# Weightlifting coaches' and athletes' understanding of injury prevention programs: a case study of Lumajang and Malang

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## ABSTRACT

**Background:** Weightlifting is a high-intensity sport with a high risk of injuries due to improper technique, insufficient warm-up, and excessive training loads.
**Objectives:** This study explores the understanding, strategies, and barriers of weightlifting coaches and athletes in Lumajang District and Malang City related to implementing injury prevention programs in performance sports.
**Methods:** This study used a qualitative case study approach. Participants were selected using purposive sampling, consisting of weightlifting coaches with at least one year of experience and athletes who had trained and competed at the regional level. Data were collected through interviews, observations, and document analysis, while data were analyzed using the Miles and Huberman model, including reduction, presentation, and conclusion.
**Results:** The results showed that coaches and athletes emphasized dynamic warm-ups, core and back strengthening exercises, and correct lifting techniques as the main strategies to prevent injuries. However, limitations in facilities, literature access, and training variety were identified as barriers to implementing optimal injury prevention programs.
**Conclusions:** This study concludes that effective injury prevention in weightlifting requires structured warm-up routines, individualized training programs, and adequate supporting equipment. Strengthening coaches' knowledge and providing better facilities are crucial to minimize injuries and enhance athlete performance.

**Keywords:** athlete performance, injury prevention, training program, weightlifting.

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## INTRODUCTION

Weightlifting is one of the sports competed in the Olympic championships. Weightlifting has a long history of development in physical strength and technique. In Chinese history, weightlifting was not only a physical activity but also part of military culture and training, which later developed into an achievement sport, emphasizing technical efficiency, coordination, flexibility, and optimal body stability (Buitrago & Jianping, 2018). Weightlifting consists of two main events, the snatch and clean and jerk, which involve almost all muscles in the body, especially the back, shoulders, and knees. However, the risk of injury in weightlifting is relatively high, especially for athletes who do not have the correct technique or rush to increase training intensity.

Injuries in weightlifting can occur due to various factors, including incorrect technique, lack of warm-up, and excessive training load. According to research by Gabbett et al. (2016), many sports injuries are caused by a sudden increase in training load without adequate adaptation. In addition, unbalanced body biomechanics when performing heavy forces can also increase the risk of injury to specific body areas such as the lower back and shoulders, which are the most injury-prone body parts in weightlifting. Weightlifters in Indonesia have a high prevalence of injuries to these areas (Hasan et al., 2024). These injuries often result from a combination of improper technique, excessive intensity, and a lack of focus on injury prevention. Not only does this have the potential to hamper an athlete's performance, but it can also cause long-term problems that affect their overall health.

Coaches' and athletes' understanding of prevention programs is one of the most important components to reduce injury risk and improve performance in any fitness or performance context. In the coaching context, coaches' lack of knowledge and confidence is often a significant barrier to adopting effective injury prevention (De Ste Croix et al., 2020).

Understanding the mechanisms and prevention strategies to create a safer training environment is important, especially in high-risk sports such as weightlifting. This evidence-based approach is also relevant for game sports such as soccer, volleyball, basketball, and tennis. However, it is also indispensable in individual (measured) sports such as weightlifting, which has a high risk of injury (Bahr & Engebretsen, 2009). It is also important that coaches understand the physical needs of athletes to prevent injury and improve performance, demonstrating the important role coaches play in injury prevention, particularly in the context of performance sports (Hanief et al., 2024). At the local level, training for coaches, such as that conducted at KONI Kota Batu, has improved their understanding of injury management and prevention techniques (Mu'arifin et al., 2019). However, the prevention techniques are still limited, as they only focus on paired stretching and massage therapy.

