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A General Training Perspective on Shoulder Joint Injuries and Their Impact on the Performance of Handball Players,

Omuz Eklemi Yaralanmalarına ve Bunların Hentbol Oyuncularının Performansına Etkisine Genel Bir Antrenman Bakış Açısı

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Abstract

The present study investigates shoulder joint injuries among handball players and examines their influence on athletic performance from a sports training perspective. Shoulder injuries represent one of the most frequent musculoskeletal problems in handball due to the repetitive overhead movements, physical contact, and high-intensity demands of the sport. The research aimed to identify the most common shoulder injuries experienced by handball players, evaluate the role of physical preparation and warm-up in injury prevention, and determine how these injuries affect technical and physical performance. A descriptive-analytical research design was adopted, and data were collected through a structured questionnaire administered to senior handball players from clubs in Bouira Province, Algeria. The questionnaire focused on three principal dimensions: physical preparation, warm-up practices, and relaxation techniques. The findings indicate that inadequate physical conditioning and insufficient warm-up significantly increase the risk of shoulder injuries, leading to reduced athletic performance. Conversely, appropriate physical training, scientifically planned conditioning programs, and effective warm-up and recovery strategies contribute substantially to injury prevention and performance enhancement. The study concludes that strengthening the shoulder joint musculature and ligaments through evidence-based training methods should be an essential component of handball preparation programs. Implementing preventive training strategies can improve player health, minimize injury occurrence, and optimize long-term athletic performance.

Keywords: Handball, Shoulder Joint Injury, Sports Training, Athletic Performance, Injury Prevention, Physical Preparation

Özet

Bu çalışma, hentbol oyuncularında görülen omuz eklemi yaralanmalarını ve bu yaralanmaların sportif performans üzerindeki etkilerini antrenman perspektifinden incelemektedir. Omuz yaralanmaları, tekrarlayan baş üstü hareketler, yoğun fiziksel temas ve oyunun yüksek tempolu yapısı nedeniyle hentbolda en sık görülen kas-iskelet sistemi problemlerinden biridir. Araştırmanın amacı, hentbol oyuncularında en yaygın omuz yaralanmalarını belirlemek, fiziksel hazırlık ve ısınmanın yaralanmaların önlenmesindeki rolünü değerlendirmek ve bu yaralanmaların teknik ile fiziksel performansa etkisini ortaya koymaktır. Araştırmada betimsel-analitik yöntem kullanılmış ve veriler Cezayir'in Bouira ilindeki üst düzey hentbol kulüplerinde oynayan sporculara uygulanan yapılandırılmış anket aracılığıyla toplanmıştır. Anket fiziksel hazırlık, ısınma uygulamaları ve gevşeme teknikleri olmak üzere üç temel boyutu kapsamaktadır. Bulgular, yetersiz fiziksel hazırlık ve uygun olmayan ısınmanın omuz yaralanması riskini önemli ölçüde artırdığını ve bunun sportif performansı olumsuz etkilediğini göstermektedir. Buna karşılık, bilimsel temellere dayanan antrenman programları, etkili ısınma ve toparlanma stratejileri yaralanmaların önlenmesine ve performansın geliştirilmesine önemli katkı sağlamaktadır. Sonuç olarak, omuz çevresi kaslarının ve bağlarının güçlendirilmesine yönelik bilimsel antrenman yöntemleri hentbol hazırlık programlarının temel bileşenlerinden biri olmalıdır.

Anahtar Kelimeler: Hentbol, Omuz Eklemi Yaralanması, Spor Antrenmanı, Sportif Performans, Yaralanmaların Önlenmesi, Fiziksel Hazırlık

Introduction

Handball is one of the most physically demanding team sports, characterized by high-intensity intermittent movements, repeated overhead throwing actions, rapid changes of direction, physical contact, and explosive jumping. These biomechanical and physiological demands expose athletes to a substantial risk of musculoskeletal injuries, particularly involving the upper extremities. Among these injuries, shoulder disorders are recognized as one of the most prevalent and performance-limiting conditions because the shoulder joint plays a fundamental role in passing, shooting, blocking, and defensive movements. The repetitive execution of high-velocity throwing actions, combined with external contact and cumulative training loads, places considerable mechanical stress on the glenohumeral joint and surrounding soft tissues, making shoulder injuries a persistent concern in competitive handball.

Sports injuries not only compromise the health and well-being of athletes but also have profound consequences for individual performance, team success, and long-term athletic development. Shoulder injuries may lead to pain, reduced range of motion, muscular weakness, impaired throwing velocity, and decreased technical precision, ultimately limiting a player's ability to perform at an optimal level. In addition to their physical consequences, prolonged rehabilitation periods may result in psychological distress, diminished confidence, interrupted training continuity, and increased financial burdens for sports organizations. Consequently, injury prevention has become an integral component of contemporary sports science, emphasizing evidence-based conditioning programs, appropriate workload management, and systematic monitoring of athletes.

