
	<b>Gema WIRALODRA</b>
	Editor-in-Chief: Yudhi Mahmud
	 Publisher: Universitas Wiralodra

## The Characteristics of Muscle Soreness – Delayed Onset Muscle Soreness in Sport Person from South Sulawesi

Nurussyariah<sup>a</sup>, Etno Setyagraha<sup>b</sup>, Nurul Ichsania<sup>c\*</sup>, Guruh Amir Putra<sup>d</sup>

<sup>a</sup>Universitas Negeri Makassar, Indonesia  
[nurussyariah@unm.ac.id](mailto:nurussyariah@unm.ac.id)

<sup>b</sup>Universitas Negeri Makassar, Indonesia,  
[etno.setyagraha@unm.ac.id](mailto:etno.setyagraha@unm.ac.id)

<sup>c</sup>Universitas Negeri Makassar, Indonesia,  
[nurul.ichsania@unm.ac.id](mailto:nurul.ichsania@unm.ac.id)

<sup>d</sup>Universitas Negeri Makassar, Indonesia,  
[guruh.amirputra@unm.ac.id](mailto:guruh.amirputra@unm.ac.id)

### To cite this article:

Nurussyariah, N., Setyagraha, E., Ichsania, N., Putra, G. A. (2024). The Characteristics of Muscle Soreness – Delayed Onset Muscle Soreness in Sport Person from South Sulawesi. *Gema Wiralodra*, 15(3), 945 – 951.

### To link to this article:

<https://gemawiralodra.unwir.ac.id/index.php/gemawiralodra/issue/view/27>

### Published by:

Universitas Wiralodra

Jln. Ir. H. Juanda Km 3 Indramayu, West Java, Indonesia

## The Characteristics of Muscle Soreness – Delayed Onset Muscle Soreness in Sport Person from South Sulawesi

Nurussyariah<sup>a</sup>, Etno Setyagraha<sup>b</sup>, Nurul Ichsan<sup>c\*</sup>, Guruh Amir Putra<sup>d</sup>

<sup>a</sup> Universitas Negeri Makassar, Indonesia [nurussyariah@unm.ac.id](mailto:nurussyariah@unm.ac.id)

<sup>b</sup> Universitas Negeri Makassar, Indonesia, [etno.setyagraha@unm.ac.id](mailto:etno.setyagraha@unm.ac.id)

<sup>c\*</sup> Universitas Negeri Makassar, Indonesia, [nurul.insania@unm.ac.id](mailto:nurul.insania@unm.ac.id)

<sup>d</sup> Universitas Negeri Makassar, Indonesia, [guruh.amirputra@unm.ac.id](mailto:guruh.amirputra@unm.ac.id)

Correspondence: [nurul.insania@unm.ac.id](mailto:nurul.insania@unm.ac.id)

### Abstract

Muscle Soreness – Delayed Onset Muscle Soreness (MS – DOMS) is the immediate and delayed muscle pain experienced by individuals after exercising. This study aims to observe the characteristics of MS-DOMS and the pattern of dietary intake and physical activity of athletes in South Sulawesi. The research method used was an observational description method with cross sectional design using a closed-ended questionnaire given to 211 samples categorized as athletes and non-athletes in South Sulawesi. The questionnaire was distributed using G.Forms and QR codes. The questionnaire used was a modified between the McGill Pain Questionnaire and the numerical pain scale, SQ – FFQ, as well as the form of physical activity performed. The indicators of the questions include physical activity, dietary patterns, and the characteristics of muscle pain. This study took place from May to October 2024. The results obtained showed that 69.2% of respondents experienced muscle pain after exercise, with 44.4% experiencing it less than 6 hours after exercise, with a duration of pain felt for less than 6 hours (44.2%). The most common location of muscle pain was in the thighs (31.8%) with a pain scale of 3 (19%), while the pain felt after 24 hours received the most answers, scale 3 and 5 (17.5%).

**Keywords:** MS – DOMS, sportsperson, nutritional intake, physical activity

### 1. Introduction

The experience of pain or discomfort that is often felt by athletes when the training load is increased or the duration of exercise is extended is a common occurrence. This condition is categorized as a mild sports injury or known as delayed onset muscle soreness (DOMS). The pain will worsen, especially if there is any activity done. However, the pain will disappear if the body is rested. This is certainly something that hinders the activities of athletes. Thus, causing a feeling of laziness to exercise. However, exercising has become one of the most important things to do today, and has even become a trend in modern life (Lesmana, 2019).

