

# **Optimal Post-Exercise Recovery Interventions for Competitive Gymnasts**

By Kristine Trujeque and Graduate Student Mentor, Anna M. Welch

## **Introduction-**

Gymnastics is the number one most watched Summer Olympic sport according to the bleacher report (1). Its highly arousing performances give the viewer entertainment while they marvel at the incredible feats the athletes accomplish with every routine. Gymnastics comprises a group of different competitive disciplines that require the ability to poses strength, power, speed, flexibility, balance, coordination, and all while maintaining incredible showmanship. These athletes maintain a very delicate balance of aerobic and anaerobic workouts while also being incredibly flexible; things that do not normally go hand in hand. An average training session for gymnasts is about 2 hours and they perform 10- 14 sessions per week. According to Jaske (2), competitive gymnasts typically average about 24 hours of practice per week and 30-40 hours per week before a big competition, with Sunday as being mostly a rest day. These extensive workouts often put a toll on the athletes' muscles and joints and is metabolically and mentally exhausting. Most of these athletes are under the age of 18 which makes it even more difficult because their bodies are still growing and developing while being put through these intense bouts of exercise. The goal of this article is to provide information to, not only the athletes, but to the coaching staff about the importance of post-exercise recovery for these young athletes. Post-exercise recovery is especially important for these athletes because they need to be able to safely perform their death-defying skills in back-to-back consecutive bouts of training.

Implementing post-exercise recovery interventions to combat fatigue, muscle damage, and inflammation, is also imperative for restoring psychological and physiological functions of these athletes.

## **Fighting fatigue-**

Gymnasts typically eat, sleep, and breathe gymnastics. Exercising roughly 30 hours per week, these athletes experience both mental fatigue and muscular fatigue. It is important to note that while it is usually associated with feeling tired, fatigue can affect the whole body as well as large and small muscle groups. Mate-Munoz (3) defines muscle fatigue as “the incapacity of the neuromuscular system to produce energy around a joint” and notes several mechanisms that inhibit muscles to forcefully contract, specifically metabolic acidosis and depletion of glycogen. While certain training can aid in the body's ability to efficiently use glycogen stores and buffer from acidosis, other measures are sometimes needed to fully maintain and restore these cells. Sleep has been shown to be one of the most effective tools in recovery. Sleep has been shown to not only help replenish stores but also to maintain

metabolic systems. Schmid found that acute sleep loss reduces circulating concentrations of glucagon (4). This can affect the athlete's performance because a reduction in glucagon concentrations can negatively affect glucose metabolism and the glycolytic system. If the body cannot send signals for glycogen stores to be released when blood sugar gets too low, as with intermittent exercise, then the body cannot adequately produce energy during these metabolically stressful periods. Although there is not current information about the required amount of sleep an athlete should get, studies suggest that there is a recommended amount of sleep that adults and children should get. Watson (5) quotes the American Academy of Sleep Medicine which says that adults require between 7-9 hours of sleep and adolescents require 8-10 hours of sleep. He also notes that this number may vary within individuals, lifestyles, and amount of physiologic and psychologic stress one endures from day to day. Watson's study showed that athletes poorly self-assess their sleep duration and quality and are often sleep deprived. Many overtrained athletes also suffer from sleep impairments for several reasons. Sleep deprivation can negatively influence performance by causing reduced reaction time, decreased alertness, inadequate substrate availability, and increased fatigue (5). Watson also reports that sleep deprivation can increase the likelihood of injury up to 70% and as sleep decreases and training load increases the risk of injury increase. He suggests that this is due to impairments in reaction time and cognitive ability due to sleep deprivation (5). Although passive rest and sleep are the best tools, many athletes have external factors that contribute to inadequate duration and quality of sleep such as travel, busy schedules, competition schedule interfering with regular sleep schedule, etc. Dupuy (6) created a meta-analysis that included 140 studies which looked at several modalities used as intervention tools to combat delayed onset muscle soreness (DOMS), perceived fatigue, and muscle damage and inflammatory markers. Interventions for perceived fatigue included active recovery, massage, compression garments, immersion, contrast water therapy, and cryotherapy. Dupuy (6) found that a 20–30-minute massage immediately following or up to 2 hours after exercise reduced circulating cortisol and increased the concentration of beta endorphins. Cortisol is the primary stress hormone. It is produced when your body enters the fight-or-flight mode and communicates with the brain portion that controls mood, fear, and motivation (7). Beta endorphins are produced in the pituitary gland and are powerful pain suppressors. Because massages reduce cortisol and increase beta endorphins Dupuy suggests that therefore there was such a significant reduction on perceived fatigue (6). Out of the other interventions, they only found compression garments and cold-water immersion to have a significant influence on perceived muscle fatigue. Massage could be used as an alternative for both mental and muscular fatigue. Gymnasts have very busy schedules so squeezing a 30-minute massage into their

daily schedule may not be as practical as other intervention tools such as compression garments and cold-water immersion. Massages can also be costly and so they may not be an option for some athletes due to affordability. Because each athlete has different circumstances each of these tools should be given equal consideration to find the best solution toward combating fatigue and aiding in the recovery from exercise.