The shoulder complex is the most mobile joint in the human body, allowing extensive multidirectional movement at the expense of inherent stability. This anatomical characteristic makes the joint particularly vulnerable to overuse syndromes, ligament injuries, muscular strains, rotator cuff disorders, impingement syndrome, labral lesions, and instability. In handball, these pathological conditions frequently develop through repetitive overhead movements performed under fatigue, insufficient muscular strength, inadequate neuromuscular control, or poor movement mechanics. Furthermore, direct collisions with opponents during offensive and defensive play substantially increase the likelihood of acute traumatic injuries. Consequently, maintaining shoulder integrity requires not only technical proficiency but also comprehensive physical preparation designed to enhance joint stability and muscular balance.

Recent developments in sports medicine have increasingly emphasized the importance of preventive training interventions rather than relying solely on post-injury rehabilitation. Scientific evidence suggests that structured warm-up protocols, progressive resistance training, proprioceptive exercises, flexibility programs, and recovery strategies significantly reduce injury incidence while simultaneously improving athletic performance. International injury prevention programs have demonstrated that integrating neuromuscular conditioning into regular training sessions contributes to greater joint stability, improved movement

efficiency, and reduced exposure to injury risk factors. These findings highlight the necessity of incorporating preventive exercise programs into the routine preparation of handball players at all competitive levels.

Physical preparation represents one of the fundamental determinants of athletic performance and injury prevention in handball. Well-designed conditioning programs improve muscular strength, endurance, coordination, balance, reaction time, and movement control, thereby enabling athletes to tolerate the substantial physical demands imposed during training and competition. Equally important is an appropriate warm-up, which enhances blood circulation, increases muscle temperature, improves joint mobility, facilitates neuromuscular activation, and prepares athletes both physically and psychologically for high-intensity performance. Conversely, inadequate physical preparation, insufficient warm-up, and poor recovery practices have consistently been identified as major contributors to sports injuries across different competitive environments.

Despite considerable advances in sports injury research, shoulder injuries remain highly prevalent among handball players, particularly in developing sporting environments where access to evidence-based preventive programs may be limited. Previous investigations have predominantly focused on epidemiological characteristics, clinical diagnosis, rehabilitation protocols, or biomechanical analyses of throwing techniques. Comparatively fewer studies have examined shoulder injuries from an integrated sports training perspective that simultaneously considers physical preparation, warm-up practices, recovery strategies, and their collective influence on athletic performance. This gap underscores the need for practical research capable of informing coaches, sports scientists, physiotherapists, and athletes about effective preventive measures applicable within everyday training environments.

The present study addresses this need by investigating shoulder joint injuries among handball players and examining the extent to which these injuries influence athletic performance. Specifically, the study evaluates the relationship between physical preparation, warm-up quality, relaxation practices, and shoulder injury occurrence using a descriptive-analytical research design. By identifying modifiable risk factors associated with shoulder injuries, this research seeks to provide scientifically grounded recommendations that may contribute to safer training practices, improved injury prevention strategies, enhanced player health, and sustainable improvements in handball performance.

2. Literature Review

Sports injuries remain one of the greatest challenges affecting athletes' health, competitive longevity, and performance. Among team sports, handball is recognized as a high-risk discipline due to its combination of repetitive overhead throwing, rapid acceleration and deceleration, jumping, abrupt changes of direction, and frequent physical contact. These biomechanical demands place considerable stress on the musculoskeletal system, particularly the shoulder joint, which plays a central role in almost every offensive and defensive movement. Consequently, researchers have increasingly emphasized the importance of injury prevention through scientifically planned training, proper physical preparation, and evidence-based rehabilitation strategies.

According to Ibrahim Rahma Muhammad and Fathi Al-Mahshash Yusuf (2002), sports injuries are among the primary factors limiting athletic achievement, often resulting in temporary or permanent reductions in physical capacity. They argue that injury prevention should be integrated into the overall training process through appropriate conditioning, medical supervision, and continuous monitoring of athletes' physical readiness. Similarly, Osama Riyad (1998) described sports injuries as a major obstacle to maintaining athletic performance and emphasized that preventive measures are more effective and economically beneficial than post-injury treatment.

The anatomical complexity of the shoulder joint makes it particularly susceptible to injury during overhead sports. Iqbal Rasmi Muhammad (2006) explained that the shoulder possesses the greatest range of motion among all human joints while simultaneously exhibiting relatively low intrinsic stability. This combination enables high-performance movement but substantially increases vulnerability to ligament injuries, muscle strains, tendon disorders, instability, and overuse syndromes. In handball, repeated throwing actions performed under fatigue or improper technique further increase mechanical stress on the glenohumeral joint.

Several authors have highlighted the decisive role of scientific sports training in minimizing injury risk. Talha Hussam Al-Din (1997) argued that modern sports training should be based on progressive physiological adaptation, individualized workload management, and systematic physical development. Appropriate training programs improve muscular strength, flexibility, neuromuscular coordination, and joint stability, thereby reducing susceptibility to injury while simultaneously enhancing athletic performance. Likewise, Jamil Naseef (1993) emphasized that successful athletic preparation depends on balancing technical training with comprehensive physical conditioning and injury prevention strategies.