Several assumptions exist that the occurrence of DOMS is limited to the general public (non-athletes). However, in reality, both athletes and non-athlete exercisers can experience DOMS. DOMS typically occurs within 24-72 hours after physical activity (Rahman, F. et al. 2022). The pain is caused by cellular damage in the muscles, commonly referred to as muscle tears, leading to inflammation and the production of metabolic waste. This triggers eccentric contractions, resulting in a delayed increase in serum levels of the creatine kinase (CK) enzyme (Sonkodi. 2022). Endurance exercises are among the types of exercise most susceptible to DOMS (Putra, et. al. 2022).

The mechanism of muscle contraction resulting from muscle fiber elongation induces tearing. Some researchers previously believed that DOMS was closely related to the formation of lactic acid. However, currently, lactic acid production can no longer be classified as the

primary cause of DOMS. DOMS is categorized as a type I muscle injury occurring in the distal part of the muscle. Deformation in muscle tissue damages the Z-line and can extend the damage to the sarcomere (Zulaini, et. al. 2021). In some cases, DOMS occurs due to excessive muscle contraction and eccentric contraction. When muscles adapt to strength, muscle soreness occurs. Muscle soreness is defined as the tearing of muscle fibers that elongate to adapt to strength. These tears can occur due to excessive muscle activity caused by excessive exercise intensity or improper exercise movements. Other factors that exacerbate DOMS include muscle stiffness, contraction speed, and muscle fatigue (Mirza, et. al. 2021).

A well-structured and targeted exercise program can improve overall fitness. However, poorly planned exercise programs can lead to injuries. One type of exercise program that frequently results in DOMS is weight loss programs. These programs are highly popular among the general public. Therefore, it is deemed necessary to study their characteristics in order to provide solutions for managing DOMS and minimizing its negative effects caused by exercise.

## 2. Method

This study employs a descriptive observational method with a cross-sectional approach, a type of research that explains and describes the results of observations, whether from secondary or primary data obtained during the research. The data includes frequency, distribution, or characteristics. The data collection technique used is a closed-ended questionnaire. This technique is a way to collect data by providing a set of questions on a questionnaire with predetermined answer choices, which respondents can then select based on their observations. The questions asked must be relevant and measure the research variables. Some indicators observed in this study can be seen in the following table.

Table 1

*Questionnaire Item Indicators*

No.	Research Indicators
1	Physical Activities
	a. Warm-up exercise, warm-up duration, warm-up modality
	b. Cool-down exercise, cool-down duration, cool-down modality
2	Observed dietary pattern
	a. Carbohydrate intake
	b. Protein intake
3	Supplementation intake
	Characteristics of MS – DOMS
	a. Occurrences of muscle soreness
b. Symptoms of muscle soreness	
	c. Symptoms of delayed onset muscle soreness

The sampling method used was non-probability sampling with an accidental sampling type, which is a type of sampling determined based on the availability and convenience of the sample. The samples were not selected randomly, but rather those that were easiest to find were

chosen. This type of sampling is most suitable when using a survey or questionnaire-based research method. The respondents involved as samples were 211 people, consisting of both athletes and non-athletes.

The questionnaire used was created using Google Forms and then modified with QR codes to facilitate online surveys. The questionnaire was a modified version of the McGill Pain Questionnaire and a numerical pain scale. To assess dietary intake, an SQ-FFQ form was used, focusing on carbohydrate, protein, and supplement intake. This research was conducted from May to October 2024 in South Sulawesi. The collected data was then analyzed in terms of percentages and interpreted to give meaning to the collected data.

### 3. Result and Discussion

A total of 70.6% of respondents were athletes, while 29.4% were non-athletes. All respondents chose to warm up before exercising, with the majority (62.6%) warming up for less than 15 minutes, and the most common warm-up type being dynamic stretching (57.3%). Most respondents exercised for more than 60 minutes (62.6%). Nearly all respondents performed a cool-down (94.8%) with a duration of less than 15 minutes (84.8%). The most common type of cool-down, based on respondents' answers, was self-directed active cooling (68.2%).

Not only the type of physical activity was observed in this study, but also the dietary intake pattern was observed to determine the type of intake that directly influenced the characteristics of MS-DOMS. Based on the questionnaire results, 98.1% of respondents reported consuming carbohydrates daily. The most commonly consumed carbohydrate by respondents was rice, with a response rate of 93.8%. The highest amount of carbohydrates consumed by respondents was two scoops of rice or its equivalent, with a percentage of 46%.

