

Analysis of Delayed Onset Muscle Soreness in the Gastrocnemius Muscle Post Pre-Competition Athlete for the 2024 POPDA Batam Basketball Team Athlete

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Abstract: The aim of this study is to analyze the delayed onset of muscle soreness in the Gastrocnemius muscle after the pre-competition for the 2024 POPDA Batam men's and women's basketball teams. This research is a descriptive study using a survey method. The sample for this study was 24 people consisting of 12 male athletes and 12 female athletes. The research instrument used was the results of Delayed Onset Muscle Sores (DOMS) measurements carried out after 48 hours of pre-exercise. The data analysis used is descriptive statistics. The results of the research were that those experiencing very severe pain were athletes presenting (0%) and female presentations (0%), conditions of severe pain for male presentations (66.6%) and female presentations (50%), moderate pain conditions for male presentations (25%) and presentation daughter (25%), mild pain condition of presentation son (8.3%) and presentation daughter (25%), non-pain condition of presentation son (0%) and presentation daughter (0%).

Keywords: DOMS, Gastrocnemius Muscle, Pre-Competition Training

A. Introduction

Sport is an activity or activity that has been an integral part of human life since ancient times. In general, sport involves the use of body strength or skills carried out with aspects of attributes such as athleticism, muscle and other physical activities. Sports activities can vary from simple to very complex (Farley et al., 2020). Sport not only affects physical aspects, but also mental and social aspects of individuals. The health benefits of exercise have been scientifically proven, such as improving heart health, improving hormonal balance, increasing muscle and bone strength, and improving mental well-being (Di Liegro et al., 2019; Kramer, 2020). Sports is also one of the areas that needs to be paid attention to currently in its development, because sports can improve and also make the nation's name proud on the regional and international stages (Li & Feng, 2022). Therefore, in accordance with Law no. 3 of 2005 article 1 paragraph 13 concerning the national sports system explains that:

“Achievement sports are sports that foster and develop sportsmen in a planned, tiered and sustainable manner through competition to achieve achievements with the support of sports science and technology.

Basketball is one of the most popular sports and is played all over the world. Created by Dr. James Naismith in 1891, this sport quickly spread and developed into a sport that is popular with many people (Zhang, 2023). The game of basketball is a sport that has a type of team game, where the main principle in team games is cooperation or teamwork of one team with the aim of achieving victory. To achieve the intended goals, each player is first expected to be able to master the basic techniques of playing basketball (Nopembri et al., 2022). The game of basketball is an active game and works together with a solid team. In Indonesia, basketball also has quite a few fans, from professional clubs to amateur clubs.

At the city level, basketball is not only a place for sport but also a place to develop the skills and potential of young athletes. This is because basketball is a game that has complex movements, namely a combination of walking, running, jumping as well as elements of physical condition of strength, speed and accuracy (Shao et al., 2023). Basketball is a sport that is popular with various groups, this is because basketball contains values such as educating, entertaining, competitive and healthy. Then, playing basketball requires skills in mastering basic techniques which are really needed to carry out various patterns of attack and defense (Malik & Rubiana, 2019). Yenes & Gutrianto (2021) stated that in the sport of basketball, mastering the basic techniques of catching, shooting, throwing, and dribbling is a skill that must be mastered from an early age. The right training program for the male and female athletes of the Batam 2024 POPDA basketball team is very crucial, considering that POPDA VIII at the provincial level next month. Special preparation is an important post-pre-competition in developing the motor skills, techniques and mentality needed to achieve first place in the event. Provincial level POPDA. However, in the progress of pre-competition training, the 2024 POPDA Batam Basketball team still faces a number of challenges, especially in handling the maintenance of physical condition and handling sports injuries, especially after special preparations. The game of basketball has preparations that must always be developed by each player, namely physical, technical, tactical and mental development (Borukova, 2020).

In the 2024 Batam POPDA basketball team training, both the men's and women's teams must make maximum preparations, starting from general preparation, special preparation, pre-competition, and rehabilitation, to get first-place results in the 2024 Riau-level POPDA VIII provincial event. Especially after the pre-competition, athletes are required to do physical activities that involve muscle contractions and cause muscle fatigue. Someone who trains with a targeted program will potentially experience delayed onset muscle soreness (DOMS). Gastrocnemius muscle damage

is the result of excessive training, which occurs due to various factors, such as high training intensity, too long training duration, and lack of adequate recovery.

