

RESEARCH ESSENTIALS FOR ULTRARUNNING

# REFU



NO HYPE. JUST SCIENCE.

A SPECIAL EDITION

ISSUE 01 | VOLUME 2

# CONTRIBUTORS



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Jim Rutberg has been an athlete, coach, and content creator in the outdoor sports, endurance coaching, and event industries for more than 20 years. He is the Media Director and a coach for CTS and co-author of several training and sports nutrition books. He is also a columnist for Road Bike Action Magazine and trainright.com. A graduate of Wake Forest University with a Bachelor of Science degree in Exercise Physiology, Jim resides in Colorado Springs, Colorado, with his two sons, Oliver and Elliot.



## STEPHANIE HOWE, PHD

Stephanie Howe (PhD) is a professional trail and ultrarunner born and raised in Minnesota, currently residing in Annecy, France. Stephanie loves spending most of her day outdoors, preferably in the mountains with her dog Søren. Stephanie is a mom to Julien, who loves the outdoors and running, skiing, biking with his mom. Stephanie has a PhD in Nutrition & Exercise Physiology and owns a nutrition business centered on healthy, sustainable nutrition for health and performance. Competitively, Stephanie has won many races including Western States 100 and Lake Sonoma 50. Stephanie is passionate about the outdoors and protecting our earth.

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## HILARY YANG

Hilary Yang is an award-winning photographer, graphic designer, writer, media producer, and ultra runner. She is born and raised in Vancouver, Canada, but now resides in Los Angeles, California, with her husband Billy Yang and rescue mutt Charlie Salami. She is passionate about creating visual content and storytelling that inspire people to get outside and explore the great outdoors for themselves.

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# Koop's Take



**A**nti-doping efforts are coming to trail and ultrarunning. Already, races like the Pikes Peak Marathon, UTMB and Mammoth Trailfest offer best in class in-competition testing through World Anti-Doping Agency (WADA) signatories like USADA (The United States Anti-doping Agency) and the AFLD (French anti-doping). The Western States Endurance Run announced a partnership with USADA as we were producing this edition of REU. However, the anti-doping landscape lacks cohesion and continuity. For example, elite athletes currently serving bans for performance enhancing drugs in other sports have registered and raced in high profile trail races. But athletes who served bans many years ago and have since returned to sport have been refused entry. Trail and ultra athletes have been sanctioned for using intravenous fluids out of competition (a banned method) and forgetting to file for Therapeutic Use Exemptions. Both of these rules should be widely known already, particularly by elite athletes, but they are not. A hodgepodge of testing agencies, obscure rules tucked away in the far corners of race websites, and a spectrum of opinions from keyboard warriors dot the landscape. At the crux of all of this consternation is the lack of education among elite and recreational athletes. There is no source, agency or organization to take responsibility for this convoluted space.

Consider this edition of Research Essentials for Ultrarunning an initial attempt to get the ball rolling. Using three pieces of recent research, and a robust list of resources at the end of the issue, I hope to get some momentum going in this area.

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— KOOP

# THE ANTI-DOPING ISSUE



— by Jason Koop & Jim Rutberg, with research contributions by Stephanie Howe & Nick Tiller

# BACKGROUND

Ultrarunning has a doping problem, but it's not what you think. Yes, there are age-group and elite athletes purposely using performance-enhancing drugs. That will be an ongoing battle, as it is in every sport, but it's not the sport's biggest problem with doping. The bigger problem is inadequate knowledge and education around supplements, over-the-counter medications, and anti-doping rules. The vast majority of people engaged in sport - athletes, coaches, doctors, event directors, sponsors, etc. - are honest, believe doping and cheating are wrong, and support clean sport. The problem is, many of those honest, moral, and trustworthy athletes are consuming banned substances inadvertently and will never know about it until a positive doping test result lands in their mailbox. That is why we decided to devote this entire issue of Research Essentials for Ultrarunning to anti-doping. Our aim is to show you the science that describes the risks you face as an athlete, and to provide resources you can use to align your behaviors with your stance on antidoping.

## THE STAKES ARE HIGH

People fail to recognize how critical this time period is for the sport of ultrarunning. We have the opportunity to make ultramarathon a model for how emerging sports create antidoping regulations and establish a clean sport culture. Or we can blunder our way to becoming a clown show where doping is rampant, enforcement is inconsistent and feckless, and the sport's mainstream reputation is forever tarnished. For a clear illustration of that pathway, look to cycling.

The culture of doping was ingrained in cycling decades before the EPO-fueled cheating scandals of the 1990s and 2000s. More than 20 years later, despite spurring the development and implementation of more stringent anti-doping methods and technologies (e.g., the Biological Passport, athlete whereabouts tracking, etc.), doping is still a problem within cycling and the sport's mainstream reputation has not recovered. Case in point: On March 7, 2024, Spanish anti-doping officials turned up unannounced at the finish of an amateur bike race after the riders had started the competition. Once the peloton learned anti-doping officials were waiting for them at the finish, **130 OF 182 RACERS DROPPED OUT.**

WE HAVE THE OPPORTUNITY TO MAKE ULTRAMARATHON A MODEL FOR HOW EMERGING SPORTS CREATE ANTIDOPING REGULATIONS AND ESTABLISH A CLEAN SPORT CULTURE.



## ATHLETES ARE ABOUT TO GET “WRECKED”

Ultrarunning is a decade or more behind other sports in terms of anti-doping, but as the sport catches up, a lot of athletes are going to endure a rude awakening. We can all agree that we want ultrarunning to be a clean sport and that performance-enhancing drugs and prohibited methods have no place in our community or competitions. But are you prepared for the discipline and attention to detail necessary to comply with both the spirit and letter of the rules?

Ultramarathon runners are, on average, unprepared and undereducated in terms of complying with clean sport practices. It is not as simple as “just saying no” to anabolic steroids or erythropoietin. It requires a critical examination of every supplement, medication, and training/recovery modality you use. You must be skeptical of ingredient labels and marketing claims on products produced by an unregulated supplement industry, and even the guidance of medical professionals, nutritionists, coaches, and especially fellow athletes. It’s not that the people around you want to mislead you; it’s that they are often no more informed than you are about clean sport practices and anti-doping rules. At the end of the day, athletes are individually responsible for the substances they consume and training/recovery methods they use.



