

# **Overtraining Syndrome**

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## **Introduction**

Overtraining syndrome or OTS is defined as a “severe condition when overtraining without rest and recovery leads to performance decrements that last greater than 2-3 months coupled with mood disturbances” (1). Although, OTS is common in elite athletes it can also occur in children, which could be detrimental to development. OTS is becoming more prevalent in children due to a lack of daily physical activity paired with high intensity sports, is causing higher rates of overuse injuries (2). Overtraining can have a negative effect on sports performance. Overtraining syndrome can have different causes that can stem from an athlete’s diet or training program combined with inadequate recovery periods. Overtraining syndrome needs a clinical diagnosis, but it is important that athletes and those around them, such as coaches and trainers are aware of the signs and symptoms of OTS. With the right guidance and knowledge, an athlete has the potential to avoid the consequences associated with OTS. This article will focus on the causes, diagnosis, and prevention measures relating to OTS.

## **Diagnosis**

The symptoms of OTS can be confused with other issues throughout the body, making the diagnosis a challenge. Since symptoms can effect multiple parts of the body, they are often mistaken as different underlying disturbances (1). OTS can be caused by different variables such as training programs or diet. For example, if an athlete participates in a rigorous training program with minimal rest, they are more likely to experience OTS. Diet may play a huge role in OTS. In fact diet can be an independent trigger of OTS (3). Cadegiani and Kater (2019) performed a study on 87 athletes and evaluated variables that may be associated with OTS based on diet and training. They found most of the cases of OTS were caused by diet and sleep disturbances. It was discovered “at least one factor between low carbohydrate, low protein intake, and low overall caloric intake, and poor sleep quality was present in 100% of the study’s cases of OTS” (3). Therefore, it is essential athletes have a proper caloric and dietary plan to meet the needs of their body to avoid OTS.

## **Causes**

Overtraining syndrome is a very complex condition that can come from many different factors. The balance of hormones also plays a part in OTS. Hormone disruption in athletes with

OTS stems from other factors but can be diagnosed as a change in drive. As OTS progresses athletes may feel unmotivated to perform. Growth hormone (GH) is one of the hormones associated with exercise. Cadegiani and Kater (2019) published another study and discovered more factors that can be involved with OTS. They discuss the deconditioning period athletes often go through when they have OTS. This deconditioning period occurs due to poor hormonal responses to exercise. The hormones commonly effected are GH, cortisol, and prolactin. When these hormones do not respond as they should, it leads to underperformance and what is known as the deconditioning of an athlete during OTS (4). As OTS progresses the more it has effects on the body. In the early stages of OTS hormones like GH, adrenocorticotrophic hormone (ACTH), and cortisol are not effected by OTS. As OTS progresses it independelty delays hormonal responses (4). In that same article by Cadegiani and Kater (2019), they mention how testosterone is also negatively effected by OTS. Ovetraining syndrome decreased the testosterone-to-estradoil (T:E) ratio by 43% .(4). These two hormones are key in the body and at times can aid in muscle strength. Therefore, OTS can cause an indirect effect on muscle strength causing a deconditioning effect. Hormones do not only affect an athlete's motivation, but it also effects their mood. Athletes may become irritable, frustrated, along with many other negative emotions. A change in mood, fatigue, depression and confusion, are signs and symptoms of poor sleep quality and hormonal imablances (4). Hormones and rest are vital to keep an athlete healthy and are involved in the quality of life and performance of an athlete.

Although the symptoms of OTS seem straight forward, they can be associated with many different issues such as asthma, anemia, and depression. Therefore, it can be difficult to diagnose OTS correctly. However, biomarkers are a great way to distinguish one diagnosis from another. There is no one specific biomarker to diagnose OTS, in fact there are several that need to be accounted for, especially in elite athletes (1). Biomarkers that can help diagnose OTS include markers relating to oxidative stress such as a decreased glutathione. Glutathione is a powerful antioxidant that protects cells from oxidative damage. If the ratio of oxidative stress trumps over the rate glutathione, cells in the body can exeperince damage. If cells become impaired this could lead to a suppressed immune system, poor performance, and many of the factors that come with OTS. Other biomarkers include hematologic markers, immunologic markers and endocrinologic markers (1). Although, there are many biomarkers to test from and a diagnosis could potentially come from using several biomarkers, research still needs to be continued. There

