases such as "I am a discomfort master, I thrive in all conditions – particularly in imperfect and uncomfortable conditions, everything I need to succeed is already within me, and it is here to stay."

Step Six: Sound File. Athletes are now asked to listen regularly at bedtime to sound files that reinforce their ability to experience discomfort without fear in PUP conditions. I refer often in these sound files to the trigger phrases listed in step five, such as being a *Discomfort Master*. Prior to listening to the sound file, I have the athletes smell the scent that was used previously for the olfactory trigger. Pairing the scent with the sound file suggestions strengthens learning and further cements their newly rewired neural pathway (Rasch et al., 2007).

Summary

Excelling under pressure and competitive conditions is a function of managing game-time discomfort and fear. When athletes collapse under these conditions it is most often related to an overly reactive fear center in the brain. The millennial generation athlete is predisposed to developing a hair trigger fear reaction. Discomfort training offers a method of directly rewiring this overly sensitive fear center. Unlike other methods of managing discomfort and fear in sports, discomfort training does not attempt to banish discomfort or eradicate negative attributions in competitive and pressure conditions, but rather to train the brain to no longer consider discomfort and negative attributions as a threat. Discomfort training strategically and methodically exposes the athlete to greater levels of physical and emotional discomfort enabling athletes to perform at their potential in all conditions – particularly imperfect conditions.

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Devery Karz (R) and Michelle Sechser of the United States of America compete in the Lightweight Women's Double Sculls heats during Day 1 of the 2015 World Rowing Cup III on Lucerne Rotsee on July 10, 2015 in Lucerne, Switzerland. (Photo by Philipp Schmidli/Getty Images)

Mindfulness for the Elite Coach

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Phil Jackson, current New York Knicks president and former coach of the Chicago Bulls and Los Angeles Lakers, observed in his 1993 book “Sacred Hoops” that being an *aware* athlete is more useful than being a *smart* one. *What?* This probably sounds like pretty strange advice from a coach of his stature, particularly given the win-oriented, pressure-packed culture he was coaching in when he wrote that classic book. However, perhaps this was more sage advice than strange advice. The purpose of this article is to provide an overview of how increasing awareness can benefit you, your staff, and your athletes.

Seldom do we find or intentionally take time to step away from all of the busy-ness and distractions in our lives to simply rest in awareness. As a matter of fact, in a recent study, several college students — particularly men — preferred to self-administer a mild electrical shock rather than sit with their own thoughts for a period of 15 minutes (Wilson et al., 2014). So what is the good news for coaches? The awareness Phil Jackson referred to can be trained. Coaches and their athletes can be more focused in practice, games, team meetings, etc. To achieve this goal, we often suggest athletes ask not only, “What have I done for my body today?,” but also “What have I done for my mind today?”

Along with other high performance fields, (e.g., Fortune 500 companies and the military) mindfulness training has emerged in athletics, perhaps most famously in the meditation techniques used by the 2014 Super Bowl champion Seattle Seahawks. As a matter of fact, Pete Carroll was recently featured on the cover of “Mindful Magazine.” Additionally, several mindfulness-based programs have been developed specifically for athletes, such as the Mindfulness-Acceptance-Commitment approach to enhancing optimal performance (Gardner & Moore, 2007) and Mindfulness Sport Performance Enhancement (Kaufman, Glass, & Arnkoff, 2009). These programs have demonstrated promising results including helping athletes improve both athletic performance and overall well-being.

Just like athletes, coaches’ performance and well-being can benefit from mindfulness. For example, coaches who participated in Mindfulness Training for Coaches (MTC) experienced less anxiety and more emotional stability, along with enhanced coaching, athletes, and personal life (Longshore & Sachs, 2015). Below we will share five ways that cultivating mindfulness can serve as a benefit for coaches. We will also offer several concrete suggestions for very brief formal and informal methods to cultivate mindfulness. If you would like more information on longer formal exercises (e.g., sitting meditations) please contact the authors.



