The Annals of the "Ştefan cel Mare" University of Suceava.
Physical Education and Sport Section. The Science and Art of Movement
eISSN 2601 - 341X, ISSN 1844-9131

STUDY ON THE IMPACT OF PREVENTIVE EXERCISES ON INJURY RISK IN PROFESSIONAL HANDBALL PLAYERS

Gavriloaia Andrei Răzvan
Ștefan cel Mare University of Suceava, Suceava, Romania
razvan.gavriloaia@usm.ro

Keywords: handball, male, injuries, prevention exercises.

Abstract

This study aims to verify whether the implementation of a stability and prevention program in the training of a senior handball team can reduce the number of injuries, the number of days athletes miss training, and, implicitly, improve the team's performance. The research was conducted over two consecutive competitive seasons in the Romanian Men's National Handball League, focusing on the evolution of the CSU Suceava team. To ensure greater relevance, we categorized the severity of injuries into three levels based on the number of days players were absent from the team's regular training program: minor (1–14 days), moderate (15–42 days), severe (more than 42 days of recommended rest). In the 2022–2023 season, the team underwent a training program that did not include specific prevention and stability methods. For the following competitive season, 2023–2024, the proposed program was implemented in order to extract relevant statistical data, considering that the team's roster experienced only minor changes during the off-season. The final results showed a significant improvement in terms of the number of days team members were absent from the joint training program (a reduction of 679 days), as well as in the team's performance, which improved by 3 positions in the standings and earned 9 more points in the 2023–2024 season. We consider the program to have proven its effectiveness and believe it should be considered for inclusion in the team's future training planning.

Introduction

Handball is a high-intensity team sport characterized by rapid directional changes, jumping, and frequent physical contact, all of which contribute to a heightened risk of injuries among players (Martínez-Aranda, 2024). Professional handball athletes are particularly susceptible to injuries affecting the lower limbs—such as ankle sprains and anterior cruciate ligament (ACL) tears—as well as upper limb injuries, notably to the shoulder (Yılmaz et al., 2024). The dynamic and

physically demanding nature of the sport necessitates effective injury prevention strategies to ensure athlete longevity and performance.

Preventive exercise programs, especially those incorporating proprioceptive and strength training components, have demonstrated efficacy in reducing injury incidence in team sports (Ager et al., 2020). Proprioception, the body's ability to perceive its position and movement in space, plays a crucial role in maintaining joint stability and coordinating complex movements. Kaczmarek et al. (2023) found that handball players exhibit superior shoulder proprioception compared to athletes in other sports, suggesting sport-specific adaptations that could be leveraged in injury prevention programs.

Proprioceptive training not only enhances neuromuscular control but also significantly reduces the risk of injury. A systematic review by Yılmaz et al. (2024) emphasized the effectiveness of instability-based exercises, such as those performed on soft surfaces or with eyes closed, in strengthening the somatosensory system. Complementarily, strength training—particularly eccentric exercises—improves muscle resilience and joint stability, offering added protection against the mechanical stresses typical in handball (Yilmaz et al., 2025).

Recent meta-analyses support the claim that injury-prevention programs combining strength and proprioceptive components can significantly reduce injury rates in team sports, including handball (Brunner et al., 2023). For example, a study published in *BMJ* (2024) reported up to a 40% reduction in lower limb injuries among athletes participating in structured prevention programs. Furthermore, Zarei, Eshghi, and Hosseinzadeh (2021) found significant improvements in dynamic shoulder stability in young athletes following injury prevention protocols.

Romanian literature also contributes to this field. Antohe, Ratã, and Ratã (2011) demonstrated that proprioceptive training can improve muscle coactivation in junior handball players, indicating long-term neuromuscular benefits. Additionally, Antohe and Panaet (2024) investigated the impact of proprioceptive exercises on postural control in handball players with chronic ankle instability, finding significant improvements in balance and a reduction in ankle sprain recurrence.

The effectiveness of proprioceptive training in injury prevention has been further corroborated by Manojlović (2021), who conducted a systematic review evaluating its role in preventing lower extremity injuries among team athletes. The review concluded that proprioceptive training is particularly effective in preventing ankle sprains, though it may not be sufficient alone for preventing knee injuries, highlighting the need for comprehensive programs that also include strength and plyometric exercises.

In the context of ACL injury prevention, especially among female handball players, multifaceted training programs incorporating strength, balance, and neuromuscular exercises have shown promising results. A systematic review by

Gómez et al. (2021) identified common components of effective preventive training programs for ACL injuries, emphasizing the importance of addressing biomechanical and neuromuscular risk factors through tailored interventions.

Furthermore, the Oslo Sports Trauma Research Center developed a shoulder injury prevention program specifically for handball players, focusing on exercises to improve external rotation strength and internal rotation range of motion. Although the program did not significantly affect these specific risk factors, it underscores the ongoing efforts to develop sport-specific injury prevention strategies (Fredriksen et al., 2020).