When widespread in-competition and out-of-competition testing comes to the sport of ultrarunning - and it is coming - athletes who have been using unsophisticated methods of cheating will likely get caught. A much smaller number of hardcore and well-funded dopers will continue to evade detection. Age groupers and naive elite runners will likely suffer the greatest consequences. A positive test triggered by unintentional doping (e.g., a contaminated supplement or a medication they didn’t know needed a therapeutic use exemption) can yield the same penalties as purposefully consuming performance-enhancing substances. Proving that a supplement was contaminated is difficult, time-consuming, and can be prohibitively expensive.

After testing positive, both the unintentional and intentional dopers will offer the same defenses: “I didn’t know.” “I would never take anything that would be harmful to my health or career.” “I’m not a cheater.” Meanwhile, the court of public opinion will condemn the athlete as a doper and the reputational damage will be nearly impossible to reverse.

## THE DECK IS STACKED AGAINST YOU

The responsibility for being a clean athlete is on you but the deck is stacked against you. Antidoping officials have technologies that can detect minuscule traces of prohibited substances in blood and urine samples. This is a good thing because it gives officials the ability to catch cheaters who go to great lengths to mask or eliminate all traces of their doping behaviors. However, highly sensitive equipment and zero tolerance policies also mean supplements contaminated with tiny amounts of a prohibited substance can lead to positive drug tests. Compounded drugs - medications made by pharmacists who combine multiple drugs in a compounding pharmacy - are another source of such cross-contamination.





Supplement companies are largely protected from risk, but you are not. They are not held to the same standards as drug or food manufacturers. As a result of lax regulations, supplement manufacturers are not required to prove that the substance they're selling does what it is marketed to do. They are not required to prove that what is in the bottle contains everything listed on the ingredient label, in the amounts listed, or even that it's safe. If you're taking tablets, capsules, gummies, or powders, (including those "greens" powders) there's no requirement to prove that ingredients are distributed equally between individual tablets, capsules, gummies, or servings. Supplement contamination - either accidental or on purpose - has been a known problem for a long time. A 2008 review study cited an example of 634 supplements purchased

in 13 countries in 2001-2002 that "about 15% of the nonhormonal nutritional supplements were contaminated with anabolic-androgenic steroids" (Geyer et al. 2008).

There is also no requirement to prove there are no additional, unlisted substances present. This means that if you want to market an herbal supplement that's supposed to "boost energy" and you list B Vitamins on the label, you can lace the supplement with an unlisted amount of a stimulant (e.g., caffeine) to increase the likelihood that customers will experience the effect claimed in the Instagram ad. That's a relatively benign deception. Sometimes, undeclared ingredients can increase health risks. For instance, a company that wants to increase the "energizing" effect of a "pre workout" supplement could add high doses of multiple stimulants, which can increase blood pressure and contribute to cardiac events like arrhythmias. On the doping side, if you market a "mass gainer" protein supplement to people who want to build muscle, adding an unlisted anabolic steroid could help improve customer satisfaction.

## PEOPLE TRUST UNRELIABLE SOURCES

Many people trust unreliable sources of information on clean sport practices and anti-doping rules. Although social media has democratized information and given everyone a platform to exercise their opinions (even if they're misinformed), the unintended consequence we've witnessed over the past decade has been "the death of expertise." Every day, some of the world's top experts - people who have spent their lives immersed in their particular fields - are asked to defend their expertise against social media influencers with giant audiences but zero credibility. The social media algorithms amplify anything that draws attention, regardless of its accuracy or reliability, which leads your second cousin to tell you, in earnest, that seed oils or vegetables are poison. Or was that sugar?

How influential are friends, media personalities, and social media posts? According to data from a study on nutrition knowledge by Vázquez-Espino et al., (2022) with about 500 subjects, "The sources of information mentioned by athletes as usually consulted included family (57%), dietitians (57%), physiotherapists (53%), coaches (49%), Internet (38%), friends (21%), magazines

(10%), scientific journals (8%), and books (6%).” Athletes in the study were compared against high-school students, undergraduate philosophy students, sports technical team members (trainers), and dietetics students. On average, athletes scored similarly to high school students and undergraduate philosophy students and far below both trainers and dietetics students. Furthermore, researchers found that subjects with lower scores on nutrition knowledge “tended to overestimate their competence in nutrition”.

People believe what they see and hear from Youtube, podcasts, social media posts, and mainstream media content featuring poorly-interpreted studies, and recommendations from well-meaning friends, coaches, and teammates. A study by Blennerhassett and colleagues found that “ultra-endurance athletes favored other athletes (73%) over nutrition experts (8%) as a source of nutritional information” (Blennerhassett et al., 2019). As a result, when someone goes on Joe Rogan’s podcast to rant about seed oils, nutrition professionals and coaches get questions immediately. The problem is these professionals must spend an increasing amount of their time and effort combating misinformation.



Many healthcare professionals, nutrition professionals, and coaches are not prepared to have meaningful conversations about clean sport practices or anti-doping rules. These topics are simply outside their scope of practice or irrelevant to the people they typically treat or work with. Your doctor is concerned with your health and may overlook the anti-doping implications of prescribing hormone replacement therapy or iron infusions for anemia. There are legitimate medical reasons for people to take erythropoietin, testosterone, glucocorticoids, and intravenous infusions. If your doctor doesn’t regularly work with competitive athletes, it is unrealistic to expect anti-doping ramifications to even enter into their decision-making process regarding treatment options.

Similarly, contaminated supplements may not be as much of a concern for nutrition professionals who work primarily on the public health side of dietary sciences (i.e., obesity prevention, diabetes treatment and prevention). Of course, contaminated supplements are a problem for all people, and we hope nutrition professionals recommend supplements wisely and only when necessary, but anti-doping rules are probably not top of mind for the RD working in the diabetes clinic. This is even more true for the nutrition influencers on social media, who may have no formal education in nutrition and zero certifications, or have nutritionist certifications from for-profit certification mills.

## SO, WHY SHOULD YOU TRUST US?

For one thing, we’re not trying to sell you a nutrition plan, a supplement, or a medication. For another, we are in the trenches with you, so to speak. As coaches and sports science educators, we work directly with athletes who are committed to clean sport practices and struggling to navigate the current minefield of supplements, over-the-counter medications, and shifting anti-doping rules. I have paid my own money to have USADA’s experts educate the athletes and coaches I work with on clean sport best practices and anti-doping rules. In particular, I work

closely with elite and emerging elite athletes so they understand the value, importance, and necessity of establishing impeccable discipline around living a clean sport lifestyle.