Symptoms that are often experienced include muscle pain, stiffness, and decreased strength in the muscles Gastrocnemius (Stožer et al., 2020). If not handled properly, muscle damage Gastrocnemius can cause more serious injuries and affect the athlete's career in the long term as well as not achieving the target of first place at the 2024 POPDA VIII event throughout the Riau Islands. A thorough understanding of Gastrocnemius muscle damage after intense special preparation is essential for coaches, athletes and medical personnel (Luo et al., 2023). By knowing the causal factors and mechanisms of muscle damage, especially muscles Gastrocnemius, effective prevention and treatment strategies can be developed. Basketball is a physical activity that carries more risk Delayed Onset Muscles Soreness (DOMS), namely activities dominated by eccentric type muscle contractions. This type of contraction has the potential to cause muscle damage which will induce an inflammatory response and then cause pain Delayed Onset Muscles Soreness. Delayed Onset Muscle Soreness (DOMS) occurs more often in sports that involve lots of high-intensity movements, for example in swimming, cycling, basketball, badminton and so on (Nedelec et al., 2018).

There are findings that eccentric exercise can cause someone to experience events Delayed Onset Muscle Soreness. DOMS causes stiffness, swelling, decreased strength and pain in the muscles. DOMS is recognized by the presence of pain that occurs 12-24 hours after exercise and peaks within 24-48 hours after exercise (Zulaini et al., 2021). Painful Delayed Onset Muscle Soreness (DOMS) is caused by the accumulation of metabolic waste such as lactic acid in muscles and fluids extracellular which irritates the ends of the fibers sensory. The accumulation of lactic acid in the blood is the cause of pain and fatigue, resulting in reduced muscle performance. Pain can be caused by an inflammatory process or caused by exercise that involves a lot of eccentric muscle contractions (Hody et al., 2019). Thus, sports activities can be disrupted so that the athlete's performance can decrease due to functional limitations and the pain that must be experienced due to suffering from Delayed Onset Muscle Soreness (DOMS) pain (Cheung et al., 2003).

Mechanism of Occurrence Delayed Onset Muscle Soreness (DOMS)

Delayed Onset Muscle Soreness (DOMS) is included in type 1 muscle injury which is caused by the accumulation of metabolic waste such as lactic acid in muscles and fluids extracellular which irritates the endings of sensory fibers. Acid accumulation lactate in the blood is the cause of pain and fatigue, resulting in reduced muscle performance. Pain can be caused by the process inflammation or caused by exercise that involves a lot of muscle contractions eccentric (Zuo et al., 2019). Thus, sports

activities can be disrupted so that the athlete's performance can decrease due to functional limitations and the pain that must be experienced as a result of suffering from pain Delayed Onset Muscle Sorenes (DOMS). Delayed Onset Muscle Soreness often occurs after exercise that involves a lot of muscle contractions eccentric, where the muscle lengthens when bearing weight. During eccentric contractions, muscles experience a combination of lengthening and tension, which causes microscopic damage to the muscle fibers. This can disrupt muscle structure and cause discomfort and pain after exercise. Microscopic damage to muscle fibers that occurs during eccentric exercise, in which the muscle is stretched while contracting. This damage triggers an inflammatory response that plays a role in the healing process, but also causes the pain and discomfort typical of DOMS (Hotfiel et al., 2018).

Gastrocnemius Muscle

Place the affected muscle Delayed Onset Muscle Sorenes (DOMS), Hadad Akbar et al. (2023), stated that the muscles most susceptible to DOMS are muscles Quadriceps Femoris, Adduktor Longus, Anterior Tibial and muscles Gastrocnemius. This is related to the role and function of these muscles in the game of basketball, namely as support for the body during activities and as a mover for the legs, especially in movements that require strength, speed and explosive power. From the predominance of contraction type, muscle Gastrocnemius dominantly moves using a contraction type eccentric which increases the risk of experiencing Delayed Onset Muscle Sorenes. The dominant muscle contracts eccentric. It will be easier to experience fatigue and pain after doing activities. Exercising can trigger the production of lactic acid in the muscles used to contract. Accumulated lactic acid interferes with performance and causes pain when used for activities. Excessive contractions and the amount of lactic acid that accumulates cannot be separated from the training program given by the trainer. The wrong or excessive program will more quickly trigger pain caused by lactic acid and excessive muscle contractions. Excessive muscle tension and lactic acid trigger an inflammatory response or muscle inflammation which causes pain after exercise. The resulting inflammatory response triggers pain after exercise. Disorders that occur due to eccentric contractions, lactic acid, and exercise programs cause pain. The pain felt shortly after doing exercise can be said to be delayed onset muscle soreness (DOMS). Delayed Onset Muscle Sorenees (DOMS) is a sensation of pain, edema and increased stiffness that occurs 24-48 hours after high intensity eccentric exercise (Keriven et al., 2023).