Research on injury prevention has grown rapidly in recent decades, with various programs specifically designed to reduce the risk of injury in various sports. In football, structured programs such as FIFA 11+ have been shown to effectively reduce the incidence of injury in players through warm-ups and muscle-strengthening exercises (Bizzini & Dvorak, 2015; Kirkendall et al., 2010; Sumartiningsih et al., 2022). In volleyball, a preventive approach involving the development of muscle strength, neuromuscular balance, and correct movement technique also yielded significant results in reducing the risk of injury to players' musculoskeletal system (Kirichenko, 2024). In basketball, research shows that the prevention of knee injuries,

such as anterior cruciate ligament (ACL) and patellar tendinopathy tears, relies on muscle strengthening, dynamic warm-up, and proprioception training. Coaches in basketball rely on specific warm-ups such as squat jumps and dynamic stretches to improve knee flexibility and stability before games or intense training (Wang, 2024). Also in tennis, specialized warm-up protocols such as "TennisReady" that incorporate aerobic, neuromuscular, and sport-specific activities effectively reduce injuries associated with movement overload and repetition (Ibn & Fazal, 2023).

Injury prevention in weightlifting involves several aspects, including understanding correct technique, adequate warm-up, and strengthening the core and back muscles. Correct technique is the primary basis for avoiding injury in weightlifting. Athletes who perform movements with improper technique are at high risk of injury due to unbalanced weight distribution on their bodies. For example, the snatch, clean, and jerk movements require high shoulders and lower back stability. If the athlete does not have good muscle stability, the heavy load can put excessive stress on the joints, leading to injury. In addition, core and lower back strengthening exercises are also crucial in preventing injury. Core strengthening helps improve overall body stability, crucial for maintaining balance when lifting heavy weights. Strengthening exercises in injury prevention programs are important, as they can reduce joint stress and help athletes maintain correct posture during physical activity (Potach & Meira, 2022). Core exercises that include plank, side plank, and back extensions can help reduce stress on the lower back, often a source of injury in weightlifters.

However, previous studies have limited the applicability of injury prevention strategies in individual sports such as weightlifting. Most studies, such as the FIFA 11+ program in football (Sumartiningsih et al., 2022: Hanief et al., 2025), movement technique development in volleyball (Kirichenko, 2024), knee injury-focused prevention programs in basketball (Wang, 2024), and TennisReady warm-up protocols for tennis (Ibn & Fazal, 2023), have focused on playing sports that involve team or opponent interaction. These approaches significantly reduced injuries through muscle strengthening, stabilization, and movement technique. While these programs have contributed significantly to understanding injury prevention, their direct application to weightlifting is limited. As an individual sport that demands maximal physical ability and precise technique, weightlifting requires adapting appropriate strategies and athlete-specific needs.

Previous studies on injury prevention programs have primarily focused on team sports such as football, basketball, volleyball, and tennis (Bizzini & Dvorak, 2015; Hanief et al., 2025; Ibn & Fazal, 2023; Kirichenko, 2024; Wang, 2024). However, limited evidence specifically examines injury prevention in individual sports like weightlifting, which requires maximal physical ability and precise technical execution. This gap highlights the novelty of the present study in addressing injury prevention strategies specifically for weightlifting.

The novelty of this study lies in the coaches' understanding of injury prevention programs implemented in weightlifting at the local level. This research focuses on coaches and athletes in Malang City and Lumajang Regency implementing relevant injury prevention techniques, such as warm-up, core muscle strengthening, and minor injury management techniques. In Indonesia, weightlifting has become one of the sports that often achieves success, even in the prestigious 2024 Olympics competition, Indonesia gets 1 one gold medal. However, with the many achievements obtained by Indonesian athletes, research on weightlifting is still rarely

found. Thus, integrating an evidence-based approach into the local context, this study aims to identify barriers, evaluate the effectiveness of injury prevention programs, and provide recommendations that can support efforts to improve the performance of weightlifters in Indonesia.

The contribution of this study lies in providing empirical evidence on how coaches and athletes understand and apply injury prevention strategies in weightlifting at the local level. The findings are expected to enrich the body of knowledge in sports injury prevention and offer practical recommendations for developing evidence-based programs that can be adapted in similar individual sports contexts.