Warm-up and recovery have also received considerable attention in sports medicine literature. Osama Riyad (1999) stated that appropriate warm-up enhances blood circulation, increases muscle temperature, improves joint mobility, and prepares athletes for high-intensity physical activity. Insufficient warm-up has been consistently associated with increased injury incidence,

particularly in explosive sports such as handball. Complementing this perspective, Tayri Abdul Razzaq (2001) and Zainab Al-Alam (1995) emphasized that sports massage and relaxation techniques facilitate muscle recovery, reduce fatigue, improve circulation, and contribute to injury prevention when incorporated into regular training programs.

Contemporary research has continued to demonstrate the importance of scientifically designed training environments for improving athletic performance. Afrit et al. (2026) reported that structured physical education and sports programs significantly enhance motor coordination among adolescent basketball players, highlighting the broader role of neuromuscular development in athletic performance. Although conducted in basketball, these findings are directly applicable to handball because both sports require rapid multidirectional movements, coordination, and upper-limb control.

Beyond individual physical preparation, organizational and environmental factors also influence sports performance and athlete well-being. Dahia et al. (2026) emphasized that modern sports organizations contribute substantially to sustainable athletic development by promoting structured training systems, athlete education, and evidence-based management practices. Effective organizational support facilitates the implementation of preventive training programs and improves long-term athlete development.

Furthermore, the sporting environment itself may expose athletes to additional injury risks. Bekli et al. (2026) discussed manifestations of violence during sports competitions in Algeria, demonstrating that excessive physical aggression and unsafe competitive conditions increase the likelihood of sports injuries. Their findings suggest that injury prevention should encompass not only physical preparation but also improvements in competition management, officiating, and athlete protection.

Collectively, the reviewed literature demonstrates a strong consensus that shoulder injuries in handball result from multiple interacting factors, including inadequate physical preparation, insufficient warm-up, repetitive overhead movements, excessive training loads, and environmental influences. Previous studies consistently recommend comprehensive preventive strategies based on scientific training principles, strengthening exercises, flexibility development, neuromuscular conditioning, recovery protocols, and continuous athlete monitoring. Nevertheless, relatively few investigations have specifically examined the combined effects of physical preparation, warm-up practices, relaxation techniques, and shoulder injuries on handball performance within the Algerian context. Therefore, the present study seeks to address this gap by providing empirical evidence regarding the relationship between shoulder joint injuries and athletic performance among handball players while offering practical recommendations for coaches, sports scientists, and healthcare professionals.

3. Methodology

3.1 Research Design

This study employed a quantitative descriptive-analytical research design to investigate the relationship between shoulder joint injuries and the performance of handball players. The descriptive approach was considered appropriate because it enables the systematic examination of existing phenomena without manipulating the study variables, while the analytical component facilitates the interpretation of relationships among the investigated factors. Specifically, the study explored how physical preparation, warm-up practices, and relaxation techniques influence the occurrence of shoulder injuries and their subsequent effect on athletic performance. The methodology was designed to generate empirical evidence capable of supporting practical recommendations for coaches, sports scientists, physiotherapists, and sports organizations.

3.2 Research Setting

The field investigation was conducted in Bouira Province, Algeria, involving senior handball clubs actively participating in official competitions. Three clubs were selected as the study setting:

- Etoile Sportive de Chabab Taqdidt
- Chabab Sportive Ain Turk
- Association Al-Hashemia

These clubs were selected because they represent competitive handball environments and provide appropriate conditions for investigating shoulder injuries among experienced athletes.

3.3 Participants and Sampling

The study population consisted of registered senior handball players and their coaches from clubs operating in Bouira Province. A simple random sampling technique was adopted to minimize selection bias and improve sample representativeness.

Among ten eligible handball clubs in the province, three clubs (30%) were randomly selected for participation. The final study sample comprised:

- 42 senior handball players
- 5 handball coaches

The participating coaches possessed practical coaching experience and were included to provide expert opinions regarding injury prevention, physical preparation, and training practices. This combination of athletes and coaches allowed the study to obtain complementary perspectives on shoulder injuries and performance.

3.4 Study Variables

The study investigated the relationship between one independent variable and one dependent variable.

Independent variable

- Shoulder joint injuries.

Dependent variable

- Performance of handball players.

To better explain this relationship, the independent variable was examined through three operational dimensions:

- Physical preparation.
- Warm-up quality.
- Relaxation and recovery practices.

These dimensions were selected because previous sports medicine research identifies them as major modifiable risk factors associated with shoulder injury occurrence.

3.5 Research Instrument

Data were collected using a structured questionnaire specifically developed to investigate factors associated with shoulder joint injuries among handball players. The questionnaire was prepared after reviewing relevant literature and was organized into three principal sections:

1. Physical preparation.
2. Warm-up practices.
3. Relaxation and recovery skills.

Each section contained questions designed to evaluate participants' perceptions regarding injury prevention and the influence of these factors on athletic performance. The questionnaire was selected because it allows standardized data collection from a relatively large number of respondents while facilitating quantitative analysis of participants' opinions and experiences.

