

## Turmeric for athletes: Hitting new PRs

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Endurance athletes are some of the most disciplined patients encountered in a medical practice. Any medical practice. They are typically willing to do whatever it takes to get back into training and competition after an injury and to modify their diets, lifestyles, and equipment to shave miniscule amounts of time from their personal bests. Having been a competitive runner in the past, I can personally attest to the somewhat questionable decisions made in the search for lower and lower numbers on the finishing clock. Having worked as a bicycle mechanic during grad school, I can professionally attest to the extreme amounts of money spent on bicycle components in pursuit of saving 10-15 grams or decreasing drag coefficients by almost imperceptible levels. And having treated many of these compatriots over the course of my career I have settled on the belief that the one thing that will almost universally benefit the every athlete, from the sponsored cyclist down to someone completing their first 5k is simple: it's turmeric.

There are a few common threads that run through all athletes. Pain, inflammation, and the periodic injury or sickness are relatable issues regardless of the level. The premise of endurance exercise is simple: long term stress applied to the musculoskeletal, cardiac, and respiratory systems to evoke an adaptation that allows the person to travel further, at a faster rate, for a longer period of time. The stresses applied to the body require a recovery period where the body goes through the repair and adaptation process to become stronger often accompanied by pain and inflammation. Chinese medicine has been using turmeric - jiang huang (*rhizoma curcuma longa*) since at least the Tang Dynasty to invigorate blood, promote the movement of qi and alleviate pain, and to expel wind (Dharmananda, 2009). There are huge industries built around decreasing pain and inflammation, but as it turns out this fragrant relative of ginger can reduce pain (Nicol, 2015), decrease inflammation caused by endurance athletics (McFarlin, 2016), and keep athletes healthy throughout the rigors of their training.

It has been well established that the curcuminoids found in turmeric (curcumin, demethoxycurcumin, and bisdemethoxycurcumin) help to control inflammation (Aggarwal and Harikumar, 2009). But it has only been in the last two decades that biomedical science has started to understand why. Some 30 separate inflammatory pathways have been found to be downregulated by curcuminoids, as of the Aggarwal and Harikumar review. The summary of their review is seen in figure 1. The more significant pathways for systemic inflammation are tumor necrosis factor alpha (TNF- $\alpha$ ), nuclear factor NF- $\kappa$ B, and one of its byproducts interleukin 6 (IL-6) (Pedersen, 2000).

There are several very important proinflammatory biological markers that show up in high concentrations during intense physical activity. With endurance athletics specifically it has been shown that TNF- $\alpha$ , IL-6,

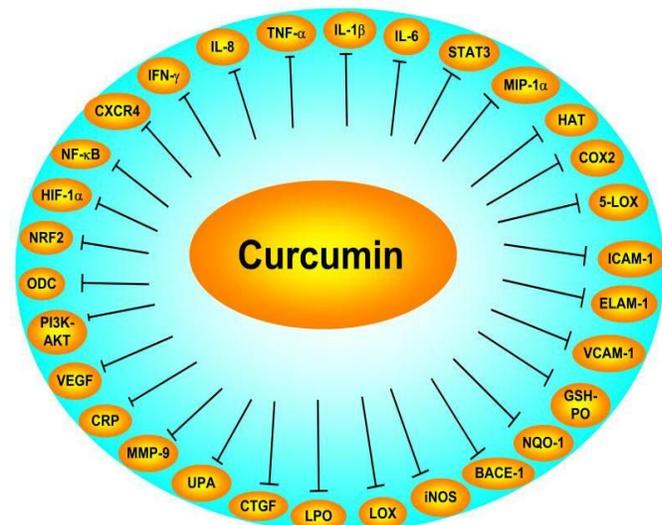


Figure 1 (Aggarwal & Harikumar, 2009)

IL-1 $\beta$ , IL-8, and C-reactive protein (CRP) all spike (Gunzer, 2012). Each of these is either decreased, inactivated, or inhibited along with NF- $\kappa$ B by curcuminoids. It is important to note that two anti-inflammatory cytokines are also produced during endurance athletics: IL-10 and IL-1ra (Gunzer, 2012). Curcuminoids have not shown any attenuation effect on either of these interleukins.

