In generations past, the off-season was the time for athletes to relax, recover from the season, and rest up for the following year. Now athletes not only train in the off-season, they train even harder than they do in-season. The pursuit of increased strength, stamina, and skill means that the modern athlete must engage in off-season training to keep up with the competition. This article will discuss general principles of nutrition and supplementation that are critical for helping athletes adapt and recover effectively from training. I will also highlight specific areas – digestion, immunity, and inflammation – that are crucial for maintaining the health of the athlete during intense training. In addition, I will review three major areas that should be addressed by NDs for off-season trainees: nutrition, supplementation and integrative care. I believe that naturopathic doctors are best suited to ameliorate these areas, and thus accelerate recovery and performance during off-season training.

**Nutrition**

Athletes typically engage in strength-training regimes in the off-season to increase strength, size, power, and stamina (aerobic and/or anaerobic). It’s also very common for today’s athlete to engage in “two-a-day” training sessions or multiple workouts in the same day. Therefore, optimizing the athlete’s diet and intake of real food (not just supplements) should be your top priority.

First, ensuring optimal intake of protein is crucial for improving physical performance, accelerating recovery from exercise, increasing strength, lean muscle mass, and hypertrophy. Athletes should be consuming 1.5-2.0g/kg body weight of protein per day, as per the guidelines of the International Society of Sports Nutritionists. Saturated fats in particular should be emphasized, as they are typically insufficient in the athletes diet. Studies show that athletes following a low-fat diet will experience significantly more fatigue and inability to recover compared to athletes on high-fat diets (specifically high saturated fat). Coconut oil and butter are great options that can be used daily for athletes. Men should aim for 2-4 “thumb” sizes per meal, whereas females should aim for 1-2 “thumbs” per meal. If your athlete has a lactose or casein sensitivity or allergy, use ghee or clarified butter as an alternative.

Once the athlete has achieved his desired level of fat intake, they must round out their diet with complex and simple carbohydrates. The total amount of carbs will vary from athlete to athlete, depending on their genetics, sport, current level of health, and whether they are trying to improve body composition. In general, complex carbs should make up about two-thirds of the athlete’s intake and be prioritized around meals. Staples of a high performance diet include brown rice, wild rice, sweet potatoes, yams, cassava, root vegetables, quinoa, millet, and amaranth. I prefer gluten-free sources of carbohydrates, but wheat and gluten containing carbs may be used if your athlete can tolerate them.

Next, the total caloric load must be sufficient to meet the athlete’s energy demands. Healthy fats are critically important to optimal athletic performance and overall health. Athletes should aim to consume approximately 30% of their total calories from fats, divided equally between one-third saturated fats, one-third monounsaturated fats, and one-third polyunsaturated fats. Natural simple sugars should make up about one-third of their total carb intake and be prioritized before, during, and/or immediately after bouts of exercise. If supplementing, pure glucose formulas would be preferable to sucrose forms, as excessive fructose consumption can slow gastric emptying and lead to cramping and abdominal discomfort. Ironically, most leading sport drink companies use sucrose rather than pure glucose.

**RECOVERY AND SUPPLEMENTATION**

As off-season training is typically quite strenuous (often involving exercising multiple times per day), supplementation is
tremendously important for supporting adequate recovery and training adaptations.

**The Best Protein Supplement Source**
The scientific literature is quite clear that there are two protein sources head and shoulders above the rest: whey protein isolate and milk. If athletes can digest milk effectively (I believe NDs are best suited to make this clinical decision), it can be a very powerful weapon in an athlete’s recovery arsenal.

**Milk**
The research states that consuming milk post-training increases muscle protein synthesis (MPS), strength, recovery from exercise and improves body composition. Despite sub-optimal concentrations of the branched-chain amino acid (BCAA) leucine, slower absorption rate, and predominantly casein form of protein, studies show milk is still a superior form of recovery drink for athletes compared to whey concentrate, soy, and carbohydrate only drinks. Researchers postulate the potential mechanisms for the performance improvements via milk supplementation post-exercise are: its ability to stimulate insulin, variety of protein types (whey and casein), additional growth factors and the additional carbohydrates found in milk. Milk should only be used post-training, as milk consumption pre- or peri- (during) exercise can lead to cramping and discomfort.

**Whey Isolate**
Athletes can also use whey protein isolate around bouts of exercise. Whey protein isolate supplementation is considered the gold standard by expert researchers for pre- and/or post-workout supplementation because of its ability to promote significant increases in training adaptations such as increased physical performance, recovery from training, strength, lean body mass, and muscle hypertrophy. The rapid rate of absorption of whey protein isolate into the bloodstream, along with superior levels of BCAA leucine, make it a superior choice to whey concentrate, soy, rice, and pea. It’s important to note that even individuals who struggle to tolerate dairy products can often do well with whey isolate, because it typically has less than 1% lactose. However, if your athlete cannot tolerate milk or whey, then vegetarian protein sources should be used.

**Vegetarian Proteins**
Vegetarian proteins are typically lower in BCAAs, most notably leucine. To mitigate these effects and mimic the beneficial effects of whey isolate, 3-4g of leucine should be added to all vegetarian protein shakes. Creatine levels also tend to be lower in vegans/vegetarians, therefore supplementation with 5g daily can be considered for this population.

**How Much Protein To Take**
A dose of 0.4-0.5g/kg per lean body mass (LBM) should be utilized either before, during, and/or after exercise. This typically amounts to 30-40g per shake for males, and 20-30g per shake for females. Ideally, most athletes should consume two liquid shakes (either before and after, before and during, or during and after) to maximize recovery and training adaptations. Athletes struggling to recover, maintain playing weight, or suffering from depressed immunity may need to consume all three drinks around exercise.

