

# A Review on the Effect of Nutrition on Exercise-Induced Muscle Damage (EIMD)

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## ABSTRACT

A muscle strain develops when a muscle lengthens or is torn. This would be frequently caused by muscle exhaustion, abuse, or misuse. Exercise-Induced Muscle Damage (EIMD) is defined based on indicators appearing soon after initiating an exercise session and continues for up to 14 days after the end of the session. Muscle damage from trauma, inherited genetic illnesses, pathology or complete circumstances are highly common and cause significant socio-economic consequences. Athletes care about EIMD-related loss of muscle strength and discomfort since they can affect their performance significantly. This current review is intended to highlight the updated findings and its present preventive and management strategies. The review also discussed the pathophysiology behind EIMD in detail to highlight the understanding points regarding EIMD. The frequency of EIMD following exercise must be linked with strength training, and muscle strain as measured by an increased level of serum kinase (CK), the percentage of tissue micro-injuries. EIMD is quite frequent among athletes and also among the general population. This review has discussed the available diet and nutrition to prevent such EIMD and tackle it, if EIMD sets in. Finally, this current review has covered EIMD from all the phases and recommendations have been made for further study, especially in clinical trials.

**Key-words:** Exercise-induced muscle damage (EIMD), Nutrition, Sports medicine, Serum kinase (CK)

## INTRODUCTION

Exercise-Induced Muscle Damage (EIMD) is defined based on indicators appearing soon after initiating an exercise session and continues for up to 14 days after the end of the session. The most significant effect of EIMD for athletes would be a reduction in muscle tissue activity as well as discomfort. A person's level of weakness to the harmful stimulation and the strength and extent of the harmful activity both influence the duration and severity of these signs leading to a decline in performance <sup>[1]</sup>.

Alongside, eccentric exercises are a vital component of any player's training program, irrespective of the type and level of the activities. Athletes, however, are motivated to seek measures to prevent or relieve symptoms of EIMD because of the difficulty and decline in the efficiency of their ability that they experience <sup>[2]</sup>. In addition, A muscle strain develops when a muscle lengthens or is torn. This would be frequently caused by muscle exhaustion, abuse, or misuse. Strains could occur in any joint but are most prevalent in the lower back, neck, shoulder, and hamstring. Alongside, as a result of the temporary discomfort, loss of strength, and pain that can come from EIMD, some people choose to forego working out in the future <sup>[2,3]</sup>. This tissue, which accounts intended for 40–45% of the whole-body form, is accountable for making services that ensure alive and program. The situation remains also a metabolic and hormone structure. Muscle damage from trauma,

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inherited genetic illnesses, pathology or complete circumstances are highly common and cause significant socio-economic consequences. Skeletal muscle damage indeed leads to long-term discomfort and impairment, limiting everyday life activities and working days. Skeletal muscle tissue has a tremendous regenerating capability, which is hampered by severe and prolonged injury. In particular, skeletal muscle tissue may pay intended for up to 20% of influence figure loss, but above this threshold, natural muscle material figure and purpose cannot be restored [2-4].

**Significance of the EIMD-** Workout-induced muscle harm or EIMD is characterised by histological alterations in strength cells that result in skeletal muscle injury as a result of physical activity. The breakdown of skeletal muscle tissue results in an immune disease, which lowers the athlete's actual work potential and exercise performance as a result of the injury [5]. Athletes care about EIMD-related loss of muscle strength and discomfort since they can affect their performance significantly. Numerous sports nutrition regimens aim to speed up recovery and prepare for the next workout. Many nutritional and functional ingredients have been studied for EIMD relief [6]. However, EIMD may get poor short-term effects on intensity and manifestation of the pain, it is assumed that the muscle cell injury and increased protein turnover involved with it are essentially associated with the long-term adaptations.

**Pathogenesis of the EIMD-** Topic muscle harm (EIMD) is a brief reduction in muscle mass output, a rise in passive tension, muscle pain, and oedema, and a rise in muscle serum caused by a novel or a new type of exercise [7,8]. Therefore, as the outcome, EIMD can provide a major effect on one's ability to do future cycles of action and therefore maintain an exercise plan. Before muscles are fully recovered, damage happens in the post-exercise phase. The factors that create exercise-induced muscle strain and relief, are largely unknown [9]. Dopamine, endosomal, tissue, superoxide, power sources, and cellular and various proteins are among the elements that could also influence the injury and recovery processes. Following repeated cycles of activity, exercise creates adaptability in which all symptoms of injury disappeared.