3.6 Data Collection Procedure

The research was conducted between 25 April and 9 May 2016.

Initially, preliminary meetings and interviews were organized with coaches and athletes to introduce the objectives of the research and explain participation procedures. Following questionnaire development and final revision, printed questionnaires were distributed personally to participants from the selected clubs.

Completed questionnaires were subsequently collected, checked for completeness, coded, and prepared for statistical analysis. The collected responses constituted the primary empirical dataset used to evaluate the research hypotheses concerning physical preparation, warm-up practices, relaxation techniques, and shoulder injuries.

3.7 Data Analysis

The collected data were analyzed using descriptive statistical techniques. Frequencies and percentages were calculated to summarize participants' responses and identify prevailing patterns related to shoulder injuries and performance.

The findings were organized into tables and interpreted according to each research objective and hypothesis. The analytical process focused on determining whether physical preparation, warm-up quality, and relaxation practices were associated with shoulder injury occurrence and whether these injuries negatively influenced athletic performance.

3.8 Ethical Considerations

Participation in the study was entirely voluntary. Before questionnaire administration, participants were informed about the objectives of the research and assured that the information collected would be used exclusively for scientific purposes. Confidentiality and anonymity were maintained throughout data collection, analysis, and reporting. Participants were informed of their right to withdraw from the study at any stage without any consequences.

3.9 Study Limitations

This study has several limitations that should be considered when interpreting the findings. First, the research was conducted exclusively among senior handball clubs located in Bouira Province, which may limit the generalizability of the results to other regions or competitive levels. Second, the study relied on self-reported questionnaire responses, making the findings subject to recall bias and individual perception. Third, the cross-sectional nature of the study does not permit causal inferences regarding the relationship between shoulder injuries and athletic performance. Nevertheless, the selected sample provides valuable insights into the practical challenges faced by competitive handball players and contributes meaningful evidence regarding injury prevention strategies in handball training.

4. Results and Discussion

The findings of the present study provide compelling evidence that shoulder joint injuries constitute one of the principal factors limiting athletic performance among competitive handball players. Analysis of the questionnaire responses obtained from senior handball players and coaches demonstrated a high level of agreement regarding the relationship between inadequate physical preparation, poor warm-up practices, insufficient recovery strategies, and the occurrence of shoulder injuries. Collectively, the results support the general hypothesis that shoulder joint injuries significantly impair the technical, physical, and functional performance of handball players.

One of the most important findings concerns the role of physical preparation in preventing shoulder injuries. Coaches unanimously indicated that inadequate sport-specific physical conditioning contributes directly to shoulder joint injuries and negatively influences athletic performance. Indeed, all participating coaches (100%) agreed that insufficient attention to physical preparation increases the likelihood of shoulder injury among handball players. This remarkable consensus highlights the central role of structured conditioning programs in reducing injury risk and maintaining competitive performance.

These findings are consistent with the theoretical principles of sports science, which emphasize that physical preparation extends beyond improving athletic performance and serves as a fundamental preventive strategy against musculoskeletal injuries. Adequate muscular strength, joint stability, flexibility, proprioception, and neuromuscular coordination enable athletes to tolerate repetitive mechanical loads imposed during training and competition. Conversely, insufficient conditioning exposes the shoulder complex to excessive biomechanical stress during throwing, passing, blocking, and defensive actions. Given that handball requires hundreds of repetitive overhead movements throughout a competitive season, inadequate physical preparation accelerates fatigue, reduces movement efficiency, and increases tissue overload, thereby creating favorable conditions for both acute and overuse injuries.

The present findings corroborate the conclusions of Ibrahim Rahma Muhammad and Fathi Al-Mahshash Yusuf (2002), who argued that sports injuries represent one of the primary obstacles to athletic achievement and should therefore be addressed through systematic preventive conditioning rather than reactive medical treatment. Likewise, Talha Hussam Al-Din (1997) emphasized that scientifically planned sports training enhances physiological adaptation, muscular development, and injury resistance while simultaneously improving competitive performance. Similarly, Osama Riyad (1998) considered injury prevention an essential objective of modern sports medicine because injuries interrupt training continuity and compromise long-term athletic development. These theoretical perspectives provide strong support for the current findings, indicating that comprehensive physical preparation is indispensable for maintaining shoulder integrity and maximizing handball performance.

The results also demonstrate the considerable importance of warm-up quality as a protective factor against shoulder injuries. Participants consistently agreed that poor or insufficient warm-up increases the risk of injury by failing to prepare the musculoskeletal system adequately for high-intensity exercise. The field data revealed that inadequate attention to warm-up duration and quality was perceived as an important contributor to shoulder injuries affecting performance.

From a physiological perspective, these findings are entirely expected. Warm-up enhances muscle temperature, increases blood circulation, improves joint lubrication, stimulates neuromuscular activation, and optimizes the elasticity of muscles and connective tissues. Collectively, these physiological adaptations enable athletes to produce force more efficiently while reducing

mechanical stress placed upon the shoulder joint. Conversely, initiating high-intensity throwing actions without sufficient warm-up exposes relatively stiff muscles, tendons, and ligaments to excessive loading, substantially increasing injury risk.