To provide you with the science behind the risks you face as an athlete, and to provide resources you can use to train and compete as a clean athlete, we examined three key topics: the health effects of non-steroidal anti-inflammatory drugs (NSAIDs), the prevalence of drug use in ultra-endurance athletes, and the risks associated with contaminated supplements.



## WHAT IS KNOWN ABOUT THE HEALTH EFFECTS OF NON-STEROIDAL ANTI-INFLAMMATORY DRUG (NSAID) USE IN MARATHON AND ULTRAENDURANCE RUNNING: A SCOPING REVIEW

A funny thing happens when you have been immersed in a subject or community for a long time. Information that was once novel or controversial becomes doctrine, so accepted that you no longer bother to question it, and so pervasive that you think it must be common knowledge. The idea that non-steroidal anti-inflammatory drugs (NSAIDs), which are over-the-counter drugs that reduce pain from inflammation, are potentially harmful and dangerous for ultraendurance athletes falls into this category. Medical professionals, race directors, race doctors, coaches, and even major event organizers (e.g. Ultra Trail du Mont Blanc), have implored athletes to stop taking NSAIDs during races and prolonged training sessions for many years. We have done so because of compelling evidence that NSAID use - particularly when combined with the physical and environmental stresses of ultraendurance competitions - increases the risk of acute kidney injuries, gastrointestinal issues, and hyponatremia.

Nevertheless, athletes persist. Every time I support athletes at ultramarathons, I ask to look through their crew supplies. I am specifically looking for NSAIDs, and I'd estimate I find them in at least one athlete's aid station supplies at every race I attend. All the NSAIDs I find go directly in the trash can. There are legitimate uses for NSAIDs in a person's daily life; they are quite effective as anti-inflammatories and pain relievers. However, based on the evidence I've seen and the medical professionals I've consulted, I believe the health risks associated with NSAID consumption during an ultramarathon are unacceptable. Similarly, REU's Stephanie Howe PhD asks all her nutrition clients about medications and supplements they take, and she commented that more than half say they regularly take NSAIDs in conjunction with training and/or competition.

Our anecdotal experiences are supported by research, too. A study from 2020 reported that 68% of subjects used NSAIDs in the previous 12 months, with prevalences of 84% in triathletes, 71% in runners and 53% in cyclists (Didier et al., 2017). A 2021 scoping review by Brennan et al., references several studies that found systemic use of NSAIDs above recommended doses by elite and non-elite athletes, including runners, triathletes, student athletes, and professional soccer players (Brennan et al., 2021).

But what if we've all been wrong? Or perhaps the dangers of NSAID use during sports aren't really as dire as we've been led to believe? One of science's greatest responsibilities is to examine new and emerging evidence and challenge accepted

NSAID DRUG NAME	BRAND NAME
Acetylsalicylic acid	Aspirin
Ibuprofen	Advil, Motrin
Naproxen	Alleve
Diclofenac	Cambia
NON- NSAID BRAND NAME	BRAND NAME
Tylenol	Acetaminophen/Paracetamol

conclusions. For that reason, we decided to review the following: **“WHAT IS KNOWN ABOUT THE HEALTH EFFECTS OF NON-STEROIDAL ANTI-INFLAMMATORY DRUG (NSAID) USE IN MARATHON AND ULTRAENDURANCE RUNNING: A SCOPING REVIEW.”**



Why are we including an NSAID paper in an issue about doping and clean sport? To be clear, NSAIDs are not on the prohibited substance list for USADA or WADA. However, UTMB at one point implemented a ban on NSAID use before and during competition, which they have since rescinded. As of the publication of this edition of REU, other races like the **MARATHON DU MONT BLANC** still ban NSAID use 24 hours before and during competition. At the other end of the spectrum, Ironman had a partnership with Aleve, an NSAID most race medical directors would rather athletes avoid during competition. In fact, medical directors at events consistently discourage competitors from using NSAIDs before and during their races.

## SUBJECTS AND METHODS

As a scoping review, this study should not be confused with a systematic review. According to a 2018 paper from Zachary Munn and colleagues, “Scoping reviews are useful for examining emerging evidence when it is still unclear what other, more specific questions can be posed and valuably addressed by a more precise systematic review. They can report on the types of evidence that address and inform practice in the field and the way the research has been conducted” (Munn et al., 2018). Two of the big differences between scoping and systematic reviews are that the latter aims to answer a specific question and includes a “quality analysis” for the data included in the review. A scoping review takes a broader look at the current state of emerging research. In this case, researchers used the scoping review methodology to evaluate recent research in NSAID use among endurance athletes; something that’s been extensively studied already.

The inclusion criteria were studies published in English, focused on marathon or ultramarathon running (distance  $\geq$  26.2 miles), and reporting on the health risks associated with NSAIDs. Furthermore, after the initial search, studies were removed (e.g. duplicates, not dealing with NSAIDs, etc.) until there were 53. Of those, 23 were removed because they were not open access, meaning free to obtain without a paid subscription. This last criterion is troubling for two reasons. One, limiting a review to open-access papers often yields lower-quality research because predatory and lower-quality journals with scant peer-review are often “pay to publish” rather than pay to access. Although we’d prefer all research to be open access, that’s just not the way the academic publishing world works, yet. The second reason this is troubling, however, is that there are ways to find papers if you’re sufficiently motivated: you can often find them or their preprints on ResearchGate, access PDFs through “shadow libraries” like SciHub, or contact the researchers directly and ask for copies of their work. This means the authors of this scoping review just didn’t ask for access to the studies that weren’t immediately available; this biases the type of papers that were included. We routinely review paywalled studies for REU, as well as for our own development, and we often obtain them by a simple email to the primary author(s) of the research.

Of the 30 studies included in the analysis, most were from the USA (n=15), UK (n=7), South Africa, NZ, Denmark, and Italy. Most subjects were male and seven studies included no females. The

most common distances featured in the studies were 160km (n=8) and marathon (n=8), 110k, 80k, 89k, 60k, ironman, 24h race, and multisport competitions.

## MAIN FINDINGS

The findings from the 30 studies were divided into four categories, representing the most common health concerns associated with NSAIDs: Electrolyte imbalance and hyponatremia, acute kidney injuries (AKI), gastrointestinal (GI) disturbances, and oxidative stress/muscle damage.