Unlike carbohydrate intake, 84.8% of respondents consumed protein regularly. The most common type of protein consumed was a combination of animal and plant-based proteins, with a percentage of 53.1%. The amount of protein consumed by respondents was less than 1 g/kg body weight per day. On the other hand, 76.3% of respondents reported not consuming additional supplements to prevent post-exercise MS-DOMS, while 23.7% chose to consume supplements. The types of supplements used were not primarily BCAA, creatine, or protein. A percentage of 73% of respondents chose "other" supplements that were not listed. Further interviews revealed that the most commonly consumed supplement was a multivitamin. However, the best supplements for addressing DOMS are branched-chain amino acids (BCAAs), which regulate minerals in muscles to balance muscle contraction and relaxation, and creatine, which regenerates cells and acts as an anti-inflammatory (Penggali, 2021).

Regarding the characteristics of MS-DOMS, the first question was whether the respondents often experienced muscle soreness after exercise, to which 69.2% responded affirmatively. The highest percentage of respondents (44.4%) reported feeling muscle soreness less than 6 hours after exercise. After experiencing the pain, the majority of respondents (44.2%) stated that the pain would last up to a maximum of 6 hours after exercise. When experiencing muscle soreness, the top three responses were: 78.2% of respondents would rest, 41.7% would stretch, and 19.6% would apply pain relief cream. The most commonly reported pain location was the thighs (31.8%) and calves (30.8%). The intensity of post-exercise muscle soreness was rated at level 3 (19%) on a scale of 1-10, with 1 being very mild pain and 10 being

very severe pain. After 24 hours, 17.5% of respondents reported muscle soreness at levels 3 and 5, which gradually decreased to level 1 after a week (45.5% of responses).

The most common description of muscle soreness reported by respondents was a tingling or numb sensation (34.6%), followed by a piercing sensation (24.2%). The muscle soreness then changed to a coming and going pain after 24 hours to a week. This was indicated by 49.3% of respondents. The second most common description was a persistent pain with fluctuating intensity, reported by 43.6% of respondents.

Stretching and cooling down have a close relationship with the occurrence and intensity of post-exercise muscle soreness. When stretching, muscle fibers in the body adapt before engaging in high-intensity or long-duration exercise. The optimal time for stretching or cooling down is at least 20 minutes to prepare the muscles before contraction and 20 minutes after exercise to normalize muscle tension after high-intensity contraction. A gradual increase in intensity, known as periodization, provides a memory for the muscles to recognize the amount and intensity of contraction, which will then be performed gradually. Therefore, for muscles that have undergone periodization, they will gradually become resistant to pressure and tension according to the previously applied periodization (Haryuni, et. al. 2022).

In line with the mechanism of stretching, people who actively cool down after exercise will reduce the level of stress experienced by the muscles. Muscles that are forced to contract for a long period of time will undergo a process called oxidative stress. This stress occurs due to numerous oxidative reactions in the muscles caused by continuous sarcomere tearing over a long duration at high exercise intensity. As a result, the muscles will experience pain as a form of inflammatory reaction. This pain is then known as acute or delayed onset muscle soreness (DOMS) (Pranoto, et. al. 2022). Those who routinely perform post-exercise cool-downs are essentially giving their muscles the opportunity to gradually relax. Muscles that are accustomed to a gradual relaxation process will help the body to produce reactive oxygen species (ROS). In fact, these compounds are needed by the body in a balanced amount as they help the body repair and grow damaged cells caused by muscle contraction after exercise. However, if the body is unable to adapt or experiences prolonged contractions without adequate relaxation, then the body will produce excessive amounts of ROS. If this happens, the body will experience muscle soreness (Almeyda & Irawan. 2023).

The ideal duration for stretching should be adjusted based on the type of exercise to be performed. The duration should not be too short because the body needs stretching to increase flexibility, increase body temperature, increase blood flow for adequate oxygen supply, and prepare the nervous system. At least 5 minutes of stretching should be done, if less than that, it is feared that the body's readiness for exercise is not optimal. Of course, this will increase the potential for muscle soreness. A duration that is too long is also inefficient, because if it is too long, then the exercise session will be shorter and of course this makes someone waste too much time. All types of stretching are considered effective because each has its own advantages and disadvantages, both static stretching and dynamic stretching (Zulaini, et. al. 2021).