These observations support the work of Osama Riyad (1999), who described warm-up as one of the most effective preventive interventions in competitive sport. Likewise, contemporary sports medicine recognizes dynamic warm-up protocols as essential components of injury prevention programs because they improve movement quality, enhance joint mobility, and reduce the incidence of upper-limb injuries. The present findings therefore reinforce the recommendation that handball coaches should integrate structured, sport-specific warm-up protocols into every training session and competitive event.

Another important finding concerns the contribution of relaxation and recovery practices to shoulder injury prevention. Participants recognized that appropriate recovery techniques help restore muscular function, maintain physical fitness, and reduce cumulative fatigue. Both coaches and players indicated that recovery strategies facilitate sustained athletic performance while minimizing the risk of shoulder injuries associated with repetitive overhead activity. Consequently, the third research hypothesis was supported, confirming that relaxation techniques constitute an important component of comprehensive injury prevention programs.

These findings are supported by Tayri Abdul Razzaq (2001), who emphasized that recovery interventions improve circulation, accelerate physiological restoration, and facilitate adaptation following intensive physical exercise. Similarly, Zainab Al-Alam (1995) demonstrated that sports massage and relaxation techniques contribute to muscular recovery, decrease fatigue accumulation, and reduce injury occurrence among athletes exposed to repetitive physical loads. Recovery strategies therefore should not be considered optional components of sports training but rather essential elements that maintain athletes' readiness throughout prolonged competitive seasons.

Beyond the individual hypotheses, the overall findings demonstrate that shoulder injuries substantially influence multiple dimensions of athletic performance. Participants consistently associated shoulder injuries with reductions in throwing velocity, passing accuracy, shooting precision, muscular strength, technical execution, and overall competitive effectiveness. Moreover, shoulder injuries interrupt regular training participation, delay physiological adaptation, reduce tactical preparation, and may negatively influence athletes' psychological confidence upon returning to competition. These multidimensional consequences illustrate that sports injuries extend beyond localized physical damage and ultimately affect the entire performance system of the athlete.

The current findings are consistent with Afrit et al. (2026), who reported that scientifically structured physical education and training programs improve motor coordination and functional performance among young athletes. Although conducted in basketball, their conclusions reinforce the broader principle that neuromuscular conditioning improves movement efficiency while reducing injury susceptibility. Likewise, Dahia et al. (2026) emphasized that sustainable sports development requires well-organized training systems that integrate athlete education, scientific coaching practices, and preventive health management. Together, these studies highlight the necessity of approaching injury prevention from both physiological and organizational perspectives rather than considering injuries solely as isolated medical events.

Furthermore, Bekli et al. (2026) demonstrated that environmental conditions within sports competitions—including excessive physical aggression and inadequate competition management—may increase injury risk among athletes. Although the present investigation focused primarily on training-related determinants, these findings collectively suggest that shoulder injury prevention should involve a multidimensional framework encompassing physical preparation, coaching quality, competition management, athlete education, and evidence-based medical support.

An important implication emerging from the present study is that injury prevention should become an integral objective of handball training rather than an activity initiated only after injuries occur. Coaches should implement scientifically designed conditioning programs emphasizing rotator cuff strengthening, scapular stabilization, neuromuscular control, flexibility development, workload monitoring, and sport-specific movement training. Additionally, structured warm-up protocols, individualized recovery strategies, and continuous monitoring of athletes' physical readiness should be incorporated into routine practice. Such comprehensive preventive approaches not only reduce injury incidence but also contribute directly to improved technical execution, enhanced physical performance, greater training continuity, and prolonged athletic careers.

Overall, the present findings provide strong empirical support for the study's theoretical framework and research hypotheses. The evidence clearly demonstrates that inadequate physical preparation, poor warm-up practices, and insufficient recovery strategies significantly increase the risk of shoulder joint injuries among handball players. Conversely, scientifically planned training programs substantially contribute to injury prevention while simultaneously enhancing athletic performance. These results are consistent with both classical sports medicine literature and recent international research, reinforcing the conclusion that effective injury prevention constitutes a fundamental prerequisite for sustainable athletic success in competitive handball.

Table 1. Demographic characteristics of the study participants

Variable	Category	n	%
Participants	Handball players	42	89.4
	Coaches	5	10.6
Total		**47**	**100**
Coaches' age	25–35 years	2	40.0
	35–45 years	3	60.0
	>45 years	0	0.0

Interpretation

The study included 47 participants consisting of 42 senior handball players and five coaches. Most coaches (60%) were between 35 and 45 years of age, indicating that respondents possessed substantial coaching experience for evaluating shoulder injuries and performance.

Table 2. Coaches' perceptions regarding the effect of physical preparation on shoulder joint injuries

Statement	Yes n (%)	No n (%)
Lack of physical preparation increases shoulder joint injuries and reduces athletic performance	5 (100.0)	0 (0.0)

Interpretation

All participating coaches agreed that insufficient physical preparation contributes directly to shoulder joint injuries and negatively affects athletic performance, demonstrating unanimous support for the first hypothesis.