### ELECTROLYTE IMBALANCE AND HYPONATREMIA.

Exercise-associated hyponatremia (i.e., plasma sodium concentration < 135 mmol/L) was the main focus of 14 studies examining disturbances in electrolyte balance. Results were mixed regarding NSAID use and hyponatremia, with six studies showing no significant correlation, six showing a correlation, and two failing to present sufficient data. There was only one randomized controlled trial, conducted at Western States Endurance Race, and it showed “no significant alteration in serum electrolytes in those who had taken ibuprofen before and during the ultrarace (n=49), compared with placebo (n=25). In contrast, an observational study focusing on athletes competing in an Ironman triathlon found that 100% of athletes who developed hyponatremia had taken NSAIDs.”

### ACUTE KIDNEY INJURY (AKI)

Acute kidney injuries are often measured using creatinine (Cr) levels in the blood. Creatinine is produced by the breakdown of creatine in muscle, and healthy kidneys filter it out of the blood. Therefore, high Cr levels indicate the kidneys are not functioning properly. Cr levels 1.5x baseline are considered a risk for AKI, and Cr levels 2x baseline are considered injury. Six studies included in the review focused on the link between NSAID use and AKI, and results were mixed. All found a “potential link” but none found statistically significant results. There was one double-blind randomized study in which subjects who consumed 400 mg ibuprofen during a multi-stage race were more likely (22 of 42 subjects) to develop AKI compared to placebo (16 of 47 subjects), but these results were not statistically significant. The other papers included small retrospective case studies and review articles that were inconclusive. Acute kidney injury is difficult to study for ethical reasons, leading to mostly observational case studies with low numbers of subjects. The scoping review indicates the link between NSAIDs and AKI is likely and that the potential consequences are significant and detrimental to athlete health, but does not provide a slam-dunk link between NSAIDs and AKI.

### GASTROINTESTINAL DISTURBANCES

The synopsis from the review was, “Four of the 30 studies focus on GI issues among the ultra-runners, including one prospective observational study, one



review and two case reports. Out of the four studies, none of them found a clear correlation between NSAID use and GI issues.” Again, this is a difficult area to study and no controlled studies were included, just observational, review, and case studies. Although not widespread, each found a troubling incidence of GI disturbance among the respective cohorts in the studies, including fecal blood loss, vomiting, rupture of the esophagus, and even the development of ischemic colitis at mile 12 of a marathon. But the link to NSAID use was not clear. The most compelling evidence of a link between NSAID use and GI disturbances came from a study by Robertson et al., that found that there was a significant increase in fecal blood loss during marathon running, which was exacerbated by consumption of pain relievers. However, the study is quite old (1987) and included NSAIDs and other drugs, including acetaminophen (sold as Tylenol in the US and Paracetamol in Europe), which is not an NSAID (Robertson et al., 1987).

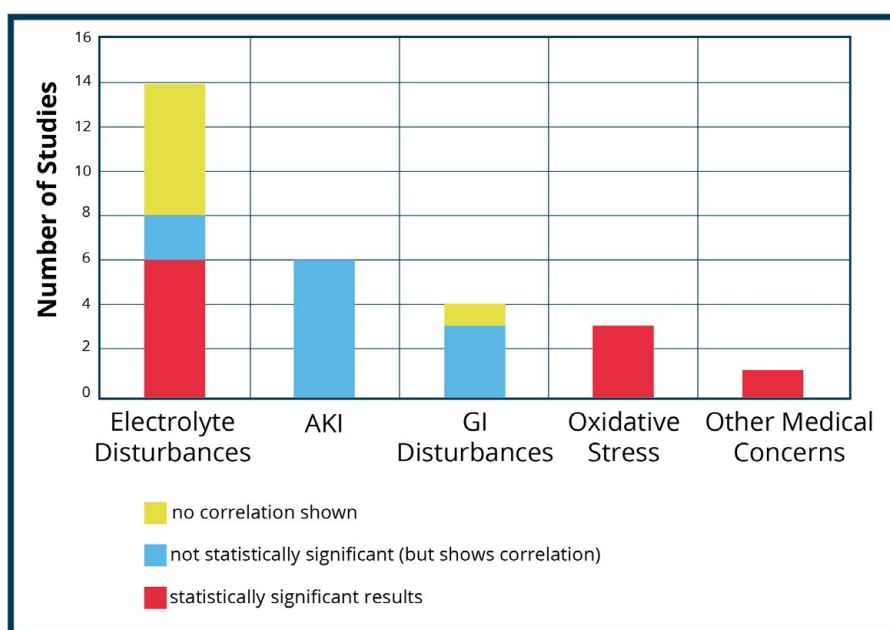
## OXIDATIVE STRESS AND MUSCLE DAMAGE

Only three of the studies included in the review looked at the potential link between NSAID use and oxidative stress and systemic inflammation, which are common and expected consequences of ultramarathon running. These are also symptoms NSAIDs are commonly prescribed for, in non-sports contexts, which is part of the reason so many athletes are quick to turn to NSAIDs during and after endurance exercise. The studies included in the review - one randomized control trial, one non-randomized control trial, and one observational study - found mixed results. Two found an increase in oxidative stress and one found a decrease, and none found a change in athletic performance during the events.

The review also referenced two studies that looked at cardiac injury (a case study with one athlete, no apparent link to NSAID use) and a survey of triathletes that looked at ibuprofen use and commonly reported side effects. A notable insight from that study was that 196 of 327 triathletes (60%) reported NSAID use, despite 27% being aware of the potential for AKI and more than 50% recognizing GI distress as a potential side effect.

## INTERPRETATIONS AND TAKEAWAYS

Looking solely at the scoping review, it is difficult to say there is compelling evidence to show that consuming NSAIDs before, during, or after ultramarathon training and competition has a negative impact on athlete health. There’s also no compelling evidence that they are safe to consume, either. When that is the case, we must look for context in the wider body of research. When we do that, there is compelling evidence that regular and prolonged use of NSAIDs in the general public can increase the risk of GI issues (e.g., upper GI



Adapted from Pannone E, Abbott R. What is known about the health effects of non-steroidal anti-inflammatory drug (NSAID) use in marathon and ultraendurance running: a scoping review. *BMJ Open Sport Exerc Med.* 2024 Feb 2;10(1):e001846. doi: 10.1136/bmjsem-2023-001846. PMID: 38318269; PMCID: PMC10840051.

peptic ulcer disease and bleeding). We also know from previous research that ultramarathon running increases the risk for GI distress and injury. Similarly, there is a strong body of research indicating that ultramarathon runners are at greater risk for AKI, and there is compelling evidence from the general public that NSAID use is associated with an increased risk of AKI.