According to current data, the protective effect of education could be attributed to the closure of an again

this exercise. There is a decrement in morphological abnormalities and performance decline at an initial exercise spell delivered three to six days after the incident bout or quick training effect, several theories have been proposed. Anxiety fibres can be reduced, or important parts within a fabric can necrotize and grow new. There have been several nutritional ways to improve muscular function and minimize muscle soreness and inflammation during training. Many nutritional supplements, including creatine supplementation, testing phase, omega-3 fatty acids, vitamin D, vitamin C, and anti-provocative multivitamin pills like pharmacological and sour cherry liquid are thought to be successful among the popular systems for reducing the soreness of muscle and the overall management of the muscle damage due to exercise [3]. There is scientific proof that biochemical influences might very well explore a role in the progression of EIMD following strength and stamina activities where an example of this phenomenon would be less significant, even though perhaps the high mechanical framework through myofibrillar overwork for example the original activity in the pathogenesis of EIMD stays the utmost widespread and acknowledged among the factors associated [4].

**Evaluation of EIMD-** Workout-induced muscle damage or EIMD remains a temporary spectacle produced by unfamiliar, damaging exercise and is considered a physical injury to muscle fibres besides inferior redness ensuing from leucocyte access into the damaged tissues. According to the present understanding, the first and last phase in the evolution of EIMD is the forceful deformation of muscle fibres while they are contracting, resulting in the disruption of their organization and management, as illustrated for the first time by Friden and colleagues three decades ago while analyzing muscle fibre samples [5-7]. Furthermore, current methods limited physical specialisation and installation to field sports, and are largely employed for individual muscle strains. Thompson discovered that an interrupted cycling program causes muscular discomfort by putting a lot of strain on the quadriceps. There are several experimental techniques developed for studying EIMD. One of the features of sprint performance training with a quick descent to produce EIMD in the hamstring, thigh, and calf has also been developed. It uses this activity to elicit EIMD in soccer players [8]. The depletion

of ATP causes the release of extrinsic calcium ions into cell cytoplasm due to both Na-K-ATPase and Ca<sup>2+</sup>-ATPase pump failure [9]. The frequency of EIMD following exercise must be linked with strength training, and muscle strain as measured by an increased level of CK. The percentage of tissue micro-injuries has been extensively studied in strength and conditioning sessions emphasising eccentric movements 6-8 and the control of dynamic stretching actions on the degree of muscle micro-damage [10].

**Comparative Efficacy of whey protein and vegetable bases protein on EIMD-** Protein is thought to be superior to plant protein due to its high leucine concentration and rapid digestion. Protein powder contains all the key amino acids essential for muscle repair and synthesis after an activity [11]. In addition, a diverse variety of agricultural and vegetable crops are susceptible to soil-borne infections that cause significant production losses. As a result, plant pathogens have grown into a global problem for resource efficiency under greenhouse and field conditions, particularly in agricultural practices [12]. Therefore, each cell's nutritional quality and structure may be more suited to its needs. Whey and plant-based proteins can promote weight-reduction and gaining muscle mass [10,12].

**Efficacy of other nutritional supplements (including carbohydrate supplements) on EIMD-** It has been found that lowering oxidative injury, along with lifestyle modifications, food and nutritional supplements or mineral additives can serve as therapeutic options for EIMD [13]. Furthermore, there are around 90,000 vitamins available. Few are natural, like fish oil, while many are manufactured or synthetic. Vitamin plays a crucial role in the restoration and maintenance of muscle strength [10-13].

**Role of Vitamins or Supplement-** Many specialists have suggested nutrients like fish oil and multivitamins. But medical research has not backed up these assertions. Vitamins and supplements commonly claim health advantages including better memory, brain health, and improved immunity and many studies have demonstrated that a moderate but clinically important weight reduction of 5% in those with overweight, hypertension, or insulin can have numerous health, illness prevention, and treatment benefits. Dietary

control (500–750 calorie deficit), improved bodily activity (90–175 min/week), and long-term behaviour modification is key approaches used in a comprehensive lifestyle intervention. Studies have found that long-time consumption of carbohydrates in the right amount has a positive effect on EIMD [11-14].