Five Benefits of Mindfulness Practice for Coaches

Improved stress management. Coaching at the elite Olympic level can be extremely stressful. Jokingly a coach recently told us that there are only two times he feels stressed — “day and night”. While experiencing stress is inescapable and some stress, such as training, can be a positive stressor, the problem is our bodies are not meant to be in a constant state of stress — positive or negative. Chronic stress has been associated with a range of physical diseases, reduced quality of life, under-recovery and negatively affecting an individual’s mental well-being. Additionally, being in a state of chronic physiological and psychological hyper-activation can lead to personal exhaustion and burnout. Think of it this way – from an evolutionary perspective, we developed our stress response to protect us from physical threats to our lives. However, in the present day, instead of our stress response being activated because we are being chased by an enemy or a mountain lion, it is activated by daily overtraining and preparing, dealing with the adversities of others and self, the constant barrage of e-mails, phone calls, and texts, balancing work and home life, and the list goes on...

Ultimately, life is demanding and its stressors cannot be avoided. What truly matters is how we respond to stress. If you will, try this brief one-minute breathing exercise at least two times per day to help regulate your stress response. Due to its impact upon the stress response cycle, focused breathing is associated with greater calm, social engagement, and positive emotions.

One Minute Breathing Exercise

1. Either sitting or standing establish yourself in a position that embodies the type of pride and dignity you’d like to bring to practice or competition.
2. Allow your eyes to close if you’re comfortable with it or fix your gaze on a spot out in front of you.
3. Begin by focusing your attention on the breath.
4. Rather than trying to control or think about the breath, just notice the sensation of the breath where it is most vivid (e.g., rise and fall of abdomen, passage of air through the front of nostrils).
5. When the mind wanders (believe us, it will) simply bring your attention back to the breath. This is not about emptying the mind, which really isn’t possible... Just notice the chatter of the mind and when it wanders (even if it does so 20 times) simply bring your attention back to the breath. This returning to the breath is the “weight-training” for the mind.

Responding rather than reacting. Let’s face it, as human beings we all experience moments in which our emotions get the best of us and we react impulsively. This can particularly be the case when we are under intense pressure such as stress related to competition, interpersonal conflict, or other common situations. As a coach, you probably have witnessed at least a few times when an athlete’s – or coach’s – performance becomes impaired because he or she lost emotional control. Typically our impulsive, knee-jerk reactions involve either lashing out or finding a way to escape/avoid the stressful situation altogether. These behaviors may be different, but the underlying function is typically the need to get rid of an uncomfortable emotion — albeit for a brief period. Through mindfulness practice you can become more aware of your thoughts and emotions, and not immediately react to a situation.



Why bother practicing? Reduced negative reactions to stress can lead to improved relationships with staff, family and athletes, better communication, reduced negatively experienced distress and a host of other benefits. Additionally, mindfulness practice can help you learn how to tolerate and endure discomfort rather than immediately react with ways to eliminate it. This practice can be beneficial both physically and emotionally. Try the exercise below to practice tolerating discomfort. For example, the inability to tolerate physical pain may lead an athlete to shutdown despite being capable of more and the inability to tolerate anger can lead to chronic attempts (e.g., over-aggressive/mean-spirited behavior, avoidance of anger-provoking situations) to get rid of the emotion (e.g., in the case of a very bad call or a significant player mistake).

Connect to a Task You've Been Avoiding

1. Choose a task you've been putting off. This can range from a sport-specific task to a household chore.
2. Set aside 15-20 minutes to work on that task.
3. While engaging in the task, notice whatever arises and attempt to experience it fully regardless of what comes up in your mind and body. For example, if you start to feel irritated by the task, just notice it without trying to fix or eliminate it in any way. Just redirect your attention to the task.
4. Connect fully with whatever arises using your five senses as a way to observe what's happening
5. Stop after 15-20 minutes or continue