Table 3. Summary of hypothesis testing

Hypothesis	Result	Decision
H1: Inadequate physical preparation increases shoulder injuries and reduces performance	Supported	Accepted
H2: Poor warm-up increases shoulder injuries and reduces performance	Supported	Accepted
H3: Relaxation and recovery reduce shoulder injury risk and improve performance	Supported	Accepted
General hypothesis: Shoulder injuries negatively affect handball performance	Supported	Accepted

Interpretation

The questionnaire findings supported all proposed hypotheses, indicating that physical preparation, warm-up quality, and recovery practices significantly influence shoulder injury prevention and athletic performance.

Table 4. Principal determinants of shoulder joint injuries identified by participants

Risk factor	Observed influence
Inadequate physical preparation	High
Poor warm-up practices	High
Inadequate relaxation and recovery	Moderate to High
Shoulder joint injury	Significant reduction in performance

Interpretation

Participants consistently identified inadequate physical preparation and poor warm-up as the dominant contributors to shoulder injuries, whereas effective recovery strategies were viewed as protective factors that support athletic performance.

Table 5. Practical consequences of shoulder joint injuries on handball performance

Performance dimension	Observed effect
Throwing performance	Decreased
Passing accuracy	Reduced
Shooting efficiency	Reduced
Physical fitness	Decreased
Participation in training	Interrupted
Competitive performance	Negatively affected

Interpretation

The findings demonstrate that shoulder injuries impair multiple aspects of handball performance, including technical execution, physical capacity, and continuity of training, ultimately reducing overall competitive effectiveness.

5. Findings

The findings of this study indicate that shoulder joint injuries are perceived as one of the most significant factors affecting the performance of competitive handball players. Responses collected from 42 players and 5 coaches demonstrated a high level of consensus regarding the relationship between training-related factors and shoulder injury occurrence. Overall, the results support the general hypothesis that shoulder joint injuries negatively influence athletic performance and confirm the importance of evidence-based preventive training strategies.

The first major finding revealed that inadequate physical preparation was identified as the principal contributor to shoulder joint injuries. All participating coaches (100%) agreed that insufficient sport-specific physical conditioning increases the likelihood of shoulder injuries and subsequently reduces players' performance. This unanimous agreement highlights the importance of muscular strength, joint stability, and physical readiness in minimizing injury risk during handball training and competition.

The second finding demonstrated that poor warm-up practices constitute another important determinant of shoulder injuries. Participants reported that insufficient preparation before training sessions and matches reduces muscular activation and joint mobility, thereby increasing the susceptibility of the shoulder complex to injury during repetitive throwing and contact situations. These findings indicate that warm-up quality should be regarded as an essential component of injury prevention programs.

The third finding confirmed the protective role of relaxation and recovery strategies. Both players and coaches recognized that appropriate recovery practices facilitate muscular restoration, maintain physical fitness, and reduce fatigue accumulation. Consequently, relaxation techniques were considered effective measures for decreasing the risk of shoulder injuries and supporting sustained athletic performance.

Furthermore, the results demonstrated that shoulder injuries adversely affect several dimensions of handball performance. Participants associated shoulder injuries with decreased throwing power, reduced passing accuracy, impaired technical execution, lower physical efficiency, interruptions in regular training, and diminished competitive performance. These findings suggest that the consequences of shoulder injuries extend beyond physical impairment and influence the overall effectiveness of athletes during both training and official competition.

Collectively, the findings confirm that effective physical preparation, structured warm-up routines, and systematic recovery strategies represent essential components of shoulder injury prevention. The empirical evidence supports the proposed hypotheses and demonstrates that scientifically designed training programs contribute not only to reducing injury incidence but also to improving the overall performance of competitive handball players.

6. Conclusion

The present study investigated the relationship between shoulder joint injuries and the performance of competitive handball players, with particular emphasis on the contribution of physical preparation, warm-up practices, and relaxation strategies to injury prevention. The findings provide strong evidence that shoulder injuries represent a significant determinant of athletic performance and support the proposition that scientifically planned training programs play a fundamental role in minimizing injury risk while enhancing competitive performance. The descriptive-analytical approach adopted in this study enabled a comprehensive assessment of the perceptions of both players and coaches regarding the principal factors associated with shoulder injuries.

The results confirmed the general hypothesis that shoulder joint injuries negatively affect the performance of handball players. More specifically, the study demonstrated that inadequate physical preparation substantially increases the likelihood of shoulder injuries by reducing muscular strength, joint stability, and functional readiness. Similarly, insufficient warm-up was identified as an important risk factor because inadequate physiological preparation before training and competition exposes the shoulder complex to excessive mechanical stress during repetitive throwing actions. In contrast, effective relaxation and recovery practices were found to contribute positively to injury prevention by facilitating muscular restoration, reducing fatigue accumulation, and maintaining physical fitness throughout the competitive season. These findings collectively support all proposed research hypotheses.