Pre-Competition Training

In the pre-competition period, the player's condition has reached the peak and perfection both physically, technically and tactically. Thus, physically, technically,

tactically and mentally the players are ready to compete. The aim of training during the competition period is to keep players high in fighting spirit and in peak condition. The pre-competition period is a crucial phase in an athlete's training regimen. During this time, athletes focus on fine-tuning their skills, building strength and endurance, and mentally preparing for the upcoming competition. This period allows athletes to peak at the right time, ensuring they are in top form when it matters most. Additionally, the pre-competition period is a time for athletes to address any weaknesses or areas of improvement, so they can perform at their best when it counts. During the pre-competition period, coaches and trainers closely monitor the player's physical and mental condition to ensure they are progressing as planned. This may involve regular assessments of strength, speed, and agility, as well as mental preparation techniques such as visualization and goal-setting. Athletes may also work with sports psychologists or mental performance coaches to address any mental barriers or challenges they may be facing. Overall, the pre-competition period is a time of intense focus and preparation, where every detail is carefully considered to ensure the athlete is ready to perform at their peak when it matters most.

The competition period is divided into two stages, namely pre-competition periodization and 6-week competition periodization. The training materials provided during the pre-competition period are as follows: a). The form of training is specific to football matches, both in terms of the types of technical movements and the dominant energy used. That is, the same as the situation during the competition period (except for the intensity and volume of training). b). The aim of training in the pre-competition period is to apply fighting skills through simulations and trials, maintain muscle fitness and energy fitness with exercises that lead to the specifications of the sport of football. During simulations or practice matches, the coach provides feedback and emphasizes all the techniques and tactics that have been carried out. c). Training sessions are structured according to the competitive situation. This means that the ratio between playing and rest time must be the same as the real situation. For this reason, training places more emphasis on the psychological abilities of players. d). The form of training uses drill techniques with speed and accuracy. This means that every technique performed must have a target. As a parameter, if the technique used is always correct, then the level of technical productivity is high. e). Muscle fitness targets prioritize speed and power, energy fitness targets are anaerobic and speed. f). Each movement is done quickly and explosively with high intensity and slightly lowered volume. The forms of training include: short distance sprinting, shuttle running, and plyometrics. The abilities obtained from previous training must be maintained. g). Interrupting training aims to maintain strength, with 4-6 types of exercises, performed 6-8 repetitions in 2-4 sets, moderate intensity, frequency 1x/week. Interrupting training aims to maintain

aerobic ability by jogging, moderate intensity, duration 20-30 minutes, frequency 2x/week.

POPDA Batam Basketball Men's and Women's Team 2024

In the Riau Islands, especially in Batam, basketball has begun to show significant development. The Riau Islands are a beautiful archipelago in Indonesia, known for its stunning beaches, colorful coral reefs, and rich cultural heritage. Among the many islands in the region, Batam stands out as a bustling center of economic and tourism activities. With its strategic location near Singapore and Malaysia, Batam has become a popular destination for travelers seeking a mix of relaxation and adventure. The island offers a variety of sports facilities, including basketball courts, where residents and visitors can engage in friendly competitions and tournaments. The passion for basketball in Batam is evident in the many local leagues and clubs that cater to players of all ages and skill levels. In addition, the sport serves as a unifying force in society, bringing people together for a commitment based on a shared love of the game. As such, basketball plays a vital role in promoting social cohesion and a healthy lifestyle in Batam.

Batam City, which is one of the centers of economic and industrial growth in Indonesia, is also experiencing progress in the field of sports, including basketball. The development of basketball in Batam cannot be separated from the participation of various schools, communities and active amateur clubs such as the Yos Sudarso club, Rajawali club, MJ Arena club, Ananda club, BASS club and many other clubs in promoting and developing this sport. Local tournaments, such as the Ananda Cup, Mondial Cup, Sanford Basketball League (SSBL) and POPDA have become an opportunity for young players, especially basketball players trained by the city of Batam, to improve their talents and abilities to face the 2024 provincial level POPDA VIII event, plus the city Batam this year is the host of the 2024 POPDA VIII event throughout the Riau Islands. Apart from that, support from the local government and various supports also contributed to the progress of the Batam POPDA basketball team.