### **Repairing muscle damage-**

Gymnasts require extremely specific physical skills which allow them to perform at the highest level possible. Mkaouer (9) identified these skills to be power speed, isometric and explosive strength, strength endurance, and dynamic and static flexibility. This means that gymnasts are required to perform and use a delicate balance of both the aerobic and anaerobic metabolic systems while maintaining a high level of flexibility. Many studies have shown that excessive stretching of joint proprioceptors can decrease strength ability immediately following, however, gymnasts have seemed to prove just the opposite as their performances combine flexibility and strength. Training for these skills, identified by Mkaouer (9), often results in muscle damage. Muscle damage is marked by an increase in creatine kinase (CK) in the blood stream. CK is an enzyme that is produced naturally within the body and plays a major role in maintaining ATP homeostasis and use of the phosphocreatine (PCr) system (9). Simple tests can be done to test for CK and identify the level of muscle damage that occurs during exercise. Intense bouts of exercise along with eccentric muscle contractions usually yield the highest levels of CK (9). While gymnasts do not perform long durations of intense exercise, they do require many eccentric contractions for their skills. Jumping is a basic skill that is involved in almost every aspect of a gymnastics routine from leaps to tumbles. However, gymnasts are stringently judged by their ability to stick or hold their landing position with point deductions for every foot or extra hop after the initial impact. This skill requires not only core stabilizers but the practiced ability to eccentrically contract the hamstrings to stick and hold the landing from a powerful, high-velocity skill. The ability of gymnasts to adequately recover and maintain stores of PCr is imperative for their performance as this could be the difference in a gold or silver medal. Because the PCr system fuels short bursts of energy, as those required by gymnasts, it is imperative that they have interventions in place that aid in this portion of recovery. Creatine supplements have been used as interventions for muscle damage, but with all supplements care should be taken and research should be done to ensure that they are safe, effective, and legal for athletes. A decrease in CK in the blood signifies faster recovery. Dupuy (6) found that massages, again, are the most effective way to reduce CK levels in the blood after exercise and states, “massage was effective in alleviating the symptoms of exercise-induced

muscle damage and was associated with a decrease in plasma CK activity after eccentric exercise.” Small tears in the muscle, soft tissue, and ligaments happen frequently with intense exercise and overuse. Giving an athlete the proper tools and adequate recovery time from muscle damage can significantly reduce the risk of severe or season ending injury.

### **When to treat inflammation-**

Inflammation is natural defense of the body used to fight toxins, infections, and injuries in attempt to fix itself. Exercise-induced inflammation is often caused by muscle damage due to intense exercise bouts(6). Inflammation is often thought of as a negative effect of exercise and training programs and is often treated with anti-inflammatory medicine, ice, cold-water immersions, cryotherapy, etc. One current way of effectively treating inflammation is with the use of tart cherry juice. Tart cherry juice (TCJ) has been shown to reduce recovery time after intermittent bouts of exercise due to its anti-inflammatory properties. Quinlan’s (10) study shows that TCJ has prominent levels of phytochemicals, specifically anthocyanins which have powerful antioxidant and anti-inflammatory properties. In this study they measure recovery by a repeated countermovement jump or a 20 m sprint at 1 hr., 24 hrs., and 48 hrs. post exercise and compare them with individual baseline performance values. They found that in both types of exercise the athletes taking TCJ were able to recover quicker and get back to their baseline performance within 48hrs. After initial exercise which was significant compared to the placebo group. Quinlan (10) also measured the CK in the blood stream at the same intervals as well as pre-exercise and found that the CK in the blood stream was significantly less in the TCJ group than in the placebo group noting that this was due to the decreased inflammation and oxidative damage from supplementation of TCJ. Some studies now show that inflammation is important for muscle hypertrophy and strength gains (11). Because of this, it is suggested that interventions for inflammation only be used during competition season or when back-to-back consecutive days of intense exercise is required by the athlete. Research shows that reduced inflammation can relieve pain associated with muscle damage and inflammation which also warrants use of anti-inflammatory interventions.

### **Conclusion-**

Gymnasts work very hard to master specific and complex skills, related to their performances on the balance beam, vault, bars, and floor routines. They have multiple practice sessions each day and are required to perform at maximal capacity during each session. Recovery is imperative for these young athletes and all measures to aid in recovery of their fatigue, muscle damage, and inflammation need to be evaluated and considered to enhance performance. Research suggests that adequate sleep is one of the best intervention tools for fatigue as it allows the body to recover at the molecular level. Massages

are a useful tool to combat both fatigue and muscle damage as it reduces circulating cortisol and CK in the blood, as well as increases beta endorphins. Lastly, TCJ has been shown effective to aid in both sleep and inflammation due to its powerful antioxidant properties and that it contains melatonin. Recovery interventions are often overlooked as coaches and athletes tend to focus on learning skills and training for competitions. Recovery is just as important as mastering these skills because it allows the body to adequately restore itself which leads to improved performance.