are still many limitations biomarkers have. Relying on a single biomarker to expose OTS or the risk of injury would be unethical (5). Therefore, biomarkers alone are not a promising diagnostic tool. Thus, it is important health professionals are able to look at multiple factors of OTS such as biomarkers, mood, training, diet etc. The only way to diagnose OTS is after an evaluation by a health professional and rule out medical conditions that are common amongst athletes (1).

OTS comes with more than just mood changes and low motivation, a number of overuse injuries can also occur. While exercise is a positive, anabolic stimulus for muscle, too much exercise can actually become detrimental to the muscles. In fact, one of the most distinguishing symptoms of OTS is muscle weakness (6). There are many components that can cause muscle weakness from OTS on a biological level. For instance, glycogen stores play a vital role in maintaining energy within the muscle. Low glycogen stores can cause muscle weakness which leads to developing OTS (6). If an athlete experiences glycogen depletion in the muscle, it can impair their ability to perform (6). Low glycogen stores have also been associated with depression. Thus, glycogen depletion could be correlated to the change in motivation and mood of an athlete. It is clear that muscle glycogen is not the only reason for fatigue or mood changes. Others can include exercise-induced muscle damage, mechanical damage, inflammation, and other stressors on the body caused by an imbalance of training and rest.

Many different types of athletes can develop musculoskeletal injuries that stem from overtraining. One of these sports include swimming. In fact, overuse injuries and overtraining are among the top common issues swimmers have (7). The shoulder, hips, knee and spine are common places to find overuse injuries on a swimmer. Which means many swimmers could be struggling with performance due to intramuscular weakness and injuries. It is important that athletes know their limit and get the adequate rest needed for their efforts. Overtraining syndrome is most prevalent in endurance athletes. Endurance athletes spend many hours exercising their muscles with minimal recovery. Resistance based athletes can also develop OTS, but it is less common among these athletes. This is related to the work load and rest that is typically associated with resistance based athletes, higher intensities and longer rest periods in between training sessions.

### **Overtraining in Children**

Overtraining occurs in children in a similar way it occurs in adults. Children become less motivated for physical activities and suffer from overuse injuries. One main aspect that differs

between children and adults is the way overtraining is diagnosed. Often times children are diagnosed more with pain than changes in mood. Launay (2015) explains there are four stages that can be used to diagnose overuse/overtraining in a child: “stage 1: pain after physical activity; stage 2: pain during physical activity with no impact on function; stage 4: pain during all physical activities, even basic musculoskeletal functions” (2).

Pain is most common in the growth plates. Since pain stems from the epiphyses, apophyses, or physes it can be a concern if a child is overtraining because their body is still growing. There are many parts of the body a child can experience an overuse injury. It is more prevalent to find overuse injuries in the lower part of the body than the upper. Yet, this all depends on what sport a child is involved in. For example, injuries to the shoulder are uncommon in children compared to wrist injuries (2). The joints, such as the knees, are especially sensitive to overtraining due to the many growth conditions that occur in a child. One of the most common growth diseases is Osgood-Schlatter. Osgood Schlatter can be described as distally migrated proximal cartilage cells that replace the fibrocartilage in the middle (2). Which results the tuberosity not being able to handle force caused by the quadriceps (2). Therefore, if a child is already suffering through a condition like Osgood Schlatter overtraining can have a negative effect and possibly make the condition worse.

### **Prevention**

It is always essential to implement a plan to avoid overuse injuries. Stretching has been recommended as one prevention method. According to Launay (2015), to avoid a decrease in muscle performance, a child should not passively stretch before competition or practice. But it should also be avoided immediately after exercise because passive stretching could potentially make the micro damage in the muscle that takes place during practice worse (2). Passive or static stretching is not recommended due to the potential risk of injuries in children. However, dynamic stretching has been a great way in all age groups to warm up and cool down. Dynamic stretching is often tailored to the specific sport someone is participating in. It is an active way to stretch by having the muscles and joints complete their full range of motion. Stretching is vital to preventing injuries, but it is important to know what type of stretching can be beneficial or detrimental. Children should involve themselves in different sports to work different muscles. Therefore, specializing in a sport is not recommended (2). The most important key of overuse prevention is a child knowing how to listen to his/her body, along with parents and coaches.