**Pre-, Peri- (During), Or Post-Exercise Supplementation**
The use of protein supplementation pre- and post-training has been shown to significantly increase work capacity in subsequent exercise bouts. It is well established in the scientific literature that muscle protein synthesis falls three hours after consuming a meal. If athletes are training more than three hours after their last meal, this is considered "training in fasted-state." Therefore, athletes should be consuming whey protein isolate, milk, or vegan protein drink post-exercise to offset accelerated proteolysis or muscle protein breakdown. Failure to do so can lead to significant elevations in muscle protein breakdown, persisting up to 24 hours after exercise. This is potentially highly detrimental during intense off-season training, condensed training camp style competition, and tournament style competitions when recovery is critical to subsequent performance. The research suggests that athletes do not need to take a protein and carb shake immediately after training unless they are training in the fasted-state, or more than three hours after last eating. If this is the case, your athlete is best to have their shake pre-workout and then consume a meal afterwards. Post-exercise antioxidant supplementation should not be recommended, as it can dampen positive training induced adaptations to exercise. Adopting a more alkaline diet will help maintain high levels of antioxidants. Athletes following an ancestral or Paleo diet consistently score even higher on alkalinity tests than vegetarians and vegans.
\textbf{"Two-A-Day" Training}

Playing multiple games or performing multiple training sessions in one day necessitates optimal recovery strategies to mitigate muscular damage, loss of lean muscle mass, elevated cortisol levels, and immune suppression. For athletes performing multiple workouts in one day, the research shows that a protein and carb shake, as well as a meal, between bouts of exercise significantly improves training outcomes in the subsequent training session. It's critical to include carbohydrates in this recovery shake. The amount of carbs required by the athlete will vary between a 1:1-4:1 ratio (carbs: protein), depending on their genetics, body-fat levels, and overall goals.

\textbf{Hydration}

Remarkably, most team sport athletes do not drink enough water to offset sweat loss, as 50% of athletes are sub-optimally hydrated. A mere 2% drop in hydration can reduce performance by 8-10%. For team sport athletes, this can result in significant reductions in sport specific skills. By the time an athlete feels thirsty, they are already dehydrated. Athletes should aim to consume three cups of water for every pound lost during training or competition.

\textbf{Integrative Support (Digestion, Immunity, Inflammation)}

The "x-factor" where functional medicine and naturopathic medicine can really make a difference with athletes is in supporting the digestive and immune system, as well as the inflammatory response to intense exercise.

\textbf{Digestion}

The need to ingest large amounts of food and simple sugars lends itself to increased likelihood of digestive dysfunction. Dysbiosis and leaky gut are common amongst athletes and should be assessed by the clinician. In addition, the common use of NSAIDs has been shown to induce intestinal hyperpermeability, further exacerbating digestive dysfunction. Limiting the consumption of gluten is also beneficial, as consumption can disrupt the CXCR3 gene, altering zonulin function and leading to increased risk of intestinal hyperpermeability. Zonulin dysfunction and subsequent leaky gut is associated with increased incidence of food allergies and chronic inflammation. The addition of a probiotic supplement, multiple times per day, can mitigate these effects in athletes. Increasing the intake of short-chain fatty acids (SCFAs), such as acetate, propionate and butyrate has also been shown to improve the growth and repair of the gut. They also exert potent anti-microbial effects on the gut.

\textbf{Immunity}

Immunity can also be compromised in athletes training intensely, particularly in high school and college level athletes. Low white blood cell counts, neutrophil counts, and secretory IgA levels are all commonly seen in young athletes. The research shows that training stress depletes natural killer cells, depletes sIgA levels significantly (low sIgA levels are associated with a 50% increased risk of contracting URI), compromises innate immunity, and can depress immune levels for 24-72 hours post-exercise. It's important to note that during the initial post-exercise window, athletes are at a higher risk of contracting upper respiratory tract infections (URTI). Therefore, adding in supportive foods rich in vitamin A, vitamin C, and zinc, as well as immune supportive herbs (mushrooms, Echinacea, astragalus) can all be highly beneficial to reverse or buffer the stress on the immune system. Probiotic bacteria can also protect against viral infection by stimulating T-cells and natural killer cells, thus enhancing the immune defense.

\textbf{Inflammation}

Finally, excessive inflammatory responses are also common when training intensely or multiple times per day, as is the norm in off-season training. Elevated C-reactive protein (CRP) levels are associated with increased levels of muscular damage and incomplete recovery. Furthermore, studies show that athletes pushing themselves hard in training will have substantially more muscle damage and soreness, and thus systemic inflammation. Increased levels of LDH (lactate dehydrogenase) and creatine kinase also serve as markers for excessive muscular damage. You may also see low ferritin levels in athletes training intensely (even in males), and this trend typically reflects an increased inflammatory response. To help mitigate the natural increases in inflammation due to intense off-season training ensure adequate rest, stretching, soft tissue work, ice baths, and proper nutrition. Fish oil supplementation is an effective tool for reducing post-exercise inflammatory markers — CRP, LDH, CK, TNF-a32, as well as reducing post-exercise increases in cortisol. Anti-inflammatory herbs (curcumin, boswelia) can also be added if further support is required.

\textbf{Summary}

Off-season training is an important time for athletes to build their fitness, physiques, and ultimately performance. Naturopathic doctors can assist in this process by implementing expertly designed sports nutrition and supplementation protocols, along with appropriate supplementation to support key systems of the body (digestion, immunity, inflammation) to provide athletes with all the tools to recover and achieve their performance potential.

\textbf{REFERENCES}


\textbf{Please refer to the member section at www.oand.org to view the full reference list.}