### **Apply it-**

- Gymnasts engage in intense training sessions and competitions. This article provides helpful information for fitness professionals and gymnasts on improving recovery from muscle damage, inflammation, and fatigue.
- Why sleep and adequate rest are so important for gymnasts during the recovery period.
- Massages can not only help with mental fatigue but can also reduce stress and increase beta endorphins for pain suppressant.

### **Bridging the gap-**

Gymnastics challenges athletes both physiologically and psychologically. Some methods of recovery can be as simple as adequate rest, therapeutic massage, or consuming tart cherry juice. Muscle damage, inflammation, and fatigue can negatively impact the athlete's performance and can also lead to burn out in some cases. Adequate recovery is imperative for these athletes because they are often young, adolescent athletes who need to learn and practice good healthy habits for training.

### **Summary statement-**

Training to be a gymnast is an incredible feat as it involves a delicate balance between both aerobic and anaerobic metabolic systems while balancing strength and power with flexibility. These athletes need a program that ensures recovery from muscle damage, fatigue, and inflammation as they perform their highly dangerous skills in competitions where they are required to perform several times a day for back-to-back competitions.

### **Pulled text-**

“While certain training can aid in the body's ability to efficiently use glycogen stores and buffer from acidosis, other measures are sometimes needed to fully maintain and restore these cells. Sleep has been shown to be one of the most effective tools in recovery. Sleep has been shown to not only help replenish stores but also to maintain metabolic systems.”

### **Bio-**

Kristine M. Trujeque is currently pursuing her B.A in Exercise Science and doubling as a Pre-Med student at the University of New Mexico. Her interests are in human kinetics, sports medicine, and pediatric care.

## References

1. **Website-** <https://bleacherreport.com/articles/2656664-ranking-the-top-ten-olympic-sports-to-watch>
2. **Journal Article-** Jakše, B., Jakše, B., Čuk, I. and Šajber, D., 2021. Body Composition, Training Volume/Pattern and Injury Status of Slovenian Adolescent Female High-Performance Gymnasts. *International Journal of Environmental Research and Public Health*, 18(4), p.2019. <https://www.mdpi.com/1660-4601/18/4/2019/pdf>
3. **Journal Article-** Maté-Muñoz, J.L., Lougedo, J.H., Barba, M., García-Fernández, P., Garnacho-Castaño, M.V. and Domínguez, R., 2017. Muscular fatigue in response to different modalities of CrossFit sessions. *PloS one*, 12(7), p.e0181855. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0181855>
4. **Journal Article-** Schmid SM, Hallschmid M, Schultes B. The metabolic burden of sleep loss. *The lancet Diabetes & endocrinology*. 2015 Jan 1;3(1):52-62. <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.943.7385&rep=rep1&type=pdf>
5. **Journal Article-** Watson AM. *Sleep and athletic performance*. Current sports medicine reports. 2017 Nov 1;16(6):413-8. [https://www.revdesportiva.pt/files/para\\_publicar/Sleep\\_and\\_Athletic\\_Performance.11.pdf](https://www.revdesportiva.pt/files/para_publicar/Sleep_and_Athletic_Performance.11.pdf)
6. **E-Journal Article-** Dupuy O, Douzi W, Theurot D, Bosquet L, Dugué B. An evidence-based approach for choosing post-exercise recovery techniques to reduce markers of muscle damage, soreness, fatigue, and inflammation: a systematic review with meta-analysis. *Frontiers in physiology* [Internet]. 2018 Apr 26; 9:403. Available from: <https://doi.org/10.3389/fphys.2018.00403>
7. **E-Journal-** Mayo Clinic, 2016. Chronic Stress Puts Your Health at Risk. <https://www.mayoclinic.org/healthy-lifestyle/stress-management/in-depth/stress/art-20046037#:~:text=Cortisol%2C%20the%20primary%20stress%20hormone,flight%2Dor%2Dflight%2Osituation.>
8. **Journal Article-** Sprouse-Blum, A. S., Smith, G., Sugai, D., & Parsa, F. D. (2010). Understanding endorphins and their importance in pain management. *Hawaii medical journal*, 69(3), 70–71.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3104618/>

9. **Journal Article-** Mkaouer, B., Hammoudi-Nassib, S., Amara, S. and Chaabène, H., 2018. Evaluating the physical and basic gymnastics skills assessment for talent identification in men's artistic gymnastics proposed by the International Gymnastics Federation. *Biology of sport*, 35(4), p.383.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6358534/>

10. **Jornal Article-** Quinlan, R. and Hill, J.A., 2020. The efficacy of tart cherry juice in aiding recovery after intermittent exercise. *International journal of sports physiology and performance*, 15(3), 368-374.

<https://research.stmarys.ac.uk/id/eprint/3194/3/Hill-Efficacy-Tart-Cherry-Juice.pdf>

11. **Journal Article-** Lundberg, T.R. and Howatson, G., 2018. Analgesic and anti-inflammatory drugs in sports: Implications for exercise performance and training adaptations. *Scandinavian journal of medicine & science in sports*, 28(11), pp.2252-2262.

<http://nrl.northumbria.ac.uk/35225/1/Review%20analgesics%20drugs%20in%20sports%20FINAL.pdf>