# METHODS

## Study Design and Participants

This research used a qualitative method with a case study approach to explore the implementation of an injury prevention program. This approach was chosen because it allows researchers to dig deeply into the understanding, strategies, and obstacles faced by coaches and athletes, as Creswell (2013) described. The research locations in Malang City and Lumajang Regency were chosen because they have different weightlifting coaching backgrounds. Malang City has been active since 2005, with achievements consistently ranked in the top 3 at the East Java regional level. Lumajang became active again in 2023 after separating the weightlifting association from bodybuilding and weightlifting. In terms of achievement, there is still nothing. In addition, in terms of experience, Malang City is more experienced both in terms of coaches and athletes than Lumajang Regency. Therefore, the choice of research location is also important to get maximum results, which will also be a comparison in terms of coaches with more than 10 years of experience, namely Malang City, with Lumajang Regency, which is approximately 1.5 years, since 2023.

Participants were selected purposively, namely coaches and athletes, who, from each region, amounted to 4 participants, consisting of 1 (one) coach and 3 (three) athletes. The criteria chosen are that the coach must have at least 1 year of experience, while the athlete has at least practiced for 1 (one) year and has competed at the regional level. This selection aims to get coaches' perspectives as program designers and athletes as implementers (Creswell, 2013).

## Ethical approval statement

This study was conducted in accordance with ethical research standards. All participants were informed about the purpose of the research and provided written informed consent before participation. Confidentiality and anonymity were maintained throughout the study.

## Research Instruments

Data was collected through in-depth interviews, field observations, and supporting document analysis. Interviews were conducted with semi-structured questions, recorded with consent, and transcribed verbatim to maintain the accuracy of the interviewees' words. Observations were made during training sessions to understand the implementation of injury prevention programs, such as warm-ups, strengthening exercises, and minor injury management. Supporting documents, such as training records, were also analyzed to complement the data of Miles et al. (2014).

### Data Analysis

Data analysis followed the reduction, presentation, and conclusion steps of Miles et al. (2014). Data were filtered to focus on the main themes, then presented in a thematic matrix to facilitate pattern identification. Conclusions were verified through triangulation of sources (interviews, observations, and documents) and member checking with participants to ensure accuracy of interpretations.

This method ensured an in-depth exploration of the implementation of injury prevention programs in two regions with different backgrounds, resulting in valid findings and rich perspectives.

## RESULTS

Based on interviews with coaches and weightlifters in Malang City and Lumajang District, it was found that a thorough warm-up is an important element in injury prevention. One of the coaches stated,

> "Warming up is very important, because by warming up we can minimize the occurrence of injuries, especially when weightlifting is related to weights. Surely, if you do not warm up, the risk of injury is greater".

A warm-up that includes dynamic stretching and focuses on vulnerable joints such as the shoulders, knees, and lower back is crucial. However, not only the warm-up, but also the technique of the movements was of utmost importance, and all athletes agreed that correct technique was paramount. One athlete said,

> "I definitely pay attention to technique. If it is incorrect, there is a risk of pain and even injury if the technique is wrong".

In addition to warming up and correcting technique, injury prevention is not only about that, but supporting exercises, such as core muscle strengthening exercises, are very important. In the implementation of training in both regions, the method of injury prevention that the coaches know and often apply is warming up, especially in areas prone to injury, such as the lower back, shoulders, and knees. These areas are the primary concern in injury prevention. The coach from Malang City revealed,

> "The method is from the provision of the training program, from the warm-up that must be a lot. Especially from the waist, shoulders, and knees".

While the coach from Lumajang District revealed,

> "In general, the most common thing is called a warm-up, if specifically you can warm up with a barbell, such as warming up the ankle placed first on the thigh and on the shoulder placed on the clavicle bone."

With the interview results, both coaches indirectly agree that the warm-up method is the main thing in injury prevention. However, the arguments of the two coaches differ, as they are related to warm-ups that are specialized in certain parts. Besides that, how do trainers teach athletes the right ways to prevent injuries? Malang City coach revealed,

> "Yes, we have shared what this athlete's program lacks. In Weightlifting, not all can be equated for their needs; each athlete has their own needs in the program. Because this is in the region, yes, we hit the program equally, because the portion of sleep and food is less prepared than in Puslatda or Pelatnas. However, if the

portion of sleep and food is ready in Puslatda or Pelatnas, there are also portions for the training program."