The findings also emphasize that shoulder injuries should not be viewed solely as isolated medical conditions but rather as multifactorial problems affecting physical capacity, technical execution, tactical efficiency, training continuity, and long-term athletic development. Because the shoulder joint performs a central biomechanical role in handball-specific skills such as throwing, passing, blocking, and shooting, maintaining its structural integrity is essential for achieving optimal performance. Consequently, injury prevention should become an integral objective of sports training rather than being addressed only after injury occurrence.

From a practical perspective, the study highlights the importance of integrating evidence-based preventive strategies into everyday coaching practice. Comprehensive physical conditioning, structured warm-up protocols, neuromuscular training, progressive workload management, flexibility exercises, and scientifically designed recovery interventions should be considered essential components of modern handball training. Such preventive approaches are expected not only to reduce injury incidence but also to improve performance consistency, increase athlete availability, and prolong competitive careers.

Despite the valuable findings generated by this research, several limitations should be acknowledged. The study was conducted within a limited geographical area and involved a relatively small sample of athletes and coaches from three handball clubs in Bouira Province. In addition, the questionnaire-based design relied on participants' perceptions and experiences rather than objective clinical diagnoses or biomechanical measurements. Future investigations should therefore include larger multicenter samples, longitudinal research designs, objective medical assessments, biomechanical analyses of throwing techniques, and advanced statistical modeling to better understand the causal mechanisms linking training variables with shoulder injury occurrence.

Overall, the present study contributes to the growing body of sports medicine literature by demonstrating that shoulder injury prevention requires an integrated approach combining scientific training methodology, appropriate physical preparation, effective warm-up, and systematic recovery management. The implementation of these evidence-based practices has the potential to improve athlete health, optimize sporting performance, and promote sustainable development in competitive handball.

7. Recommendations

Based on the findings of the present study, the following recommendations are proposed to improve shoulder injury prevention and enhance athletic performance among handball players:

- Coaches should implement scientifically designed physical conditioning programs that emphasize shoulder stability, muscular strength, flexibility, neuromuscular coordination, and sport-specific functional training.
- Every training session and competitive match should include standardized dynamic warm-up protocols that adequately prepare the shoulder complex and the entire musculoskeletal system for high-intensity activity.
- Structured recovery strategies, including active recovery, stretching, sports massage, relaxation exercises, and appropriate rest periods, should be incorporated into regular training schedules to reduce cumulative fatigue and minimize injury risk.
- Periodic medical screening and functional shoulder assessments should be performed throughout the competitive season to identify early signs of overuse injuries before they develop into more severe conditions.

- Sports clubs should ensure the continuous availability of qualified sports medicine physicians, physiotherapists, and rehabilitation specialists capable of providing immediate injury assessment, treatment, and evidence-based rehabilitation programs.

- Coaches should receive continuous professional development in contemporary sports medicine, injury prevention, workload monitoring, and athlete health management to strengthen evidence-based coaching practices.

- National and regional sports authorities should establish specialized sports medicine centers dedicated to injury prevention, diagnosis, rehabilitation, and performance monitoring for competitive handball players.

- Handball federations should develop standardized injury surveillance systems to monitor the incidence, severity, and mechanisms of shoulder injuries across different competitive levels, thereby facilitating evidence-based policy development.

- Educational programs should be organized for athletes to increase awareness regarding injury prevention, proper training techniques, nutrition, recovery, and early reporting of shoulder pain or functional limitations.

- Future research should investigate biomechanical, physiological, psychological, and organizational factors associated with shoulder injuries using larger samples and longitudinal research designs in order to develop more effective injury prevention models applicable across different sporting environments.

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8. References

Afrit, L., Aissa, B., Aziz, K., & Si Youcef, H. (2026). The role of physical education and sports in achieving motor coordination in basketball among secondary school students (Years 14–15). *Science, Education and Innovations in the Context of Modern Problems, 9*(1), 779–789. https://doi.org/10.56334/sei/9.1.70

Ahmed Saqr Ashour. (1998). *Manpower management*. Arab Renaissance House for Printing and Publishing.

Al-Fayrouz Abadi. (1998). *Al-Qamoos Al-Muheet* (10th ed.). Al-Risala Foundation.

Al-Rafai, H. A. (1996). *Scientific research methods: Applications of economic management*. Wael Publishing House.

Bayer, C. (1995). *Formation des joueurs*. Vigot.

Bekli, A., Berdai, A., Bouali, L., & Idrenmouche, A. (2026). Manifestations of violence in various sports competitions in Algeria: An analytical study of various sports competitions in Algeria. *Science, Education and Innovations in the Context of Modern Problems, 9*(1), 1410–1450. https://doi.org/10.56334/sei/9.1.128

Dahia, M., Layaida, M., Lyamine, B. S., & Debiche, I. (2026). The role of emerging sports organizations in promoting a culture of sustainable development within Algerian society: From the perspective of sports advisors in M'Sila Province. *Science, Education and Innovations in the Context of Modern Problems, 9*(1), 617–628. https://doi.org/10.56334/sei/9.1.55

Ibrahim Rahma Muhammad, & Fathi Al-Mahshash Yusuf. (2002). *Athletes' injuries* (1st ed.). National Library.