Research published two years prior to the above review showed that both cyclooxygenase (COX) and lipoxygenase (LOX) were inhibited by curcuminoids at a molecular transcriptional level (Rao, 2007) - meaning that proinflammatory cytokines normally produced by cells in response to their environment was being downregulated at the level of mRNA. These are both important modulators of the proinflammatory arachidonic acid (AA) pathway - an omega 6 fatty acid that is primarily responsible for the massive anti-inflammatory omega 3 industry. In the Rao study it was shown that curcumin was specifically and selectively inhibiting COX-2 and 5-LOX. The distinction here is significant because inhibition of COX-1 is the downfall of non-steroidal antiinflammatory drugs (NSAIDs) and the reason for their potential damage to the gastrointestinal tract (Ricciotti and Fitzgerald, 2011). The damage caused by COX-1 inhibition and subsequent decrease in gastric prostaglandin is what spurred the development of COX-2 inhibitors like Celebrex (available by prescription only) and Vioxx (pulled from the market in 2005 due to the increased risk of myocardial infarction and stroke).

While looking for that little edge in competition, it has become common practice for athletes to use NSAIDs prophylactically despite their potential side effects. Athletes use NSAIDs prior to exercise to ostensibly prevent inflammation and pain before they start. In fact, NSAIDs were found to be the most commonly used prophylactic drugs by Canadian athletes at the Olympics in 1996 and 2000 (Huang, 2006). Warden, in 2010, looked at this rather prevalent usage of NSAIDs in high performing athletes, finding that the interest in eliminating inflammation eclipsed the potential of chronic use decreasing skeletal muscle adaptation. As is now becoming clear in animal models, usage of curcuminoids can decrease both pain and inflammation, but more importantly can decrease the effects of exercise on performance (Davis, 2007) and decrease recovery time.

One area where the use of curcumin may be of greatest use to high performance athletes vs beginners is in keeping them from developing upper respiratory tract infections (URTI) following a competition. URIs in and of themselves are not typically serious problems, but for endurance athletes it forces them to take time off from training and, thus, allows for loss of speed and endurance. Exercise-induced immunodepression is the term used to describe this phenomenon and the time period in question is referred to as the "open window." (Nieman and Pedersen, 1999) Wind, rather succinctly, is used to describe the phenomenon in Traditional Chinese Medicine (TCM). When athletes are subject to extreme physiologic stressors - running a marathon or competing in a triathlon - their immune systems experience an increase in circulatory leucocyte counts during the energy expenditure. During the recovery period natural killer cells tend to fall below their pre-stressor levels, thus creating a weakness in the primary immune system (Pedersen, 2000). Curcumin has been shown to decrease the severity of the immunodepression in post-exertional situations (Nieman and Pedersen, 1999) with the promise of decreasing forced days off after competition.

### **Which turmeric should be used?**

The importance of proper species identification, quality control, and proper format administration cannot be noted strongly enough when considering the usage of jiang huang in an integrative

context. There are three herbs in the TCM lexicon that are sometimes referred to as “turmeric”: jiang huang, yu jin, and e zhu. All three are part of the *Zingiberaceae* botanical family, and all three are sometimes known as ‘turmeric.’ While jiang huang is only known as ‘turmeric,’ yu jin is also known as ‘curcumin,’ and e zhu is also known as ‘zeodaria.’

Jiang huang is derived from only a single species and is the rhizome (*rhizoma curcuma longa*) - unfortunately that species is known by two botanical names depending on the source: *curcuma longa* (the most accepted name) and *curcuma domestica*. It is extremely important that the rhizome of this species is used when seeking curcuminoids. This is, in part, due to the presence of the rhizome’s essential oil, turmerone. This essential oil is found only in this species and is needed for increasing the absorption and bioavailability of the curcuminoids (Yue).

Yu jin is perhaps the most nebulous of the three turmeric. It is always the root of the plant - as opposed to the rhizome - and is typically derived from *curcuma aromatica*. However, there are two accepted versions of yu jin in the Chinese materia medica: guang yu jin, and chuan yu jin. Guang yu jin is typically derived from *curcuma aromatica*, and is sometimes known as ‘southern yu jin.’ This is the yu jin that is typically exported from China, and is considered to be the better representation of the herb (Dharmananda, 2009). Chuan yu jin is derived from *curcuma longa*, the same species that produces jiang huang, but is specifically the root rather than the tuber. This version is known as ‘Sichuan yu jin.’ Yu jin may also be derived from *curcuma zeodaria* and *curcuma kwangsiensis*. While all of these species are known as yu jin, only *aromatica* contains p-tolymethylcarbinol, which is a cholegogue that has been shown to treat cholestasis, thus creating the accepted herbal action of yu jin to “benefit the gall bladder and reduce jaundice.” (Dharmananda, 2009, Kaserbacher 2016)