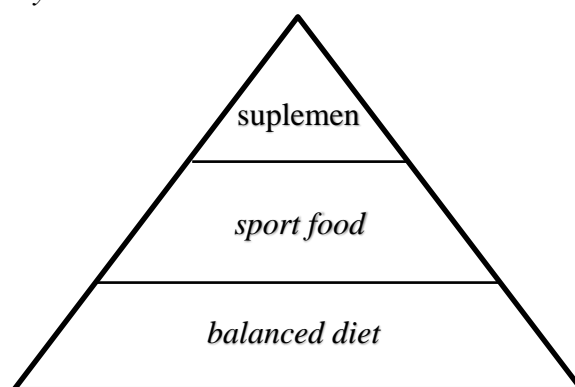
Similarly, the duration of cooling down should be adjusted based on the type and intensity of the exercise. The duration of cooling down should not be too short to give the muscles a chance to relax, lower body temperature, and allow the body to go through the metabolic

process gradually so that the heart rate does not change suddenly, which can certainly cause sudden cardiac arrest. A cooling down duration that is too long is also a waste of time and tends to be ineffective. The best type of cooling down is one that is easy to do at that time and is not troublesome for people after exercising. So it can be concluded that both active and passive cooling down can be chosen according to the current condition. Exercise that lasts more than 60 minutes will certainly result in a greater potential for muscle soreness, especially if the type of exercise is from a group of exercises with a fairly high intensity (Pranoto, et. al. 2022).

Not only the type of physical activity, but also dietary patterns influence the characteristics of muscle soreness felt after exercise. Adequate energy preparation will prepare the muscles much better compared to those who do not adjust their diet or are not in a balanced eating rhythm. Well-designed periodization is not only needed in physical activity, but also periodization of intake needs to be done. A balanced food pyramid for athletes can be seen in the diagram below (Penggali, et. al. 2021).

Picture 1

*Athlete's Nutrition Food Pyramid*



Based on the diagram above, it can be seen that the largest portion that an athlete needs to fulfill is a balanced diet. Food itself is divided into two groups of nutrients: macronutrients and micronutrients. Macronutrients are nutrients in food that are needed in large amounts to carry out the body's metabolism, while micronutrients are compounds in food that are needed even in small amounts to carry out the body's metabolism. Groups that are included in macronutrients include carbohydrates, proteins, and lipids, while those that are included in micronutrients are minerals and vitamins (Penggali, et. al. 2021). Carbohydrates are the primary compounds that function to produce energy. Carbohydrates will be converted into glucose, which is then converted into ATP to be used as energy. The amount of carbohydrates needed by adults is around 45-65% of total calorie needs. In addition to providing energy, carbohydrates also function as a source of fiber which will give a feeling of fullness and help the digestive system dispose of metabolic waste (Penggali, et. al. 2020).

Besides carbohydrates, another important biochemical compound found in food is protein. Protein has various functions, but the most important is as a compound that serves to regulate the repair of cells and tissues in the body after exercise. A body with sufficient protein will easily repair itself when there are damaged cells. In addition, protein also acts as a main ingredient in the body's defense mechanism against attacks by reactive compounds that can

damage body functions. Every adult needs at least 1 g/kg body weight of protein per day to remain active in carrying out body functions, including building and repairing body tissues, regulating hormones and enzymes, increasing the immune system, transporting metabolic compounds in the body, and maintaining the body's acid-base balance, electrolytes, and pH (Muhammad, 2021).

Consuming supplements as an additional intake is certainly a good thing. Muscle supplements, especially when consumed during the recovery process, can accelerate the healing process. Good supplements that can be chosen include those from the BCAA group, containing keratin, containing omega-9, and from the whey protein group. BCAA is a type of supplement that contains isolated branched-chain amino acids such as leucine, isoleucine, and valine. Keratin itself is a protein needed by the body for cell repair, while whey protein is often interpreted as pure protein that when consumed will meet protein needs, especially for athletes, and omega-9 itself is a compound that acts as an anti-inflammatory, thus accelerating the healing of inflammation in muscles that contract for a long time (Penggali, et. al. 2021).

Muscle soreness from exercise can be divided into two types: those felt immediately and delayed onset muscle soreness. This muscle soreness occurs due to the tearing of muscle fibers caused by the pull of exercise, causing the fibers to tear and then cause inflammation. The inflammation that occurs triggers reactive compounds in the body produced as a form of the body's response to tissue damage in the body. When these compounds appear, then pain also appears as a nerve response to muscle damage. The more novice someone is in doing exercise, the less muscle memory there is to recognize the contractions that occur. That is why the feeling of muscle soreness after exercise felt by a beginner in exercise is more severe compared to those who have done training periodization, because their bodies have not adapted well (Sonkodi, 2022).