The injury prevention program is tailored to the individual needs of athletes. However, the program is more uniform in the regions due to limited facilities (coach supervision) compared to the national training center. While the Lumajang District Coach said,

"Warming up before and after training, and adding supporting equipment to training to reduce the risk of injury to athletes, the main warm-up is the ankle, knee, hip, shoulder, and wrist joints. One can adjust the training program while educating athletes by doing the right form and adjusting to the body's anatomy, such as the long femur."

Adding equipment such as knee sleeves, wrist wraps, belts, and weightlifting suits can reduce the risk of injury. Exercises such as plank, back-ups, and good morning are often used to improve body stability and prevent injuries. Some coaches even adapted programs from other sports, such as wrestling. A coach from Malang City added,

"For the adaptation of the training program, I took it from wrestling, because I used to be in the same training place. Wrestling used to involve a waist injury because the waist has become a key area of focus in Weightlifting, so it must be strong. I told him to practice Back Up and Good Morning for his injury prevention program. I told him to practice hanging. Hence, his position was Deadhang (hanging on the pull-up pole). Later, I pulled his legs, now in the lower back (lower back), there is a clamped muscle, so I pull it so that the muscle comes out ".

This approach shows the coach's strategy in adopting injury prevention programs from other sports. The coach's assessment of the effectiveness of the injury prevention program provided to athletes is also the basis for the coach's understanding of what they are doing, and at the same time, becomes a strategy for what they are doing. A coach from Malang City said,

"If there is an injury, I reduce the program, adjusting to the injury. For example, if the injury is in the waist, I give up the waist. What exercises can be done? Pulls cannot be done. What can be done? Squats, then squats. The point is that you cannot take a break from training. If it is a leg injury, the exercises are pulls, back ups, and good morning; that is it. For the injury program, which was told to hang and pull, counted up to 8, 3 sets, five sets. Moreover, actually, in Weightlifting, it is basically a muscle tube, for example, like good morning, the strength cannot be seen for 1-2 weeks, so at least it can be seen for 1-2 months, because Weightlifting is essentially a muscle tube, no one exercises like this for 1 month, 2 months is immediately strong. Yes, that is why every exercise must be a lot of additional (supporting) exercises; the additions are whatever you want to back up. Good morning, combined, it is no problem; just the waist and shoulders are no problem. For match preparation, there is a program 10 days before the match. In preparation, it focuses on training for techniques that are not too heavy. However, supporting exercises are very much so, for example, back up, sit up, plank, or good morning exercises, which are usually for strengthening the core muscles; if for squats, it is not too heavy."

The Malang City coach adjusted the athletes' training based on the type of injury to speed up recovery. While the Lumajang District coach said,

> "Very effective, because to extend the life of athletes, if there is no additional program or equipment to support reducing the risk of injury, it is feared that athletes cannot compete longer, because with a hefty load, and very high training intensity, it allows a risk of injury."

Lumajang District coaches focus on providing additional training equipment, which is also an important aspect of training. Having adequate training equipment will help reduce the risk of injury and is also related to the longevity of the athletes. In addition, all athletes from both regions also agreed and admitted that the programs and strategies given by the coach to the athletes were very effective. All athletes said,

> "Effective, because it matches what is needed."

Besides that, coaches have their own challenges in implementing injury prevention programs. The Malang City coach said,

> "The challenge is boredom because boredom is the most frequent in Weightlifting. By bored, I mean bored with training."

Boredom and boredom are challenges in implementing an injury prevention program. While the Lumajang District Coach said,

> "The lack of facilities and infrastructure in Lumajang."