Adapted from The Happiness Trap by Russ Harris

Adoption of a beginner's mind. It may seem rather odd to be talking about beginners in an article for expert coaches who work mostly with elite athletes. However, being curious about daily experiences and seeing everything and everyone as if for the first time can help coaches perceive things more as *they are* rather than as we *think they are*. A beginner's mind can be explained through the process of a season or Olympic cycle. At the beginning, everything seems possible and players have a clean slate. There are few defined roles, personalities, positions, and skills. As time progresses, the team, players and coaches can fall into a pattern and the presence of the beginner's mind diminishes. Coaches may see what they expect to see. Players and staff are labeled: leader, lethargic, dependable, funny, skilled, problem player, attacker, or defender. How the sport is played may take on a certain form with varying performance success. Reviewers scan video, looking for important performance improvements and weaknesses according to the coaches' expert perspectives. The repetitive tasks of coaching are carried out. Although coaches and athletes may still experience performance success, infusing a beginner's mind may rejuvenate and expand coaches' perspectives toward coaching challenges — tactical, personnel, and otherwise. Adopting a beginner's mind may allow coaches to notice the thoughts and expectations towards that player, this training sessions, this email and this press conference. With this recognition, coaches can pause, quiet the expectations, labels and anticipation about the event or player; approaching each of these people and events as if for the first time with openness and possibility.

Blending your expertness with your "beginner-ness" integrates the strengths of both approaches



into your coaching. You may even become an expert beginner! Integrating acceptance and a beginner's mind into your coaching can benefit your approach and completion of job tasks, your relationship with your players and staff, and your overall well-being. Ultimately, you may find it changes your own coaching performance. The reality is that the daily emails, meetings, traveling, and training sessions are all opportunities to practice mindful coaching. Indeed, these routines and daily interactions are the path. You do not need to go out of your way or quickly finish up all of these tasks to find "mindfulness coaching". It is already here, right in front of you, in the relationships and tasks of your life. Through mindful coaching you are able to bring your whole self and presence to your coaching performance. Try the exercise below to cultivate a beginner's mind.

Cultivating a Beginner's Mind

No athlete, team, or for that matter, moment is exactly the same as another. The next time you encounter an athlete or team you've been working with, try to greet them with fresh eyes by using the steps below.

- 1) Notice any thoughts or emotions that arise when you encounter this athlete or team.
- 2) Question if you are seeing them based upon your preconceived notions, or as they are.
- 3) Remember each athlete is unique and offers unique possibilities.
- 4) If desired, repeat the above steps with your children, spouse, food, co-workers, pets, nature, etc.

Develop present moment awareness. Prior to Game 6 of the 2015 NBA Finals, LeBron James, known for his meditation practice, was shown on camera emphatically saying to his team, "Right now, right now, we cannot worry about tomorrow, it's all about right now!" The ultimate truth is that *it's always now*. We often do not realize this vital fact and how it can be both freeing and empowering, and how necessary present moment awareness is to achieve optimal performance. Additionally, a recent study out of Harvard University titled, "A Wandering Mind is an Unhappy Mind," suggests that being in the moment can also be beneficial to our emotional well-being. In the now is when you can have an impact, and actually teach or change anything – not when you are dwelling on the past or worrying about what might happen. The U.S Olympic Committee's motto, "It's not every four years, it's every day," expresses this present moment focus in the midst of a long term goal. As coaches, now is really the only opportunity you have to actually do anything. For example, *when* you are crafting a training plan, conducting a workout, having a conversation with an assistant coach or a player this is the only time these things happen.

Both formal and informal mindfulness practices can help cultivate ways to improve present moment awareness. Unfortunately, this is much easier said than done. For one thing, our captivating digital culture of information overload and multitasking clearly breeds distraction, lack of sustained focus, and impatience. Many coaches have picked up on this, sensing they need to live their lives life more fully and effectively. Yet, the practice of cultivating awareness requires commitment and self-discipline. Again, it is the nature of the mind to wander, so just like developing a physical skill, training the brain to be centered in the here and now takes a significant amount of practice. You can begin this training by engaging in one or both of the exercises below. It can help you start your day in a mindful, in-the-moment way.

Mindfulness of your Morning Routine

For many people, the chatter of the mind saying I need to do this or that begins from the moment they wake up... Increasingly, we have found that people are checking email and social media immediately upon waking up. We recommend that you invest in your own life before investing in the lives of others, and start your day connecting to the present moment with some of these suggestions.

- 1) Shower Mindfully
 - a. Feel the temperature of the water against your skin
 - b. Notice the smell of the soap and shampoo
- 2) Wake up Mindfully
 - a. Lie on your back and take 5 deep diaphragmatic breaths before getting out of bed
- 3) Eat Breakfast Mindfully
 - a. As we like to joke with people — “actually taste your food.”
- 4) Drive Mindfully
 - a. Notice the feel of the steering wheel in your hands.
 - b. Put on some music and pick out the different instruments.
 - c. Use red lights or stop signs as a moment to take one deep breath.