Some athletes intentionally damage their muscles with the aim of causing hypertrophy. Hypertrophy is a process where damaged muscle produces new muscle cells in larger numbers as the body's response to improve muscle function and memory. Therefore, the more intense the muscle soreness felt, the more excited and motivated they are to increase the intensity or duration of their training. However, what is often overlooked is that this painful event must be given an interval of several hours, so that the body can resume producing muscle tissue as a result of the hypertrophy process, rather than reducing the body's immunity (Akbar, et. al. 2023).

#### 4. Conclusion

Based on the results and discussion presented in the previous section, it can be concluded that 69.2% of respondents experienced muscle soreness after exercise, 44.4% of whom felt it less than 6 hours after exercise, with a duration of pain felt less than 6 hours (44.2%). The most common location of muscle soreness was in the thighs (31.8%) with a pain scale of 3 (19%), while the pain felt 24 hours after exercise was most frequently answered with a scale of 3 and 5 (17.5%).

## 5. Acknowledgment

We would like to express our sincere gratitude to Universitas Negeri Makassar for their significant material and moral support throughout this research. We would also like to extend our special thanks to Jagona Gym for their willingness to serve as our research center. Finally, we would like to thank all parties involved in this research.

## 6. References

- Akbar, M. T. H., Doewes, M., Syaifullah, R. (2023). Pengaruh Delayed Onset Muscle Soreness pada Mahasiswa Pencak Silat Utp. Surakarta Ditinjau dari Jenis Kelamin. *Diseminarkan Pada Seminar Nasional LPPM UMMAT*. 2: 166-172.
- Almeyda, F. A., Irawan, R. J. (2023). Efektivitas Penggunaan Terapi Ultrasound sebagai Terapi Nyeri DOMS Otot Quadriceps pada Atlet Bola Tangan Putra. *Jurnal Penjakora*. 10(2): 110-117.
- Haryuni, R. O., Hartanto, H., Hartono, B. (2022). Perbandingan Efektivitas Terapi Delayed-Onset Muscle Soreness: Studi Literatur. *Jurnal Meditek*. 28(3): 322-330.
- Lesmana, H. S. (2019). Profil Delayed Onset Muscle Soreness (DOMS) pada Mahasiswa FIK UNP Setelah Latihan Fisik. *Jurnal Halaman Olahraga Nusantara*. 2(1): 50-59.
- Muhammad, H. F. L. (2021). *Immunologi Gizi*. Gadjah Mada University Press: Yogyakarta.
- Penggalih, M. H. S. T., Dewinta, M. C. N., Pratiwi, D., Solichah, K. M., Niamilah, I. (2020). *Sistem Energi, Antropometri, dan Asupan Makan Atlet*. Gadjah Mada University Press: Yogyakarta.
- Penggalih, M. H. S. T., Solichah, K. M., Nadia, A., Ningrum, R. K., Achmad, A. S., Reswati, V. D. Y. (2021). *Pedoman Penatalaksanaan Gizi Atlet*. Gadjah Mada University Press: Yogyakarta.
- Penggalih, M. H. S. T., Sofro, Z. M., Solichah, K. M., Niamilah, I., Nadia, A. (2021). *Respons, Adaptasi Biokimia, dan Fisiologi Atlet*. Gadjah Mada University Press: Yogyakarta.
- Pranoto, T. G., Tanjung J. R., Agung, N. (2022). The Effect of Cooling Down in Easing the Symptom of Delayed Onset Muscle Soreness (DOMS). *Journal of Medicines Damianus*. 21(2): 145-152.
- Putra, R., Jayadilaga, Y., Aryatama, B. (2022). Analisis Delayed Onset Muscle Soreness (Doms) Pasca Latihan Beban Pada Atlet Panahan Science Archery School. *Jurnal Stamina*. 5(6): 247-257.
- Rahman, F., Fathya, A., Surga, P. P. U., Putri, F. N. (2022). Edukasi Cara Mengatasi Delayed Onset Muscle Soreness (DOMS) pada Komunitas Sepeda di Tasikmadu. *Jurnal Bima Abdi*. 2(2): 254-258.
- Sonkodi, B. (2022). Delayed Onset Muscle Soreness and Critical Neural Microdamage-Derived Neuroinflammation. *Journal Biomolecules*. 1-15.
- Sonkodi, B. (2022). Should We Void Lactate in the Pathophysiology of Delayed Onset Muscle Soreness? Not So Fast! Let's See a Neurocentric View!. *Jurnal Metabolites*. 1-15.
- Zulaini, Harahap, N. S., Siregar, N. S., Zulfahri. (2021). Effect Stretching and Recovery on Delayed Onset Muscle Soreness (DOMS) After Exercise. *Jurnal Physics: Conference Series*. 1811 012113.