**Nutritional diet-** Nutritional needs are met by a diet rich in fresh vegetables as well as whole carbohydrates, dairy products, and lean protein. Our bodies absorb nutrients from food better than from supplements. Whole diets also give the optimal vitamin levels for human bodies. Obese people eat fewer vegetables, fruit, whole grains, and beans and thus greasier, rising products. Few studies have justified the improvement of EIMD by consuming a nutritional diet regularly [15].

**Vitamins and Supplements that are approved by Food and Drug Administration-** FDA regulates the multivitamin and nutritional supplements sector. Unlike prescription medications, mineral supplements are thought to be safe. Because there are so many remedies available in the industry, sensible management is possible. The supplement is a substance that has recently gotten a lot of attention due to its potential health benefits. About 250 consensus studies with the word 'vitamin D' in the description have been published in 1975, but by 2007, this proportion must have grown to roughly 1600 pieces, and by 2013 it has increased to 3774 [16].

**Importance of a Vitamin-** Vitamin-rich foods is the important nutrient that must be consumed every day as the body has no natural storage structure. Alongside, sunflower is the source of Vitamin B1. The body also needs vitamin B1 to fully utilize the daily carbohydrate intake. Ornithine also promotes a healthy nervous system [17]. Furthermore, important micronutrients include vitamins and minerals because they complete a wide range of functions when they work together. Muscles and the immune system benefit significantly from their use. As well as converting glycogen into glucose, they also cure cell damage [15,17].

**Prevention and Management of EIMD-** It appears that long-term consumption of antioxidant-rich foods, together with many chronic supplementation techniques, may be beneficial in reducing the signs of workout-induced muscle soreness and inflammation [18].

The shift from standard to multi-start triathlons places more demands on the player in contact of retrieval and prevention of workout-induced muscle damage, creating a need for study into enhancing recovery and regeneration. Studies have shown that glucose reduction, thirst, hypoglycemia, and electrolyte imbalance besides ultrastructural muscle injury affect muscle force output in triathletes [16,18,19]. Several studies found workout-induced muscle damage in triathletes as a factor known to affect the muscle function in triathlons and primarily caused by the over-active lower limb muscles. A recent study found a link between post-race myoglobin and creatine kinase levels as incidental measures of strength injury [20]. To reduce muscular fatigue during triathlon competitions, the authors concluded that reducing muscle injury is important. Until now, no such tactics have been created for triathletes. The revised Olympic program now requires competitors to recover high-power muscle movement and high biomechanical productivity to perform optimally in the MTR race [21]. This analysis has described how to reduce Exercise-induced muscle damage by stiffening up a bit, reflexology of the limbs, relax. sensitivity can be reduced by applying ice to the affected area, to aid the muscles to get the blood they need and use heat, and Aspirin, a nonsteroidal anti-inflammatory medication (NSAID), is used frequently. The controversy around food nitrate's impact on EIMD may be resolved by the availability of the existing data. After that, the results might be utilised to teach athletes or coaches, or practitioners about the factors that impact the effectiveness and the indicators which can govern the status of EIMD. Toward this goal, the present study examined the effects of nutritional nitrate extras on typical EIMD indicators such as force strength, pain, creatine kinase, irritation, oxidative tension, and a variety of signs. A subordinate goal remained to see if age, sex, activity, or nitrate supply altered these results [22]. There are a few indications of EIMD that can have a significant impact on a person's capacity to execute and their overall well-being. New studies have shown that EIMD reduces productivity, impulsive power, core strength, and pain. There are a variety of methods to avoid the negative indications of EIMD. After an initial damaging assault, the neuromuscular system improves and is less prone to EIMD. The recurrent spell result stands for the name given to this occurrence. However, it appears that EIMD

magnitudes above a certain threshold are not required for this protection to take place [23].

## CONCLUSIONS

A summary of the biochemical route and therapeutic techniques for exercise-induced muscle injuries are presented here, along with an assessment of its potency based on science and clinical experience. The study drawback is the lack of research on particular therapies in top athletic activities. Several available studies, mostly on pathophysiology or therapies, popular workout-induced muscle damages include an inclusive range of players and physiological demands. Athletes' metabolic demands change among short- and long-distance athletes, and it is questionable if basic suggestions can be applied to Olympian triathletes. This research determined that more research is required, especially high-quality randomized trials, to fully assess currently available therapeutic options. As new evidence emerges, the offered recommendations must be revised.

## CONTRIBUTION OF AUTHORS

**Research concept-** Atreyee Choudhuri

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