Limited facilities and infrastructure are the main challenges in injury prevention. In addition to limited facilities and infrastructure, limitations in the literature are obstacles to implementing injury prevention programs. The coach from Malang City said,

> "For my literature until (did not follow), because from the campus too, there used to be monitoring in Jakarta once I invited him to share, he did not know (did not understand), because Weightlifting is very different from other sports. Most other sports have similar exercises, while Weightlifting is different. What is the difference? Because we exercise with weights (maximum load), the main work is the waist, that is what it is".

Meanwhile, the Lumajang District Coach said,

> "For now, it is still not, because it is felt that the old literature is still sufficient, so there is still no additional literature."

As a result, the training methods tend to be uniform, becoming a recurring obstacle, such as athletes experiencing boredom in training, due to the lack of application of the principle of variety. On the other hand, each athlete has different management in every experience of fatigue or sciatica after training, called DOMS (Delayed Onset Muscle Soreness), which is generally done through simple techniques. The Malang City athlete explained,

> "Rarely, rarely, more often sciatica (doms), especially the back, thighs, knees, and shoulders. I usually deal with it by reducing strenuous exercise," said Salwa.

> "It used to be common, but now it is never. Once it was in the wrist area, then to treat it I massaged it for 2 days, and it was over (healed)", said Ali.

"I have never had a severe injury, but I often get sciatica (doms), especially in the back, thighs, and knees. Moreover, usually if the pain (doms) is severe, I get a physiotherapy massage. I almost bumped into a 100 kg snatch barbell in the past, but thank God I was safe and not injured," said Zaki.

While Lumajang District athletes explained,

"Rarely, because I do not push myself too much (ego lifting), and I always wear training equipment", said Tanti.

"Often, especially in the lower back area, how to handle it is to reduce the exercise that makes the pain worse," said Aldi

"Rarely, but I have been injured in the shoulder area, I treat it with an ice cube compress," said Ifan.

Reducing the intensity of training when DOMS occurs is important so the body can maximize recovery. Massage and ice packs are considered adequate to overcome mild discomfort. However, further education is needed so that recovery techniques are done correctly and support faster recovery. On the other hand, athletes showed limited knowledge of injury prevention strategies, with most information only obtained from their coaches. This highlights the need for increased education to provide athletes with a better understanding of the importance of injury prevention.

## DISCUSSION

Warming up is an important element in preventing injuries in weightlifting. Warm-ups that include dynamic stretching and are specific to vulnerable joints, such as the shoulders, knees, and lower back, effectively reduce the risk of injury. The results of this study suggest that a warm-up that includes dynamic stretching and focuses on the shoulders, lower back, and other injury-prone joints is necessary to prepare the body for strenuous stress during training. This approach helps improve flexibility and minimizes strain on muscles and joints before performing heavy movements. This aligns with findings in the literature stating that a well-planned exercise plan, optimal physical fitness, correct sports skills, and proper rehabilitation training are key to preventing sports injuries (Feng, 2024).

Coaches use Dynamic warm-ups more often than static warm-ups, even though the coaches do not understand the theory. Because the implementation already supports the athlete's performance, several reasons related to its effectiveness and impact on athletic performance exist. The reason dynamic warm-ups are preferred is that they can improve athletic performance better compared to static warm-ups. Methods such as RAMP (Raise, Activate, Mobilize, Potentiate) increase heart rate, activate muscles, mobilize joints, and potentiate the neuromuscular system, all of which contribute to optimal preparation for intensive physical activity (Reid et al., 2018). Dynamic warm-ups also aid in injury prevention by preparing the body more thoroughly for physical activity, compared to static warm-ups, which can lead to decreased performance if performed without a proper dynamic warm-up (Behm et al., 2021). Additionally, athletes feel more prepared and confident after performing a dynamic warm-up. However, this research suggests that stretching (static or dynamic) does not significantly affect flexibility or physical function when performed as part of a comprehensive physical preparation (Blazevich et al., 2018).