B. Methods

This research is descriptive research using a survey method, the data collection technique is based on survey results. The data used in the research is data from participants who felt it delayed onset muscle soreness in the gastrocnemius muscle after being measured using VAS (visual analogue scale) from both Batam basketball clubs. Pain data delayed onset muscle soreness on the muscle's gastrocnemius used to determine the level of pain and decrease in pain that occurs after exercise and treatment ice massage and passive stretching.

Instruments used in collecting data about Delayed Onset Muscle (DOMS) in athletes is an instrument for measuring pain levels, namely those that comply with standards with the Visual Analog Scale (VAS). VAS is a method/method often used to measure pain in clinics and hospitals, namely a visual analog scale. Usually, the scale has eleven levels ranging from 0-10 which indicate the condition of no pain to severe pain. VAS only identifies the content of one conclusion of the pain condition, making it easier for patients to fill it in in a short time. Measurement process Delayed Onset Muscle Sorenes (DOMS) is carried out after 48 hours of pre-exercise which is adjusted to the time the pain appears in the person experiencing it Delayed Onset Muscle Sorenes.

This research used a cross-sectional approach, namely by collecting data at one time with the aim of knowing the prevalence and treatment of DOMS in basketball clubs. All samples are male and female athletes from the 2024 Batam basketball team who have met the requirements and are included in the criteria for the 2024 Batam basketball team. All athletes did not experience muscle injuries. Quadriceps Femoris, Adduktor Longus, Anterior Tibial as well as muscles Gastrocnemius. The total sample was 24 people consisting of 12 male athletes and 12 female athletes. All samples carried out special post-preparation exercises from a high-intensity trainer and rested after each set.

C. Results and Discussion

Based on the results of descriptive statistical tests, data were obtained for 24 athletes

Table 1. Research Result Description

Taste Scale Painful	Category	Son		Daughter	
		Amount	%	Amount	%
10	Very Severe Pain Condition	0	0%	0	0%
7 - 9	Severe Pain Conditions	8	66,6%	6	50%
4 - 6	Moderate Pain Condition	3	25%	3	25%
1 - 3	Mild Pain Conditions	1	8,3%	3	25%
0	Painless Condition	0	0		0
	Amount	12 Athletes	100%	12 Athletes	100%

Based on the table above, he experienced Delayed Onset Muscle Soreness in the muscles Gastrocnemius can be described in this explanation as categories of athletes who experience very severe pain conditions, male athletes 0 with presentation (0%) and female 0 with presentation (0%), who experience severe pain conditions, male 8 with presentation (66.6%) and female 6 with presentation (50%), with the category of athletes experiencing moderate pain conditions, male 3 with presentation (25%) and

female 3 with presentation (25%), with the category of athletes experiencing mild pain conditions male 1 with presentation (8, 3%) and girls 3 with presentation (25%), with the category of athletes experiencing painless conditions, boys 0 with presentation (0%) and girls 0 with percentage (0%). It can be seen that male athletes experienced a greater reduction in DOMS than female athletes on average. Gender influences individuals regarding temperature absorption in cold modalities because there are differences in the composition of adipose tissue between women and men. The adipose tissue structure in women can enlarge and store more fat tissue, whereas the adipose structure in men cannot enlarge. In research conducted by Lecoutre et al., (2022), He said that adipose tissue acts as a barrier, blocking the passage of low temperatures, so that tissue high in fat will have reduced susceptibility to these temperatures.

Prevention and Treatment of DOMS Prevention and treatment of DOMS can be done in several ways when you experience pain after exercising. Some ways to prevent and treat DOMS:

1. **Stretching.** Stretching after exercise can reduce the risk of DOMS in an athlete. Stretching can take the form of PNF stretching of the large muscles in the legs such as the hamstrings, quadriceps femoris and gastrocnemius. Large muscles that experience DOMS can feel less pain after stretching (Behm et al., 2021). Muscles that have been stretched become more elastic and have increased flexibility. Proprioceptive Neuromuscular Facilitation (PNF) is a stretching technique commonly used in athletic and clinical settings to increase both active and passive range of motion (ROM) with the intent of optimizing motor performance and rehabilitation reducing the risk of DOMS in an athlete. Stretching can take the form of PNF stretching of the large muscles in the legs such as the hamstrings, quadriceps femoris and gastrocnemius. Large muscles that experience DOMS can feel less pain after stretching. Muscles that have been stretched become more elastic and have increased flexibility. Proprioceptive Neuromuscular Facilitation (PNF) is a stretching technique commonly used in athletic and clinical settings to increase both active and passive range of motion (ROM) with the intent of optimizing motor performance and rehabilitation (Sharman et al., 2006).
2. **Massage.** Massage can reduce the pain caused by DOMS, namely by improving blood circulation in the parts that experience pain due to DOMS. The massage given only provides efflurage and shaking on the part that experiences pain due to DOMS. The manipulation carried out can help improve blood flow in muscles that experience pain due to DOMS. Massage given immediately after exercise can reduce the amount of pain and stiffness felt after exercise. Even though there is an increase in analgesic symptoms, massage has no effect on muscle function and enzymes caused by cell damage or inflammation (Dupuy et al., 2018). Giving the right massage can reduce the pain caused by DOMS.

