

Literature review

Delayed Onset Muscle Soreness (DOMS): Management Update

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Abstract

Delayed Onset Muscle Soreness (DOMS) is a prevalent issue in sports medicine and among physically active individuals, causing significant pain and disability. While the exact pathophysiology of DOMS remains incompletely understood, this article delves into non-pharmacological approaches to effectively manage and alleviate its symptoms.

The research discusses multifaceted aspects of DOMS, encompassing its complex etiology, theories, and contributing factors. Numerous theories have been proposed, including delayed inflammatory responses, lactic acid accumulation, muscle spasms, connective tissue damage, and muscle micro-tears. These theories underscore the intricate nature of DOMS and the need for a diverse management approach.

The article explores non-pharmacological strategies to address DOMS, focusing on evidence-based methods. These methods include massage, exercise, nutrition, and natural supplements. Research has shown that massage therapy enhances muscle recovery, exercise therapy reduces soreness, and nutrition therapy through protein and amino acid intake can alleviate DOMS. Furthermore, natural supplements like ginger, tart cherry juice, and curcumin have demonstrated the potential to reduce inflammation and manage DOMS.

While pharmacological interventions may be considered for severe cases, the article underscores the importance of exercising caution due to potential side effects. In summary, DOMS management necessitates a holistic approach, combining multiple modalities and nutritional strategies to alleviate pain, enhance muscle recovery, and minimize the impact of this common condition on physically active individuals and athletes.

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Introduction

Delayed onset muscle soreness (DOMS) is a common problem in sports medicine. Although the majority of athletes experience DOMS, but it remains a highly neglected subject. A literature search in some of the leading medical databases like PubMed shows that there are very few updates on the topic. There are very few relevant studies published on the topic. DOMS is not a disease. Nonetheless, it causes significant pain and disability in physically active individuals or sports people. It is a condition when muscle pain is more severe in proportion to muscle damage. The condition is not acute. DOMS causes muscle ache, swelling, tightness, and tenderness 24 hours after strenuous exercise.[1]

Perhaps one of the biggest challenges in managing DOMS is that it is still a poorly understood phenomenon. It is known that DOMS occurs due to micro tears in muscle fibers. However, unlike acute soreness, pain and muscle tightness in the condition starts after 24 or

even 48 hours. It means compromised physical training and delayed muscle recovery.[1] Years of research into the topic have failed to understand its pathophysiology. This could also be due to insufficient research into the topic, as the condition is temporary and not classified as a disease, unlike sports injury or trauma. Researchers have proposed many theories for the condition. The condition is caused by delayed inflammatory response after eccentric exercise. This response is mainly due to micro-tears in muscles.[2]

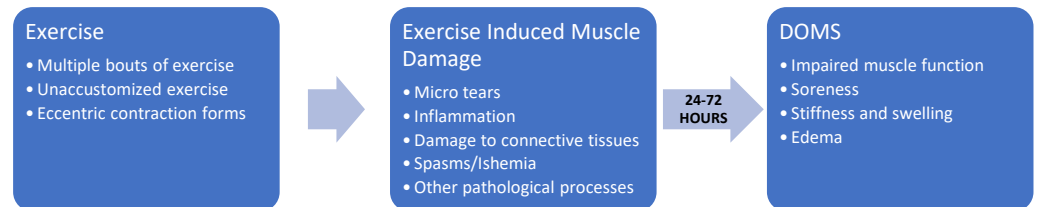


Figure 3 DOMS - possible pathophysiology

However, micro tears do not explain DOMS in all cases. Many people experience the condition after moderate-intensity exercise. Thus, the role of degenerative processes cannot be neglected. Hence, researchers have proposed some other theories like lactic acid accumulation, muscle spasms, muscle micro tears, connective tissue damage, inflammation, and higher efflux of certain enzymes. It appears that DOMS is most likely due to more than one reason. This is why managing the condition using a single modality remains elusive.[3]

Pain stimulus theory states that this delayed pain could be due to stimulation of small nerve endings in the muscles. Lactic acid theory, on the other hand, did not gain much traction since its role in DOMS is unclear. Lactic acid accumulation is more relevant in acute muscle fatigue and pain than in DOMS. Spasm theory was first proposed in the 1960s, and it says that high-intensity training causes muscle ischemia and damage, thus the pain. Connective tissue damage theory proposes that DOMS occurs due to damage to muscle sheaths. Similarly, the theory regarding micro-injuries to muscle fibers remains highly relevant. It probably contributes significantly to DOMS. Further, those prone to DOMS have higher muscle inflammation. It is evident that DOMS most likely occurs due to a combination of factors. Hence, managing the condition would also need the use of different modalities.[4]

Delayed onset muscle soreness management

There is a need for more research to identify the pathophysiological processes underlying DOMS, as it would help manage pain more effectively. DOMS has a significant negative impact on the training of athletes or sportspeople. Hence, managing the condition is vital. Moreover, in many instances, pain continues for several days and could be of high intensity. This literature review will explore various ways to manage the condition. There is no doubt that the primary focus of this literature review would be on managing DOMS without pharmacological drugs. However, the study will also explore the role of pharmacological options.