Core and lower back strengthening exercises are the primary focus in preventing injuries. One coach adapted a program from another sport, such as wrestling, to strengthen areas of the body that are often pressure points during weightlifting training. Previous research, such as the "Wrestling+" warm-up program, has shown that structured warm-ups can improve functional movement patterns and significantly reduce injury risk (Bayati et al., 2019). This warm-up program can serve as a model for weightlifting coaches to develop a more systematic and sport-specific approach. Other literature also supports the importance of muscle strength in preventing injury, stating that "higher levels of strength help reduce the risk of sports injuries" and rehabilitation should be progressive to prepare the musculoskeletal system for varying loads and speeds (Maestroni et al., 2020). This approach is important, especially in resource-constrained regions, where the coach's creativity is important in supporting the safety of athletes' training.

Exercises such as the plank, back-ups, and good morning that coaches use aim to improve body stability and protect the areas most susceptible to stress during weightlifting exercises. This approach is particularly relevant given the importance of core stability in supporting correct posture when performing movements such as snatch, clean, and jerk. Scientifically designed strength training can improve joint stability, balance, and muscle strength, thereby reducing the overall risk of injury (Ningning, 2023). In this context, coaches in the region need to be provided with additional injury prevention training to ensure the strengthening training program implemented is evidence-based and suited to the specific needs of weightlifters.

Injury prevention in sports, including weightlifting, requires a comprehensive and multidisciplinary approach. A study highlighted that injury prevention depends not only on a single factor, but on various intrinsic and extrinsic factors, such as the mechanism of injury, the training environment, and the athlete's physical condition (Edouard & Ford, 2020). Strong collaboration between coaches, medical teams, and athletes is required to create effective prevention strategies. This approach aims not only to prevent injuries but also to ensure optimal recovery after an injury occurs. In other words, "physical rehabilitation" is important in minimizing the risk of recurrent injury and improving athletic performance. The literature confirms that "physical rehabilitation training can integrate rehabilitation and physical training to accelerate the recovery of athletes' physical health and reduce injury recurrence" (Wu & Luo, 2022). In this study, methods such as ice packs have shown positive results supporting athletes' recovery.

Recovery strategies for minor injuries, such as DOMS, also play an important role in supporting athlete performance. DOMS, which are often experienced after strenuous exercise, can hinder the training process if not appropriately treated. Delayed Onset Muscle Soreness (DOMS) is a common condition experienced by athletes after performing high-intensity exercise or eccentric movements that they are not used to. Based on interviews, weightlifters in Malang City and Lumajang Regency often complain of pain in the lower back, thighs, and shoulders due to DOMS, which is usually treated with simple methods such as manual massage, ice packs, or a reduction in exercise intensity. This practice follows the basic principles of DOMS treatment: to reduce muscle stress in the affected muscles and facilitate recovery. The results showed that regional athletes used massage and ice packs as the primary methods to treat minor injuries. Scientifically recognized treatments include a combination of stretching, massage, cryotherapy, and nutritional interventions. For example, ice massage, although this method is simple, other studies have shown that

the use of ice massage 2 (two) hours after exercise can significantly reduce DOMS symptoms, including pain (Ambardini & Kushartanti, 2024). In addition, PNF (Proprioceptive Neuromuscular Facilitation) stretching was shown to improve muscle flexibility and reduce the severity of muscle pain. The combination of PNF stretching and ice massage provides better results than using only one of the techniques (Ambardini & Kushartanti, 2024; Kancherla, 2023).

However, the application of these scientific methods is often constrained by limited facilities at the local level. Local athletes tend to use improvised methods that, while effective, often lack scientific evidence. An example of improvised methods often used is manual massage done with one's hand or a friend's to reduce muscle tension. In addition, ice packs are often done using ice cubes wrapped in cloth without proper temperature or time regulation. While these techniques may provide temporary relief, this approach does not fully meet the standard scientific procedures in treating DOMS. To overcome this obstacle, additional training is needed so coaches can introduce more structured techniques to athletes, such as PNF stretching and ice massage. Previous research by Mu'arifin et al. (2019) showed that injury prevention and treatment training focused on passive stretching techniques could improve the knowledge and skills of coaches in reducing the risk of injury to athletes. However, the article has limitations because it only focuses on passive stretching without integrating other evidence-based methods, such as the use of a combination of PNF stretching and ice massage, which has been proven effective in the scientific literature (Ambardini & Kushartanti, 2024; Kancherla, 2023).