As Carl Sagan said, “Absence of evidence does not mean evidence of absence.” In the case of linking NSAID use definitely to detrimental health outcomes in ultramarathon runners, there isn’t much evidence to analyze because it is a difficult subject to study. The studies that exist suffer from small subject pools, lack of controls, and heavy reliance on observation and survey methods. What we know is that the established health risks to the general public associated with NSAID use are almost always exacerbated by the conditions and environment of ultramarathon running. Put simply, the mechanisms that cause chronic NSAID use to increase the risk of GI bleeding are the same for you and your sedentary coworker, but ultramarathon training adds another level of vulnerability.

THERE’S REALLY ONLY  
ONE TAKEAWAY HERE:  
DON’T TAKE NSAIDS  
FOR ANYTHING RELATED  
TO EXERCISE, TRAINING,  
COMPETITION, OR  
RECOVERY FROM  
COMPETITION.

There’s really only one takeaway here: Don’t take NSAIDs for anything related to exercise, training, competition, or recovery from competition. If your physician prescribes NSAIDs to reduce fever or reduce swelling from an acute injury, after surgery, or another medical reason, that’s different. But as a way to alleviate normal exercise-induced soreness and inflammation, stay away from NSAIDs.





## PREVALENCE OF DRUG USE IN ULTRA-ENDURANCE ATHLETES

**A**s described in the previous section, a significant proportion of endurance and ultraendurance athletes consume NSAIDs despite knowing the potential for detrimental health consequences. With the exception of a few select ultramarathons, NSAIDs are not prohibited in or out of competition. But what is the prevalence of ultra-endurance athletes taking drugs - both non-prohibited and prohibited? A 2020 study by Faiss et al., examined 3686 blood samples from track and field athletes competing at the World Athletics World Championships in 2011 and 2013. Researchers used Athlete Biological Passport (ABP) methodology, a longitudinal approach that analyzes individual changes in selected biomarkers over time. Their analysis suggested the overall prevalence of blood doping was 15-18% of athletes tested.

When athletes are given the opportunity to self-report the use of prohibited substances in a way that ensures anonymity, the reported prevalence of doping (inclusive of any prohibited substance) increases. In two studies using surveys of elite athletes competing in World Athletics competitions in 2011, between 39 and 62% of athletes anonymously self-reported the use of prohibited substances (Ulrich et al., 2018). In contrast, only 1-2% of tests performed by anti-doping agencies result in Anti-Doping Rule Violations (ADRVs). Thus, the picture that emerges is one in which around half of elite athletes admit to committing ADRVs, but only 15-18% of those athletes are detected through longitudinal data (e.g., ABP data), and just 1-2% actually test positive for prohibited substances or methods.

Information on the prevalence of drug use in ultramarathon athletes has been scarce up until a novel and newly published study by Paul Robach and his colleagues. In the simply titled study, ["PREVALENCE OF DRUG USE IN ULTRA-ENDURANCE ATHLETES"](#), researchers recruited subjects for a study that included a questionnaire, but also surreptitiously collected urine samples from subjects using a collection mechanism hidden in event venue bathrooms.

Understanding the actual prevalence of drug use in ultrarunning is very important for determining both the potential scope of athletes' efforts to cheat and the range of health risks ultrarunners are exposing themselves to. And both sides of that divide are important. Although we all want to promote clean sport and root out performance-enhancing drugs, we must also recognize that many substances are on the prohibited list because of the risks they pose to athlete health, and drug misuse - as opposed to purposeful doping with the goal of enhancing performance - puts athlete health at risk. So, let's get right to the study.

### SUBJECTS AND METHODS

A total of 412 individual urine samples were collected from male competitors at Ultra Trail du Mont Blanc (UTMB) events in 2017, including the Orsières-Champex-Chamonix (OCC), Courmayeur-Champex-Chamonix (CCC), Sur les Traces des Ducs de Savoie (TDS), and Ultra-Trail du Mont Blanc (UTMB). Ten days after the races, 2931 male and female competitors across the same races completed an anonymized, randomized-response questionnaire regarding drug use.

The novel and fascinating aspect of the experimental methods was the ingenious way researchers collected blind urine samples. Unbeknownst to the athletes, researchers had modified some of the urinals with a custom tubing system that collected and stored urine samples from the participants. As subjects approached the urinal, a presence sensor triggered an antenna to read the radio frequency identification (RFID) tag attached to the athlete's bib number. The individual sample was then associated with a coded number to preserve each athlete's anonymity. Using the RFID tag information, researchers were also provided with de-identified demographic information (i.e., age, race rankings, and International Trail Running Association (ITRA) performance index scores). Ethical issues notwithstanding, the point of the charade was to reduce the self-selection bias associated with asking athletes to volunteer a urine sample for testing - even if they are assured the sample would be anonymized.



Air purging was used between subjects, rather than fluid flushing, to prepare the collection apparatus for the next sample. Additional measures were taken to minimize the chance of cross-contamination between successive samples. In the subsequent analysis of samples, any substance found at equal or lower concentrations compared to the previous sample was considered a likely sign that the second sample was contaminated.

Urine samples were sent to two WADA-accredited laboratories, the French anti-doping lab in Orsay and the Italian anti-doping lab in Rome. The Italian lab tested for EPO agonists and non-prohibited substances for pain mitigation (e.g., acetaminophen, NSAIDs, and benzodiazepines). The French lab tested for a wider range of WADA prohibited substances, including EPO, anabolic steroids, beta-2 agonists (asthma medications), diuretics and masking agents, stimulants, narcotics, cannabinoids, glucocorticoids, and beta-blockers.

In the questionnaire, subjects were asked about the “use of 1) acetaminophen, 2) NSAIDs, 3) glucocorticoids, 4) cannabinoids, 5) opioids or narcotics, 6) stimulants, 7) sleeping medications, 8) anti-diarrheal, anti-spasmodic or anti-nausea medications and 9) anti-asthma medications, during the race or the 48 hours before; and 10) anabolic steroids and 11) recombinant erythropoietin or growth hormone, during the weeks/months before the race.”