Before we explore some ways to manage DOMS, it is also vital to realize that some common methods used to manage pain in sports medicine do not work for DOMS. Thus, Chueng et al., in their literature review, found that methods like cryotherapy, stretching, ultrasound, homeopathy, and electrical current modalities do not seem to have demonstrable benefits in DOMS.[3] Other studies also had similar findings showing the limited value of stretching, heat and cold application, and acupuncture.[5] A more extensive systemic review by O'Connor and Hurley also had similar findings and concluded that cryotherapy, acupuncture, stretching, pulsed ultrasound, and transcutaneous electrical nerve stimulation (TENS) did not benefit, and thus, these methods have limited utility in managing DOMS.[6]

Massage Therapy

Systemic reviews and clinical trials confirm that athletic massage post exercise is more effective than no treatment.[6] Massage therapy is frequently used to manage sports injuries. It has the benefit of an excellent safety profile. Moreover, massage therapy may have other

health benefits, like reduced stress. It appears that massage therapy helps overcome muscle spasms, enhances local blood flow, and thus promotes muscle recovery. There are multiple studies to support the use of massage therapy for managing DOMS. Thus, a study by Hilbert et al. compared massage therapy with sham treatment given two hours after exercise. In the study, researchers measured muscle soreness 6, 24, and 48 hours post-exercise. The study found that although massage therapy did not enhance muscle function, the massage group reported lower muscle pain and stiffness after 48 hours.[7] A study by Zainuddin and colleagues found that massage could reduce DOMS by approximately 30%.[8] One of the recent systemic reviews by Ernst also concluded that there is sound evidence that massage therapy works.[9]

Exercise Therapy

DOMS is caused by unaccustomed exercises or by extensive exercise sessions. Hence, one of the good ways to manage this pain is to introduce systemic exercise or a physical therapy regime. Experts also recommend engaging other supportive muscles. One should avoid stressing painful muscles. Instead, one would benefit from compound exercises. A study by Nahon et al. analyzed one hundred and twenty-one studies. The study found that there is sound evidence that active exercise helps. Additionally, it also found that combining exercise with compression therapy may have some additional benefits.[10]

Nutrition Therapy

Among all the methods, nutrition therapy must form the backbone of DOMS management. Numerous kinds of nutrition therapies have been shown to help. Nutrients help not only fasten muscle recovery but also lower inflammation. Among various options, increasing protein intake is quite important. Higher protein intake promotes muscle regeneration. It may not prevent DOMS, but it would reduce its severity. Studies show that though high protein intake or supplementing diet with whey protein may not prevent DOMS, it can facilitate recovery and post-exercise anabolism.[11] Another more efficient way to overcome DOMS could be increasing intake of specific amino acids like branched-chain amino acids (BCAAs). A study by Weber et al. found that the use of BCAAs, even after a single bout of strenuous exercise, is helpful.[12] A systemic review and meta-analysis by Fedewa and colleagues that included eight high-quality clinical studies found that there is sound evidence in favor of BCAA use. BCAA's taken just after exercise may reduce DOMS severity by as much as 30%.[13]

Apart from proteomic amino acids, non-protein-forming amino acids may also help. Thus, studies suggest that supplementing with creatine during the pre-workout phase may help reduce DOMS risk. This is due to increased energy production.[14] Yet another non-proteomic amino acid, taurine, can be of great help. Taurine is often added to various energy drinks. It helps boost energy levels and reduce fatigue. Studies show that supplementing with taurine before physical training may help lower DOMS severity.[15] Beta-alanine is another amino acid known to prevent DOMS. It works in multiple ways, like increasing muscle carnosine levels and exercise performance and reducing lactic acid accumulation.[16]

Besides amino acids and proteins, increasing the intake of essential fatty acids may help muscle recovery. Omega-3 fatty acids have anti-inflammatory properties. Since, in DOMS pathology, inflammation plays a central role, omega-3 fatty acids may help. Thus, a study by Tartibian and colleagues found that omega-3 was perhaps effective in preventing DOMS in untrained young men.[17] Similarly, Mesta and colleagues reviewed the literature regarding the efficacy of omega-3 fatty acids and concluded that regular supplementation of diet with omega-3 is suitable for both athletes and non-athletes.[18]

Natural Supplements for DOMS

It is common practice to use natural supplements and herbs. These supplements are not likely to prevent muscle damage. However, they can lower inflammation and thus prevent DOMS, or they can be useful in managing the issue. Moreover, prolonged use of herbals may modulate immune responses. Thus, studies show that regular use of ginger may be helpful. Hence, a daily intake of 4g of ginger supplementation may lower the severity of DOMS.[19]