In addition, education on nutritional interventions, such as protein or BCAA supplementation, can help accelerate the recovery of muscles affected by DOMS (Kancherla, 2023). Overall, the DOMS management strategies implemented by local athletes align with basic scientific principles, but could be improved by integrating evidence-based methods. Despite facility limitations, a more structured approach and additional education could help athletes optimize their recovery process. With proper implementation, DOMS recovery programs can sustainably support weightlifters' performance.

Overall, this study demonstrated the importance of implementing evidence-based strategies in preventing and managing injuries in weightlifting. However, the study also found limited facilities and access to additional training to be significant barriers to implementing more effective injury prevention programs. At the local level, these limitations often lead coaches to rely on improvised methods that are not necessarily evidence-based. Kirichenko (2024) emphasizes the importance of applying individual principles to delivering injury prevention programs based on the specific needs of athletes to achieve optimal results. This is relevant to the finding that coaches in the regions require additional support, both in regular training and the provision of adequate facilities. As the literature outlines, comprehensive injury prevention requires careful training planning, proper rehabilitation, and close collaboration between the parties involved (Edouard & Ford, 2020; Mendonça et al., 2021). With adequate facilities and ongoing education, the risk of injury to weightlifters can be minimized, supporting improved performance and the sustainability of their careers.

Based on the findings, several recommendations can be made to minimize injuries in weightlifting: (1) implementing structured dynamic warm-ups targeting high-risk joints such as the shoulders, lower back, and knees; (2) integrating core and back strengthening exercises like planks, back-ups, and good mornings into regular training sessions; (3) educating athletes on correct lifting techniques and ensuring

individualized training loads; and (4) providing adequate supporting equipment such as knee sleeves, wrist wraps, and belts to reduce strain during high-intensity lifting. These strategies are expected to reduce the risk of acute and overuse injuries while improving long-term athlete performance.

### Limitations of the study

This study has several limitations that need to be considered. In terms of methodology, the case study approach used allowed for in-depth exploration of the local context. However, the findings are specific to Malang City and Lumajang District and cannot be generalized to a broader population. In terms of participants, the purposive selection only involved coaches and athletes with specific experience, so the views of other parties, such as physiotherapists or sports organization administrators, were not explored. In addition, limited facilities in the study area also affected the implementation of evidence-based injury prevention strategies. These barriers align with Bahr & Engebretsen's (2009) literature, which suggests that limited resources often hinder the implementation of scientifically based injury prevention programs. This barrier may limit the study's external validity, especially regarding the adoption of scientific methods such as PNF stretching or cold therapy that participants may not have fully implemented.

## CONCLUSIONS

This study reveals how weightlifting coaches and athletes in Malang City and Lumajang Regency understand, implement, and face obstacles in injury prevention programs. Based on the results of the analysis, coaches have a good understanding of the importance of a thorough warm-up, core muscle strengthening exercises, and the application of correct force techniques to prevent injury. Dynamic warm-up and core strengthening exercises, such as plank and back up, are the main strategies implemented. Meanwhile, athletes rely more on the coach's direction without deeply understanding the program's purpose and benefits.

Recovery strategies, such as manual massage and ice packs, have effectively reduced pain and prevented minor injuries such as DOMS (Delayed Onset Muscle Soreness). However, these techniques are often practiced without clear scientific evidence-based guidelines. The main barriers include limited facilities, a lack of additional training for trainers, and limited access to modern scientific literature. This results in the implementation of injury prevention programs that tend to be improvised, although the efforts have had a positive impact on reducing minor injuries.

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## DATA AVAILABILITY

All data supporting the findings of this study are included in the article and its supplementary materials. Additional datasets are available from the corresponding author upon a reasonable request.

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## CONFLICT OF INTEREST

The author officially certifies that there are no conflicts of interest with any party with respect.

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