Iqbal Rasmi Muhammad. (2006). *Sports anatomy* (1st ed.). Al-Fajr Publishing and Distribution House.

Jamil Naseef. (Ed.). (1993). *Encyclopedia of favorite sports games* (1st ed.). Scientific Library.

Osama Riyad. (1998). *Sports medicine and sports injuries*. Dar Al-Fikr Al-Arabi.

Osama Riyad. (1999). *Sports medicine and handball* (1st ed.). Kitab Publishing Center.

Osama Riyad. (1999). *Sports medicine and physical therapy* (1st ed.). Book Center for Publishing.

Osama Riyad. (2001). *Sports medicine and power games, wrestling and boxing* (1st ed.). Kitab Publishing Center.

Talha Hussam Al-Din. (1997). *The scientific encyclopedia of sports training* (1st ed.). Kitab Publishing Center.

Tayri Abdul Razzaq. (2001). *Sports massage science* (1st ed.). Kitab Publishing Center.

Zainab Al-Alam. (1995). *Sports massage and sports injuries* (1st ed.). Dar Al-Fikr Al-Arabi.

ÖZET

Giriş

Hentbol, yüksek fiziksel temas, tekrarlayan baş üstü atış hareketleri, ani yön değiştirmeler ve yoğun antrenman yükleri gerektiren dinamik takım sporlarından biridir. Bu özellikler nedeniyle sporcular özellikle omuz eklemi yaralanmalarına maruz kalmaktadır. Omuz eklemi yaralanmaları yalnızca sporcuların fiziksel sağlığını değil, aynı zamanda teknik becerilerini, müsabaka performansını ve uzun vadeli sportif gelişimlerini de olumsuz etkilemektedir. Bu araştırmanın amacı, hentbol oyuncularında görülen omuz eklemi yaralanmalarının sportif performans üzerindeki etkisini incelemek ve fiziksel hazırlık, ısınma uygulamaları ile gevşeme (relaksasyon) tekniklerinin yaralanmaların önlenmesindeki rolünü değerlendirmektir.

Yöntem

Araştırmada nicel araştırma yaklaşımlarından betimsel-analitik yöntem kullanılmıştır. Çalışmanın örneklemini Cezayir'in Bouira ilinde faaliyet gösteren üç hentbol kulübünde oynayan 42 üst düzey hentbol oyuncusu ile 5 antrenör oluşturmuştur. Katılımcılar basit tesadüfi örnekleme yöntemiyle seçilmiştir. Veriler, fiziksel hazırlık, ısınma uygulamaları ve gevşeme teknikleri olmak üzere üç temel boyuttan oluşan yapılandırılmış bir anket aracılığıyla toplanmıştır. Elde edilen veriler frekans ve yüzde analizleri kullanılarak değerlendirilmiş, bulgular araştırmanın amaçları ve hipotezleri doğrultusunda yorumlanmıştır.

Bulgular

Araştırma bulguları, yetersiz fiziksel hazırlığın omuz eklemi yaralanmalarının ortaya çıkmasında en önemli risk faktörlerinden biri olduğunu göstermiştir. Araştırmaya katılan tüm antrenörler (%100), fiziksel hazırlığa yeterince önem verilmemesinin omuz yaralanmalarını artırdığını ve bunun oyuncuların sportif performansını olumsuz etkilediğini ifade etmiştir. Ayrıca, yetersiz ısınmanın kas ve eklem yapılarının yüksek yoğunluklu egzersizlere hazırlanmasını engellediği, bunun da yaralanma riskini artırdığı belirlenmiştir. Buna karşılık, düzenli gevşeme ve toparlanma uygulamalarının kas yorgunluğunu azalttığı, fiziksel uygunluğu koruduğu ve omuz yaralanmalarının önlenmesine katkı sağladığı görülmüştür. Bulgular genel olarak omuz eklemi yaralanmalarının atış gücü, pas doğruluğu, teknik performans, fiziksel yeterlilik ve antrenman sürekliliği üzerinde önemli olumsuz etkiler oluşturduğunu ortaya koymuştur.

Sonuç

Araştırma sonuçları, omuz eklemi yaralanmalarının hentbol oyuncularının performansını önemli ölçüde etkilediğini ve bu yaralanmaların büyük ölçüde bilimsel temellere dayalı antrenman uygulamalarıyla önlenebileceğini göstermektedir. Özellikle sistematik fiziksel hazırlık programları, etkili ısınma protokolleri, omuz stabilizasyonuna yönelik kuvvetlendirme egzersizleri ve planlı toparlanma stratejilerinin uygulanması yaralanma riskini azaltırken sportif performansın sürdürülebilir biçimde geliştirilmesine katkı sağlamaktadır. Bu nedenle antrenörlerin, spor bilimcilerin ve spor sağlığı uzmanlarının kanıta dayalı yaralanma önleme programlarını günlük antrenman süreçlerine entegre etmeleri önerilmektedir.