Another way in which natural supplements help is due to their antioxidant properties. Studies suggest that foods rich in antioxidants, like berries, may be especially good for preventing and managing DOMS. Thus, the Cochrane systemic review found that higher antioxidant intake is associated with lower DOMS risk, and antioxidants may also lower its severity.[20] Another well-tested natural DOMS remedy is tart cherry juice, which is rich in antioxidants and known to reduce inflammation. It has been extensively tested for managing DOMS. A study by Kuehl and colleagues found that ingesting tart cherry juice seven days prior to strenuous training or running may help reduce DOMS.[21] A literature review by Vitale et al. found that there is some sound evidence that a few days of tart cherry use may help promote muscle recovery and reduce inflammation.[22]

In recent years, curcumin has gained significant popularity in managing inflammatory conditions. Curcumin is derived from turmeric. This yellow compound found in turmeric has antioxidant and anti-inflammatory properties. It is often used to manage joint pains. Now, studies show that regular intake of turmeric may help counter DOMS symptoms and help relieve pain.[23] A clinical study by Nicol and colleagues found that curcumin likely reduced pain scores in DOMS.[24]

Pharmacological Therapy

Pharmacological therapy is not a treatment of choice. Moreover, prolonged drug therapy may be counterproductive, as it may cause more harm than good. Pharmacological drugs have many known and unknown side effects, and thus, using medications to reduce physical activity-related muscle soreness is the last choice. Nonetheless, some people with severe DOMS may need pharmacological treatment. Studies show that painkillers like paracetamol/acetaminophen and even certain opioids like codeine have little value in managing DOMS, as they lack anti-inflammatory effects. Instead, non-steroidal anti-inflammatory drugs (NSAIDs) like ibuprofen may be of more significant benefit.[25–27]

Discussion

Delayed Onset Muscle Soreness (DOMS) is prevalent in sports medicine and among physically active individuals. While DOMS is not a disease, it can result in significant pain and disability, making its management crucial for athletes and sportspeople. This research article discusses various aspects of DOMS, its pathophysiology, and non-pharmacological approaches to manage and alleviate its symptoms.

The primary challenge in dealing with DOMS is its poorly understood nature. Although it is generally attributed to micro-tears in muscle fibers, the exact mechanisms behind its onset and persistence remain elusive. Researchers have proposed various theories, including delayed inflammatory response, lactic acid accumulation, muscle spasms, connective tissue damage, and more, highlighting the complexity of DOMS. This multifactorial nature underscores the need for a multifaceted approach to manage the condition effectively.

The article explores non-pharmacological methods to manage DOMS, with a focus on practical and evidence-based strategies. Several approaches have been examined, and their effectiveness has been assessed in different studies. These methods include massage therapy, exercise therapy, nutrition therapy, and natural supplements.

Massage Therapy: Research supports the effectiveness of massage therapy in reducing DOMS symptoms. It enhances muscle recovery by relieving muscle spasms, improving local blood flow, and decreasing muscle pain and stiffness. Massage therapy is a safe and beneficial approach for managing DOMS.

Exercise Therapy: Engaging in systemic exercise or physical therapy while avoiding excessive stress on painful muscles can help reduce DOMS symptoms. Active and compound exercises have been shown to alleviate muscle soreness effectively.

Nutrition Therapy: Proper nutrition is crucial in managing DOMS. Higher protein intake, especially through whey protein or branched-chain amino acids (BCAAs), can promote muscle recovery and reduce DOMS severity. Other amino acids, such as creatine, taurine, and

beta-alanine, may also play a role in mitigating DOMS. Additionally, increasing the intake of omega-3 fatty acids and antioxidants from natural foods and supplements can aid in lowering inflammation and promoting muscle recovery.

Natural Supplements: Natural supplements and herbs, such as ginger, tart cherry juice, and curcumin, are known for their antioxidant and anti-inflammatory properties. Regular consumption of these supplements may help reduce inflammation and alleviate DOMS symptoms.

Pharmacological Therapy: While not the preferred treatment option, pharmacological therapy can be considered for severe cases of DOMS. Non-steroidal anti-inflammatory drugs (NSAIDs) like ibuprofen are more beneficial than painkillers like paracetamol/acetaminophen or opioids, as they possess anti-inflammatory effects. However, it is essential to exercise caution with pharmacological approaches due to potential side effects.

Conclusion

Delayed Onset Muscle Soreness remains challenging in sports medicine due to its multifaceted nature and the lack of a single, universally effective treatment. This research article emphasizes the importance of non-pharmacological management strategies for DOMS, which are often safer and more sustainable than pharmacological options. These approaches include massage, exercise, and nutrition therapy, focusing on enhancing muscle recovery, reducing inflammation, and promoting overall well-being.

While pharmacological interventions can be considered in severe cases, they should be used sparingly due to potential side effects. In summary, managing DOMS effectively requires a holistic approach, combining multiple modalities, including natural supplements and nutritional strategies, to alleviate pain, enhance muscle recovery, and minimize the impact of this common condition on physically active individuals and athletes. Further research is needed to refine our understanding of DOMS and improve its management.

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