*Adapted from **The Happiness Trap** by Russ Harris*

Connecting to your Senses

This is a relatively simple exercise that can be done as practice at any moment. The main idea is to use your senses to connect to the present moment.

- 1) Take 10 seconds to be aware of one thing you feel
- 2) Take 10 seconds to be aware of one thing you smell
- 3) Take 10 seconds to be aware of one thing you hear
- 4) Take 10 seconds to be aware of one thing you see

Develop openness and acceptance. Often these two words suggest surrender or giving up because a situation is unchangeable and a person must “just deal with it.” This view is not necessarily what acceptance means from a mindfulness perspective. Instead, acceptance generally refers to a “willingness to see things as they are” (Kabat-Zinn, 1990, p. 39). When we are willing to be accepting, we are making a conscious choice to engage with our current situation instead of ruminating about what we think the team, an athlete, or we should be and should do. Certainly, it can be quite difficult to view complex coaching work and life situations just as they are. After all, life and work as a coach is typically very challenging and unpredictable. It is a stream of pleas-



ant, neutral and unpleasant experiences. For example, coaches travel schedule may be tiring and boring, a player might be injured, there may be interpersonal conflict, or coaches might have not seen their family as much as they would really like. Even positive experiences, such as a successful Olympic Games result or a promotion, may be difficult for some coaches to experience for what they are in the moment. In these instances, coaches might act from the position of how they wish things were or what they expected them to be. This can lead to a lot of struggle and effort, which can eventually drain emotional resources. However, through developing acceptance coaches can have a clearer picture of what is actually happening and develop effective action. This is not about passive resignation or discarding values and principles. It is simply beginning to see a practice, a team's performance, sport organization's politics, family, and self for who and what they are in this moment regardless of judgments (e.g., good/bad, positive/negative). From this acceptance of now, coaches can act in ways that are facilitative for their professional and personal performance and well-being. If you do this, you could perhaps better accept the glitches in the travel schedule and make thoughtful decisions of how to manage them. You could realize that you have not spent much time with family, feel disconnected or sad, and schedule a time to video chat while on the road. These moments of awareness point toward things we can do and steer us away from the things we cannot do.

Ultimately, the willingness to see things for how they are begets openness to new ways to act. This perspective and practice may benefit the performance of the coach and her/his team. Try the exercise below to begin the process of cultivating acceptance.

Acceptance of Your Thoughts

1. Find a quiet place free of distraction to practice this exercise for at minimum 5 minutes.
2. Settle into a comfortable seated position with either your eyes closed or fixed on a spot out in front of you.
3. Bring your attention to the process of thinking, seeing thoughts as events in the mind.
4. Simply allow any thoughts to arise without pushing them away or analyzing their content.
5. Practicing noticing the thoughts and letting them pass like clouds passing through the sky or cars driving by on the highway. Some thoughts may “hook” you more than others but practice just observing this process as it unfolds.
6. When you are ready, end the exercise and practice taking a similar approach to thoughts during your daily routine.

Putting it All Together

In a nutshell, cultivating mindfulness can be thought of as a “practice” but one without a game. We like to think of the mind as a muscle that can be built and sculpted through commitment to regular practice. As one practices, the effects of mindfulness — improved psychological health, increased attention, mood regulation, discomfort/pain management and stress management — seep into our daily lives (Baer, 2003; Bernier, Thernot, Codron, & Fournier, 2009; Birrer, Rothlin, & Morgan, 2012; Keng, Smoski, & Robins, 2011). As you know, coaches and athletes do not practice only when they feel like it. They commit to it. It is the same for mindfulness type of practice - except it is strength training for the mind. As mindfulness expert Jon Kabat-Zinn has said, “You don’t have to



like it, you just have to do it.”

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On the cover: The United States team huddle prior to the 2015 Rugby World Cup Pool B match between Scotland and USA at Elland Road on September 27, 2015 in Leeds, United Kingdom.

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