## MAIN FINDINGS

Of the 412 urine samples collected, 50% contained at least one drug and 16% contained at least one prohibited drug! The main classes of drugs detected in urine are listed, from most to least frequent, in the table to the right. Notably, no samples contained EPO or “suspicious testosterone”. There were no significant differences in substances taken by athletes in the different races, despite those races varying greatly in distance and elevation change.

## QUESTIONNAIRE FINDINGS

Of the 2931 completed questionnaires, 13% were answered by female athletes. Drugs declared were acetaminophen (13.6%), NSAIDs (12.9%), and anti-diarrheal, anti-spasmodic or anti-nausea medications (2.5%). However, **no subjects reported the use of prohibited drugs on the questionnaire** (e.g., glucocorticoids, cannabinoids, opioids/narcotics, stimulants, anti-asthma drugs, anabolic steroids, and recombinant erythropoietin/growth hormone).

## COMPARISON FINDINGS

Notably, there were some discrepancies between the results of the questionnaire and urine samples. For instance, in the questionnaires, no athletes admitted using illegal drugs, but the urine analyses revealed 16% of the samples were tainted. NSAID prevalence in urine samples was nearly twice what was reported in the questionnaire (12% to 22%).

## INTERPRETATIONS AND TAKEAWAYS

This study is the first we know of to use concealed urine collection to directly test a large number of urine samples from ultramarathon runners during a competition. The results are both encouraging and disturbing. On the positive side, the urine tests did not indicate systemic or widespread doping with performance-enhancing substances. However, one in six athletes (66 out of 412) would have received an ADRV due to the presence of a prohibited substance in their urine sample. Of the prohibited substances found, the most common was morphine, an opioid painkiller. Glucocorticoids, beta-2 agonists, cannabinoids, and stimulants were found at lower rates.

So, were 16% of male ultramarathon runners at the 2017 UTMB cheating and purposely using prohibited substances to enhance their performance? That's unlikely, but not impossible. It is more likely that athletes either didn't know or didn't care that drugs (or supplements) they were taking for real or perceived ailments were prohibited in competition. For instance, glucocorticoids are anti-inflammatory steroids (e.g., prednisone, dexamethasone) that can be prescribed for allergic reactions and immune system disorders. Beta-2 agonists are bronchodilators used to treat asthma. Cannabinoids include THC from marijuana, and stimulants can include medications used to treat Attention Deficit Hyperactivity Disorder (ADHD), like dextroamphetamine (Adderall).

CLASSES OF DRUGS IN URINE	% FOUND
NSAIDs	22.1%
Acetaminophen	15.5%
Opioids	6.6%
Ethanol metabolites	5.1%
Diuretics	4.9%
Hypnotics	4.4%
Glucocorticoids	2.7%
Beta-2 agonists	2.2%
Cannabinoids	1.9%
Beta-blockers	1.7%
Stimulants	1.2%

\* No samples contained EPO or 'suspicious testosterone'

*Adapted from Robach P, Trebes G, Buisson C, Mechin N, Mazzarino M, Garribba F, Roustit M, Quesada JL, Lefèvre B, Giardini G, de Seigneux S, Botré F, Bouzat P. Prevalence of Drug Use in Ultra-Endurance Athletes. Med Sci Sports Exerc. 2024 Jan 18. doi: 10.1249/MSS.0000000000003374. Epub ahead of print. PMID: 38233983.*

	QUESTIONNAIRE RESULTS	ACTUAL % FOUND
Prohibited drugs	0%	16%
NSAIDs	12%	22%

*Adapted from Robach P, Irebes G, Buisson C, Mechin N, Mazarino M, Garribba F, Roustit M, Quesada JL, Lefèvre B, Giardini G, de Seigneux S, Botré F, Bouzat P. Prevalence of Drug Use in Ultra-Endurance Athletes. Med Sci Sports Exerc. 2024 Jan 18. doi: 10.1249/MSS.0000000000003374. Epub ahead of print. PMID: 38233983.*

**Most of the prohibited drugs found in athletes' urine samples are commonly-used drugs for everyday medical conditions.** This, along with the patchwork of anti-doping efforts mentioned earlier in this issue, just highlights the challenges amateur and professional ultramarathon runners must confront as in-competition and out-of-competition testing become more prevalent in ultrarunning.

More in- and out-of-competition is coming to major ultramarathon races around the world, including in the United States. The evidence in this study indicates athletes are reasonably knowledgeable about the difference between allowed and prohibited substances, considering there was very little difference between the prevalence of non-prohibited drugs in urine samples vs. the questionnaire, in contrast to a 16% prevalence of prohibited drugs in urine samples and zero reported use of prohibited drugs in the questionnaire. Of course, there is no way to know how much overlap there was between the questionnaire respondents and the athletes who provided urine samples, so we wouldn't expect the prevalences to be exactly the same. But zero? That indicates people know what they aren't allowed to take and are either embarrassed

**“I DIDN'T KNOW” WON'T BE ENOUGH TO SALVAGE YOUR REPUTATION.**

by it and or distrustful of the promise of anonymity. Either way, the biggest takeaway from this study is that it's time to get serious about adopting a clean sport lifestyle and complying with anti-doping rules, because testing is coming and “I didn't know” won't be enough to salvage your reputation.



## Dietary Supplements as a Major Cause of Anti-doping Rule Violations

There are two types of coaches. Svengali-like build their practices around “secret sauce” recommendations that include training plans, workouts, and supplements they claim only they know about or know how to leverage. Then there are coaches who eschew most supplements and stick with tried and true workouts and evidence-based training methods. As you can probably guess, we consider ourselves the latter and encourage athletes to avoid the former at all costs. We have frequent conversations with athletes who are taking loads of supplements or curious about the latest “secret sauce” recommendation from a popular podcast or local athlete. Blanket statements like “don’t take anything” or “just eat food” are too simplistic to be taken seriously, so our conversations around supplements often include the following questions:

- **What do you think the supplement does or provides, and is that supported by scientific evidence?**
- **Why do you think you need what the supplement provides right now?**
- **Is supplementation necessary or can you achieve the same effects from food?**
- **Is there a safe and clean sport certified version of the supplement?**

I’ve had these conversations with athletes for more than 20 years, from beginners to elites and people with no education all the way up to literal rocket scientists. In my experience, few athletes can accurately describe what the supplements they take (or are considering) actually do. Their rationales for needing a supplement are often similarly weak. As you might expect, without knowing what the supplement does and whether that effect is beneficial for performance, they don’t know how much of a supposedly key ingredient would be biologically meaningful. And because of that, they rarely know whether supplementation - purposely consuming more of a substance than you would obtain through diet alone - is necessary.