E zhu is an even more distant species of turmeric and in Ayurvedic medicine is actually not known as ‘turmeric’ but rather as ‘zeodaria.’ The species from which e zhu is typically derived is *curcuma zeodaria*, although confusingly the herb known as ‘zeodaria’ is sometimes derived from *curcuma aromatica* and *curcuma kwangsiensis*.

When using turmeric for athletic performance and inflammation control, the usage of properly identified jiang huang is extremely important due to the active compound (curcuminoid) content. In 2011 Li, et al examined these three herbs to determine which one had the highest concentrations of curcuminoids. Jiang huang was found to contain 22.21-40.36 mg/g, with the top end coming from Sichuan Province (western China). Yu jin was found to contain up to 1.94 mg/g of curcuminoids, and e zhu was found to contain up to 0.098 mg/g.

### Dosing

According to tradition in Chinese herbalism, jiang huang is dosed at 3-9 grams of dried and decocted herb per day. Interestingly, there has been research conducted specifically on the weight differences between fresh and dried *curcuma longa*. Fresh turmeric has been found to have a water weight content of 78.65% (Borah, 2015). For dosing fresh turmeric to be used in decoction format, this means approximately 14-42 grams (0.5-1.5 ounces) of fresh herb decoction should be consumed to reach the benefits of classical dosing. However, to get the most accurate picture the variability of curcuminoid content must be taken into consideration to reach a therapeutic dose. At 14 g of raw herb, the range for curcuminoid content for *rhizoma curcuma longa* is 311-565 mg, and at 42 g of raw herb, the curcuminoid content range is 933-1695 mg.

The bioavailability of curcuminoids are notoriously low. To list references would take pages unto itself. The use of adjuvants to increase the bioavailability of curcuminoids typically centers around a few methods: turmerone in either fresh herb format or added to extract, the use of piperine from the herb hu jiao (*piperis fructus*), also known as black pepper, and the use of lipophilic nanoparticle encapsulation. Piperine has consistently been shown to increase the serum levels of curcuminoids by 2000% (20-fold increase) and is currently the most potent delivery method for curcumin (Shoba, 1998). These effects have been repeated with a dosing of 1 g of curcuminoids combined with 1 mg of piperine.

In clinical practice there are three primary delivery methods: fresh turmeric root, jiang huang as a dried herb or granule, and high quality nutraceutical formulations. Content of piperine in whole black pepper ranges from 0.4 - 7% with an average around 5% (Peter, 2006). A tablespoon of black peppercorns is approximately 6.5g (carefully measured 10 times in my kitchen with a jewelers scale and then averaged), which would leave us with 325 mg per tablespoon. Clearly, not much is needed to hit the 1 mg piperine / 1 gram curcuminoids. For those wanting to use fresh turmeric root, this becomes a couple crushed peppercorns per ounce of root decocted together. Freshly crushed as piperine is an essential oil and will disappear shortly after grinding - which is why the pre-ground pepper never tastes as spicy. For usage with jiang huang as a dried herb, this becomes a couple freshly crushed corns per daily dose - 7 grams is the rough calculation. Pure piperine is also available and requires a tiny pinch for any decoction, preferably at the end as it does not require extraction. For the nutraceutical minded patients, there are a few great options with high bioavailability, and thousands of terrible options. Meriva was the first patented lipophilic nanoparticle encapsulation of curcumin to hit the market. It is used in several high quality supplements. My practice uses Designs for Health Curcum-Evail, as this is touted as the most highly bioavailable encapsulation on the market and has shown promising effects in several of my athletes, including one recent Ironman finisher who dropped close to 45 minutes off of his overall time while coming off a foot injury.

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Andrew Ball, DACM, L.Ac., Dipl.O.M. is an acupuncturist and herbalist practicing in Seattle, WA. His practice focuses on integrative care blending holistic therapies with modern scientific research on physical and herbal medicine. As a former triathlete and marathoner, he has a special interest in helping endurance athletes reach their full potential and hit their stretch goals.