3. Rest. One way to reduce the pain caused by DOMS is to take complete rest after feeling sore after exercising. By resting for \pm 5 days, you can reduce the pain caused by DOMS. Rest is done by not doing sports activities, including stretching so that the muscles rest. DOMS is usually only felt for 24-72 hours after training (Rensburg et al. 2015). Based on how long DOMS lasts, it can be seen that rest can reduce the pain caused by DOMS after heavy exercise (Abboud et al., 2019).
4. Ice Compress. Applying ice compresses is one way to reduce inflammation in certain muscle areas after heavy activity. Ice compresses given after exercise can reduce pain after exercise. The mechanism for reducing pain due to DOMS can be demonstrated, namely the administration of ice which can narrow blood vessels and speed up the recovery process by reducing inflammation that occurs in muscles that are working too hard.

D. Conclusions

In conclusion, the impact of sports on society is vast and multifaceted. From the economic benefits of the sports industry to the cultural significance of sports in different cultures, it is clear that sports play a significant role in shaping our world. However, there are also challenges that need to be addressed, such as issues of doping and cheating, a lack of gender equality, and commercialization and corruption. Despite these challenges, the benefits of participating in sports, both physically and mentally, as well as the social benefits of team sports, cannot be overlooked. Overall, sports have the power to promote social inclusion, diversity, and overall well-being in society. While sports may have the potential to promote social inclusion and well-being, it is important to acknowledge that not everyone has equal access to sports opportunities, leading to further inequalities. Additionally, the emphasis on competition in sports can sometimes perpetuate negative behaviors and attitudes, rather than promoting positive social change.

In addition to the physical and mental benefits of participating in sports, promoting sports can also have a positive impact on overall well-being. By encouraging individuals to engage in physical activity, sports can help reduce stress, improve mood, and increase overall happiness. Furthermore, participating in sports can also promote social connections and a sense of belonging, which are important factors in maintaining good mental health. Additionally, promoting sports can help combat social issues such as isolation, discrimination, and inequality by providing a platform for individuals from diverse backgrounds to come together and collaborate towards a common goal. By recognizing the importance of promoting sports for overall well-being, we can create a more inclusive and supportive society for all individuals.

Related to the promotion of sports should focus on the impact of sports on marginalized communities and ways to make sports more accessible to individuals of all backgrounds. Additionally, policymakers should consider implementing initiatives that prioritize sports participation and provide resources for individuals to engage in physical activity. By prioritizing sports as a means of promoting mental health and social inclusion, we can create a more equitable and supportive society for all. For example, future research could investigate the barriers to sports participation faced by minority communities and develop targeted interventions to address these disparities. Policy changes could include funding programs that provide free or low-cost sports opportunities in underserved areas and implementing inclusive policies to ensure that all individuals have equal access to sports facilities and equipment. By making these changes, we can help create a more inclusive society where everyone has the opportunity to benefit from the positive effects of sports. However, a detailed counterexample to this vision of a more inclusive society could be seen in the case of Title IX in the United States. Despite being implemented to promote gender equality in sports, it has been criticized for inadvertently leading to the reduction of men's sports programs in order to comply with the regulations, thus creating disparities in access to sports opportunities for male athletes. Additionally, some minority communities may face barriers beyond just financial access, such as cultural norms or a lack of representation in sports leadership positions, which may not be adequately addressed by simply providing free or low-cost opportunities. Delayed Onset Muscle Soreness will cause athletes to experience pain that is felt several days after the injury. The injury that occurs damages the structure of muscle contractile proteins (actin and myosin) so that it interferes with muscle performance, especially the Gastrocnemius muscle, to continue the next training program from the trainer. How to overcome delayed onset muscle soreness: 1) Stretching, 2) Massage, 3) Rest, and 4) Ice compress.

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