You might think I detest or resent these conversations about supplements, but I don’t. I find them valuable because they provide a tangible example of the philosophy I use to approach all aspects of coaching: **What does it do? Why do we need it? How do we obtain/achieve it? What are the risks associated with it?** This is a basic framework I hope all athletes take to heart because it is a highly effective bullshit filter. At the same time, you have to be careful to leave room for experimentation and innovation. To quote Carl Sagan, “It pays to keep an open mind, but not so open that your brains fall out.” There may be workouts, training methods, or nutrients that are worth trying, even with an incomplete understanding of how they work, but we must go through the exercise to know what questions are left to be answered.

Few dietary supplements make it past the first three questions because most supplements are unnecessary and ineffective. This was the conclusion reached in extensively researched position papers on dietary supplements from the Australian Institute for Sport (AIS), International Olympic Committee (IOC), and the International Society of Sports Nutrition (ISSN) (See Resources Section).

Out of the thousands of supplements available on the market, these position papers agree that the following supplements are safe, have strong evidence supporting their effectiveness in certain aspects of sport, and are permitted for use in sport: caffeine, creatine, nitrate, beta-alanine, sodium bicarbonate.

The IOC, AIS, and ISSN positions obviously haven't stifled the development or marketing of dietary supplements. According to a 2023 overview in *Nutrients*, the value of the global dietary supplements market was estimated to be \$152 billion in 2021, with more than 30,000 supplements available in the United States. And outside of the conversation about the need and effectiveness of dietary supplements for athletes, they must be included in any conversation of clean sport practices and anti-doping rules.



As we have explained briefly in other areas of this issue, dietary supplements are largely unregulated, can be deceptively marketed, and can contain prohibited substances, either purposely or inadvertently. Beyond the issue of potential contamination with prohibited substances and the subsequent risk of a positive doping test, athletes should also be concerned by the potential health risks of consuming unregulated supplements. Obviously, poisoning your customers would be bad for business, but for athletes who may already have underlying health challenges, undeclared ingredients in supplements may contribute to unanticipated medical outcomes. For instance, supplements overloaded with stimulants could increase risks for cardiac and cardiovascular complications (e.g., arrhythmias, hypertension).

## HOW BIG IS THE RISK OF A POSITIVE DOPING TEST?

For anyone familiar with the film “A Christmas Story,” “You’re going to test positive for something” has the same ring to it as “You’re going to shoot your eye out.” The risks of a positive doping test from a contaminated supplement are well known but no one thinks it will happen to them. This is partly because it’s been difficult to quantify the extent of the risk. How many anti-doping rule violations (ADRVs) are caused by dietary supplements? That’s the question Fredrik Lauritzen addressed in his study, [“DIETARY SUPPLEMENTS AS A MAJOR CAUSE OF ANTI-DOPING RULE VIOLATIONS.”](#)

## SUBJECTS AND METHODS

Information on doping tests and ADRVs was obtained from Norway’s annual anti-doping reports from 2003 through 2020. This included tests from athletes registered as Registered testing pool (RTP) athletes, National level (NL) athletes, and Recreational athletes. According to the study, at any given time during this period, there were about 140 RTP athletes and 2000-4000 NL athletes in Norway’s testing pool. Athlete groups were categorized as: ball and team sports, strength and power sports, muscular endurance sports, fighting sports,  $\dot{V}O_{2max}$  endurance sports, gymnastic sports and other.

Each ADRV case was re-examined to determine its association with a dietary supplement, which was categorized as sports food, medical supplement, ergogenic supplement, other, natural product, or multi-ingredient pre-workout. The initial ADRV decisions were made by Anti-doping Norway’s Prosecution Committee and Judiciary Committee of the Norwegian Olympic Committee, and supported by other recorded documents.

## MAIN FINDINGS

Out of 192 ADRVs attributed to prohibited substances across 18 years, athletes claimed supplements to be the cause in 49 cases. Evidence showed a causal relationship between the use of a dietary supplement and a subsequent ADRV in 27 cases (55% of claimed and 14% of total). Of the 27 ADRVs confirmed to be caused by prohibited substances in a dietary supplement, 24 (89%) contained a prohibited stimulant, two (7%) contained a prohibited anabolic substance (e.g., a steroid), and one contained a beta-2 agonist (typically used by people with respiratory disorders). Multi-ingredient pre-workout supplements were found to be the most likely source (20 of 27 ADRVs) of the prohibited substance. Yet, 15% of the time, the prohibited substance was declared in the ingredient list, although researchers note they were often named differently than they appeared on lists of prohibited substances.

Who tested positive? “Seventeen (63%) of the 27 cases were of Recreational athletes, while the remaining 10 cases were of NL athletes. There were no analytical ADRV’s related to dietary supplements among RTP athletes.” In terms of distribution across sport groups, 17 athletes were in team sports, four in individual strength and power sports, two in  $\dot{V}O_{2max}$  endurance sports, two from “other” sports, and one each from fighting sports and gymnastic sports.

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## INTERPRETATIONS AND TAKEAWAYS

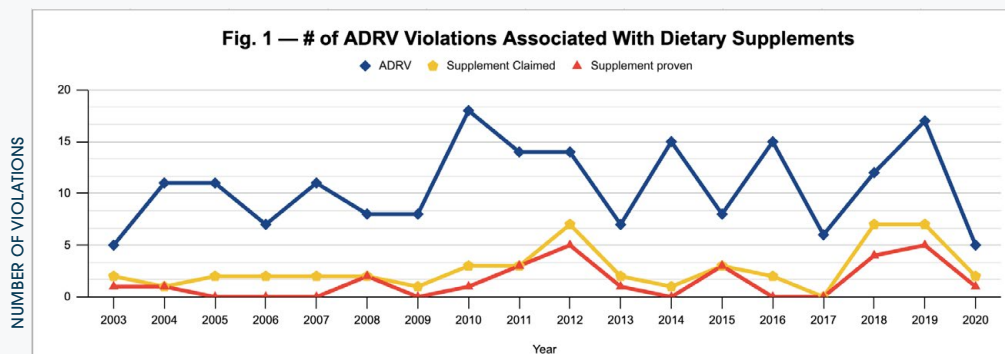
If I put a seven-chambered revolver in front of you with one bullet in it, would you play Russian Roulette? Do you like those odds?

