

## Nutritional Intervention for Rugby Injuries

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### Rugby Injuries

Rugby sevens participation has increased since it was confirmed as being included as part of the 2016 Olympic Games. Currently many rugby sevens players also compete in rugby 15's, but the general consensus is that a population of athletes will emerge as specialist rugby sevens players. These (Rugby sevens) athletes spend more time running at high intensity ( $\geq 5 \text{ m}\cdot\text{s}^{-1}$ ) and tend to show superior intermittent aerobic endurance. The aerobic energy system is important to help recover between sprints and replenish phosphocreatine during intermittent sprint sports [1].

Rugby sevens is a team sport characterized by its intermittent bouts of intensity and collisions. Players may compete in 5 or 6 matches over the course of 2 to 3 days. This physical load may lead to fatigue through disturbances in metabolic, central and peripheral homeostasis [1]. Analysis [2] has shown a decrease in work rate between the first and second half of rugby sevens matches. The physical demands on the athletes have been measured and analysed using video analysis and GPS monitoring, and they show that international players travel approximately 113-120 meters per minute, with approximately 19% of the total distance at  $\geq 5 \text{ m}\cdot\text{s}^{-1}$  and 11% at  $\geq 6 \text{ m}\cdot\text{s}^{-1}$ . They cover a mean distance of  $120 \text{ m}\cdot\text{min}^{-1}$  whilst rugby 15's athletes cover  $71 \text{ m}\cdot\text{min}^{-1}$ . Other factors influencing performance include tactical awareness and technical skills, speed, strength, power and aerobic endurance. With regard to body composition, leaner bodies may be better due to the high-intensity running demands. Lower body power is greater than the upper because of the sprinting, jumping, tackling aspects of rugby sevens [2].

According to World Rugby, an injury may be defined as "any injury or physical complaint sustained during a WRT match that prevents a player from taking a full part in all normal training activities and/or match play for more than one day following the day of injury" [3,4].

Injuries are a negative aspect of exercise and sport [5]. Rugby has one of the highest incidences within team sports. According to a meta-analysis, it has injury rates of 81 per 1000 player hours during matches and 3 per 1000 player hours during training [6]. Alongside the necessary medical and physical therapy, nutrition may help during the recovery process to enable the athlete to continue training as soon as possible and diminish the effects of reduced activity [7]. Apart from specific isolated injuries, normal muscle damage occurs during high-intensity running due to the eccentric phase in muscle contraction, and due to muscle trauma from impacts, naturally occurring in rugby sevens [1]. Fatigue may be a crucial factor to injury incidences, as numerous studies report a lower incidence during the first quarter [6]. It is well established that any deficiency should be avoided. Some

people claim positive effects from some nutrient and supplement products geared towards sports, but the real evidence suggests best results will occur from eating a well-balanced diet using whole foods, vegetables and protein [7].

Energy intake is crucial for an optimal recovery, considering that any alternative training and the healing process can increase energy expenditure by 15 to 50% [7]. Any form of malnutrition will slow the healing process [5]. The use of crutches for injuries to the lower extremities increases two-to threefold the energy expenditure. This energy deficit can result in loss of muscle mass and metabolic alterations, whilst excess energy may lead to decreased insulin sensitivity and muscular and adipose alterations. The use of indirect calorimetric measuring is recommended to estimate energy balance [7].

After an injury has occurred, the healing process begins through inflammation, proliferation and remodeling. As inflammation is part of the natural process of recovery, its suppression is not recommended. Then, the second stage of the healing process would include rehabilitation and the gradually increase of activity until regular activity can be resumed [7]. As exercise activity increases, so does the synthesis of muscle proteins, resulting in hypertrophy, and tendon collagen synthesis [5]. Severe injuries may require immobilization and/or reduced physical activity. It is reported that muscle tissue is lost within the first 36 hours of inactivity and an important amount of muscle is lost with just 5 days of inactivity. Muscular protein breakdown increases during the first days of immobility, but there is also a decrease of muscular protein synthesis which results in muscle atrophy. This will then lead to an impaired muscle mitochondrial oxidative function, metabolic flexibility and decreased insulin sensitivity of the muscle [7]. During the healing process energy expenditure increases. Evidence supports the use of creatine supplementation during a period of 10 weeks after the first 2 weeks of immobilization to enhance recovery of muscle mass in healthy, young athletes. Though, for longer periods of immobilization there's no clear evidence [5].