Children need to be routinely asked how they are feeling to avoid injuries. Children also need to be able to understand the difference between pain and soreness. This will help children learn to listen to their bodies when something is wrong. Thus, helping coaches, parents, and medical professionals get ahead of an injury or OTS. Without a child's input about how they are feeling diagnosing can become difficult and the injury could potentially get worse.

As said above there are many factors that have the potential to cause OTS. Therefore, it can be assumed there are multiple preventative measures. Preventive measures of OTS are commonly learned when participating in endurance sports along with the opinions of athletes, coaches, and medical professionals (1). Balancing all of the components of exercise such as proper training, rest, diet, and balancing life stressors and the stress of exercise is key to prevention. This is where the component of communication for an athlete is essential. Coaches need to be aware of the symptoms and risk factors and also be able to communicate with their athlete(s) to create training programs that reduce the incidence of OTS.

The most important prevention method is recovery. OTS is a condition in which the body and mind have not received adequate rest. Thus, sleep is important for those involved in any type of physical activity. Kellman et al. (2018), describe recovery as a recuperative period relating to time (8). Everyone recovers at different rates based on the severity of their OTS. Since everyone's recovery time varies; Kellman et al. (2018) suggests recovery should be individualized based on the athlete and their needs relating their sport (8). Much like a training plan a recovery plan also needs to be in place. Generally, training programs and recoveries are individualized depending on the athlete such as, what event they participate in and their athletic level. During competition and training season, athletes will have one day of recovery and one to two days of active recovery. Athletes also usually have between two weeks to six weeks of rest on their off season before training again. Depending on how long a season is or the sport an individual participates in the recovery times vary. For example, a long distance runner may have less recovery days in season but need a longer rest period off season than someone who competitively lifts weights. If athletes do not have an adequate recovery period they increase their risk for developing OTS.

## **Conclusion**

Overtraining syndrome is a condition that can occur in the most elite athletes and the most novice athletes. Overtraining can be detrimental to both physical and mental health.

Coaches and athletes having an open and healthy way of communicating can reduce the likelihood of OTS and increase adherence to exercise or sports. Without the proper rest, diet, and balance of life, OTS can occur. It is vital for athletes to communicate with their coaches and vice versa to try and prevent OTS. Since there is no specific way to diagnose OTS, but there are many indicators such as a significant decrease in performance, hormonal disturbances, and sleep disturbances. Athletes and coaches must be able to identify the signs and symptoms of OTS so, the athlete can begin recovery both mentally and physically.

### **Additional Elements Section:**

#### **Apply It!**

- It is important athletes have adequate rest throughout training cycles and sport seasons in order to avoid OTS and injuries.
- Overtraining syndrome is commonly overlooked due to poor communication. Open communication with an athlete can help coaches, trainers, and others apart of the team is important. In order to adjust a training plan that is in the best interest of the athlete.
- Working an athlete harder does not equal success, but rather leads to a decrease in performance and loss of motivation. Working an athlete with proper training and adequate rest leads to success.

#### **Bridging the Gap:**

Overtraining syndrome can be experienced by athletes of all ages. Overtraining syndrome can have a negative effect on athletic performance, due to inadequate recovery. With the correct balance of training and rest an athlete should be successful.

#### **Summary Statement:**

Overtraining syndrome is common in many athletes involved in high intensities and inadequate rest. A lack of rest and a proper recovery period can increase the chances of an athlete suffering from OTS. There are biomarkers, signs and symptoms that can indicate OTS. But OTS can only be diagnosed clinically. Preventative measures include proper recovery periods, diet, and open communication with coaches and others.

#### **Pulled Text:**

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**Bio:**

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