Obviously, the stakes with prohibited substances are not life and death, but a positive doping test can be career suicide for an emerging or elite athlete and certainly a massively negative blow to any athlete’s credibility. And don’t forget that anti-doping rules aren’t just about performance. Most of these substances are prohibited because they’re harmful to your health. According to this study, 14% percent of all ADRVs related to prohibited substances were shown to be caused by supplements, and 85% of the time, the prohibited substance was not declared on the label. At face value, that means there’s a roughly one in seven chance that a supplement you take could result in a positive doping test. Now consider the number of supplements you take - you need only take 3-4 different supplements to have a >50% chance of taking something contaminated. And keep in mind this study included positive tests attributed to pre-workout supplements, a creatine supplement, a “muscle builder” (likely a protein supplement), a “fat burner”, and a supplement marketed to enhance immune function.

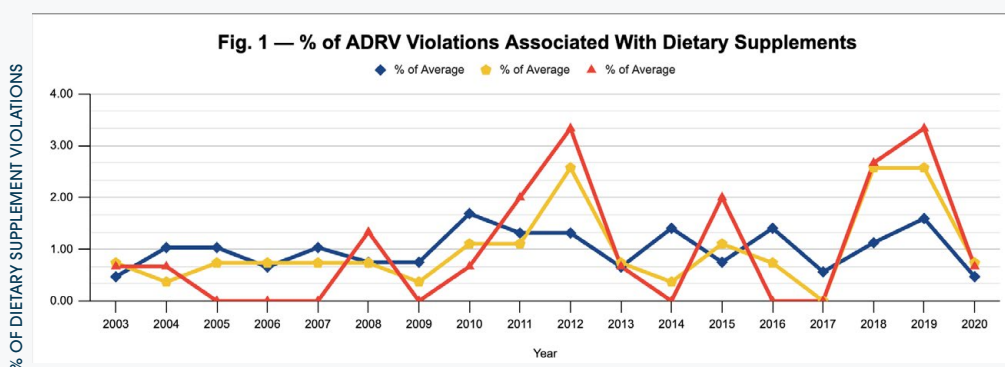
Is the presence of prohibited substances in dietary supplements a growing problem? We don’t know. The annual number of ADRVs fluctuated between 5 and 18 between 2003 and 2020, with no clear upward or downward trend. However, “...supplement ADRV’s constituted a greater proportion of total analytical ADRV’s in the most recent 3 year period (2018–2020), compared to the first 3 years of the period (2003–2005).” Although the total number of ADRVs, and the number

of claimed and proven instances of supplement contamination, were above average in 2018 and 2019, it is not a clear indication of an upward trend in contaminated supplements.

Viewed more broadly, this study suggests that most of the positive doping tests were caused by recreational athletes taking pre-workout supplements laden with stimulants. It is notable that none of the ADRVs related to dietary supplements were for athletes in the Registered Testing Pool - which represents elite athletes competing at the international level. A cynical person might say elite athletes who want to cheat have access to more sophisticated methods of doping. A more hopeful outlook would be that elite athletes are more educated in the risks associated with dietary supplements and therefore rely on safer supplements - those certified safe for sport (see Resources).



A final note about this study. Although it only looked at ADRVs for athletes in one country, Norway — despite representing a small proportion of the world's population — is a developed country with one of the best sports science systems in the world. As a result, we would expect reasonably similar results from other countries. Or, put another way, we would expect Norwegian athletes to be a reasonably representative sample of athletes from developed nations worldwide.



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## Clean Sport and Anti-Doping Resources

When you combine insights from research on drug use in ultrarunning, the risks of positive doping tests attributable to dietary supplements, and the health risks and prevalence of NSAID usage by ultra-endurance athletes, a handful of points stick out:

- Drug use is common in ultramarathon but use of prohibited substances is far less prevalent.
- Fifty percent of the urine samples collected at the start of an ultramarathon contained at least one drug but only 16% contained at least one prohibited drug.
- Athletes continue to consume NSAIDs despite recommendations against using them before, during, and after endurance exercise. A comparison of urine tests to questionnaire data indicates twice as many athletes consume NSAIDs than report it.
- The likelihood that a positive doping test can be attributed to a dietary supplement is



about 14%. In 85% of those cases, the prohibited substance was undeclared on the product label.

- **Athletes who claim their positive doping test was due to a dietary supplement are proven right about 50% of the time.**

Overall, only a handful of dietary supplements have been shown to be safe and effective, and few of those are relevant for ultra-runners. The risks of a positive doping test related to a dietary supplement are real, and the consequences can be dire. Education is an athlete's best asset in terms of mitigating the risk of consuming prohibited substances, so it is important for athletes to have access to anti-doping resources.

The following is a list of resources to stay informed and keep our athletes informed about clean sport practices and anti-doping rules.

## ANTI-DOPING RESOURCES

### US ANTI-DOPING AGENCY ANTI-DOPING 101:

This is a great starting point.

### WORLD ANTI-DOPING AGENCY LIST OF PROHIBITED SUBSTANCES AND METHODS:

Always go to WADA's website to download the most recent version of The List.

### GLOBAL DRUG REFERENCE ONLINE (GLOBAL DRO):

This is the essential resource for checking your medications and supplements against the Prohibited List. Keep in mind, you must check the country YOU PLAN ON COMPETING IN, not just where you live.

## SUPPLEMENT RESOURCES

### AUSTRALIAN INSTITUTE FOR SPORT SUPPLEMENT FRAMEWORK

### INTERNATIONAL OLYMPIC COMMITTEE CONSENSUS STATEMENT: DIETARY SUPPLEMENTS AND THE HIGH-PERFORMANCE ATHLETE

US Anti-Doping Agency High Risk Supplements. USADA'S SUPPLEMENT CONNECT- RESOURCE TO REALIZE, RECOGNIZE AND REDUCE YOUR RISK OF A CONTAMINATED SUPPLEMENT Contains a great resource of high risk supplements.

## SUPPLEMENT CERTIFICATIONS:

- NSF'S GLOBAL CERTIFIED FOR SPORT®: Independent third-party certification program recognized by the United States Anti-Doping Agency (USADA)
- INFORMED SPORT CERTIFICATION

## CONVERSATIONS

### KOOPCAST PODCAST SERIES RELATED TO ANTI-DOPING

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