Athletes may benefit from the consumption of protein [7]. When consumed prior to sleep, it can enhance recovery from resistance exercise and help increase or maintain muscle mass [4]. Insufficient protein intake will interfere with the healing process and may increase inflammation. Protein consumption is also important for collagen and other protein synthesis. Evidence has shown that higher intakes of protein, much as approximately  $2.3 \text{ g}\cdot\text{protein}/\text{day}/\text{kgBM}$ , compared to  $1 \text{ g}$ , reduces the incidence of muscle loss. It may be beneficial to spread the timing of protein consumption in equal amounts during the day to increase the muscular protein synthesis and reduce its breakdown [7]. Whey protein, which is a rapidly digested source of protein, may also be beneficial, as it stimulates protein synthesis during the "anabolic

window” [4]. When injury leads to immobility, anabolic resistance occurs, and there is a reduced synthesis from nutrition stimuli. So muscle mass maintenance may not be complete even with protein intake increases [5]. Some of the best food sources of protein include fish and shellfish, which also include omega-3 fatty acids, as well as lean red meat, poultry, eggs and legumes [8].

Evidence shows that muscle protein synthesis and balance may be impaired by low glycogen levels [5]. Glucose is required to repair and build new tissue. It is a source of energy for healing and immune response. If you don't provide your body with the right amount of carbohydrates, it will source energy through the breakdown of muscle tissue. Carbohydrates may be consumed through wholegrain cereals, as they also provide high amounts of fibre, vitamins and minerals. Fruit, low-fat yogurt and nuts can be great snacks between meals [8].

There is evidence that essential amino acid (EAA) supplementation reduces loss of muscle mass and strength. In a study by Dreyer et al. [9], 20 g of EAA ingested between meals during 1 week prior to and 2 weeks after total knee arthroplasty enhanced recovery in older patients, but it is still to be studied in injured athletes [7]. Protein intake has no effect on collagen synthesis for tendon and muscular damage, but bone collagen synthesis does respond to amino acid levels [5]. Most evidence is attributed to the amino acid leucine which is believed to increase muscular protein synthesis [7] by overcoming muscular protein synthesis resistance [5]. During bed rest, branched-chain amino acid supplementation attenuates nitrogen loss and helps increase amino acid utilization for muscular protein synthesis. A high dosage of leucine may have negative effects. Protein and amino acids, as well as anti-inflammatory compounds, have been related to the alleviation of pain and increased recovery from eccentric exercise, but there is a lack of evidence to make any conclusions [7].

Supplementation is a very common practice in sports. Creatine has been studied and recommended for its effects of muscle gains, but it may also be useful for muscle oxidative impairments occurred during muscle disuse. Its supplementation is also recommended during rehabilitation to increase muscle growth and strength. Another supplement is Omega-3 fatty acids which have been used for their anti-inflammatory and immunomodulatory properties. It may be used during prolonged periods of inflammation, because it interferes with the wound healing. After some investigation, it appears that omega-3 fatty acids, taken as fish oil supplementation, may ameliorate muscle loss during catabolism, but may not lead to hypertrophy. Vitamin C is essential for collagen formation; vitamin D and calcium are necessary for bone formation after fractures; and vitamin D deficiencies are related to impaired knee surgery recovery [7]. Protein is essential for scar formation and important amounts of energy are required for bone repair [5]. Antioxidant intake plays an important role for optimal recovery, but over-supplementation is not necessary and may have negative effects [7].

Traumatic brain injuries are common in contact sports, such as rugby. After the injury has occurred, neuro inflammation, increased excitatory amino acids, free radicals and ion imbalances lead to axonal

and neuronal damage. For this reason, antioxidants and anti-inflammatory agents have been studied with rodent models, but it is still unclear if the benefits may occur in humans. Cognitive function was improved with curcumin, as an anti-inflammatory compound, and with Omega-3 fatty acids which decrease neuronal damage and inflammation [7].

And last but not least, it is important to mention that alcohol ingestion reduces the inflammatory response and increases muscle loss in rats, and also impairs muscular protein synthesis in humans [7] and, as reported by Jeukendrup, reduces muscle glycogen synthesis as nutritional recommendations are not followed. It also interferes with sleep quality and may increase the risk of injury as it reduces cognitive function. It must be avoided, even as being a consistent thing to find after rugby tournaments, during the “third half”; especially, after an injury has occurred [7].

## Conclusion

Any nutritional advice should be taken with caution and based on science, always considering the harm/benefit ratio, and must be done on an individual basis. It must assure the person receives the correct amount of energy, macronutrients and micronutrients in order to help during the healing process and support rehabilitation and training. After each match, recovery should be a priority considering rehydration, muscle glycogen stores resynthesis and muscle tissue damage repair [1]. Injured athletes must be supported by a multidisciplinary team and they must not take any supplements without the supervision of the doctor and nutritionist as it may interfere with the recovery process.

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