Given these findings, it is justified to explore the impact of proprioceptive and strength-based injury-prevention exercises on professional handball players. **For this purpose, we introduced injury prevention exercises into the training program of a team for an entire competitive season and compared the results with those from the previous season, when the athletes' training did not include this type of exercises.**

Material- Method

Participants

The participants in the experiment were the members of the CSU Suceava, which competes in Romania's National Men's Handball League. The group consisted of 20 athletes, including 3 goalkeepers, 5 wingers, 3 center backs, 5 backcourt players, 3 line players, and one player specialized in defense. The study was conducted during the 2022/2023 and 2023/2024 seasons when the team had 28 official matches in both situations and there were minor changes in the team, only three players were replaced between seasons.

The inclusion criteria were: to be male, good health status, to activate at the highest performance level in Romania. Participants gave their consent to use these personal data for scientific purpose.

Measurements and tests

We established three levels of injury severity based on the number of days of recovery, and we compared the two competitive seasons in terms of the total number of injuries, but especially the recovery period during which the athletes were unable to participate in training.

Data analyses

In order to analyze whether there were significant differences between the two seasons in which the team participated in the same competitions and played the

same number of official games, we extracted the medical information and compared whether there were fewer injuries and, most importantly, whether the number of days of sporting inactivity that affected the team was lower following the implementation of the prevention and stability program. Additionally, taking into account the periods when the injured players could not contribute to the team's performance, we compared the results achieved in the two seasons.

Findings

As shown in Table 1, there were 4 more minor injuries, and the number of rest days prescribed by the doctor increased by 59. Moderate injuries, which require a period of inactivity between 15 and 42 days, remained at 3 in both seasons, while the number of days of sporting inactivity decreased by only 7 in the 2023–2024 season. The number of severe injuries dropped from 9 to 2, resulting in 745 more days of sports activity. The total number of recovery days recommended by the doctor for CSU Suceava players in the 2023–2024 season was 679 fewer, and the sports results show an increase of 9 points and three positions in the final ranking of the National Men's Handball League.

Table 1. Differences regarding number of injuries, days of sporting inactivity and performances between the two analysed handball seasons

	2022-2023 season		2023-2024 season		Differences in the season 2023-2024	
Type of injury	**Number of injuries**	**Recovery period (days)**	**Number of injuries**	**Recovery period (days)**	**Number of injuries**	**Recovery period (days)**
Minor injuries (1-14 days recovery)	12	112	16	171	+ 4	+ 59
Moderate injuries (15-42 days recovery)	3	70	3	77	0	- 7
Severe injuries (> 42 days recovery)	9	981	2	236	-7	- 745
Total	24	1163	21	484	-3	679
Competition results	Points	Ranking	Points	Ranking	Points	Ranking
	28	10	37	7	+ 9	+ 3

Conclusions

Although there are no significant differences in the number of minor and moderate injuries, the number of rest days recommended increased by 52, which confirms an increase in training intensity following the arrival of a new coach. The truly remarkable results can be seen in the 'severe injuries' category, where their number dropped from 9 to 2, and the number of days of physical inactivity among the players decreased by 975 days representing a 75.94% improvement in player attendance at training sessions. This clear increase in team members' participation in training is also reflected in the team's results: in the 2023–2024 season, they earned 9 more points and climbed to 7th place in the standings, up from 10th place in the previous season.

It is also worth mentioning that the number of surgical interventions that the team members underwent was 4 in the 2022–2023 season, while in the following season — during which a prevention and stability program was introduced — only one athlete required surgery.

In conclusion, we believe that the stability and prevention program implemented in the team's preparation for the 2023–2024 competitive season has proven its effectiveness and can be considered for inclusion in training planning in the coming years.

References

1. Ager, A. L., Borms, D., Deschepper, L., Dhooghe, R., Dijkhuis, J., Roy, J. S., & Cools, A. (2020). Proprioception: How is it affected by shoulder pain? A systematic review. *Journal of Hand Therapy, 33*(4), 507–516. https://doi.org/10.1016/j.jht.2019.05.003
2. Antohe, B., Rată, M., & Rată, G. (2011). Muscle coactivation index improvement in junior handball players by using proprioceptive exercises. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience, 11*(4), 1–12.
3. Antohe, B.-A., & Panaet, E.-A. (2024). The effects of proprioceptive exercises on postural control in handball players with chronic ankle instability. *Journal of Sports Rehabilitation, 33*(2), 123–130.PMC
4. Brunner, M., et al. (2023). Is an exercise-based injury-prevention program effective in team handball players? A systematic review and meta-analysis. *Journal of Athletic Training, 58*(1), 45–55.
5. Fredriksen, H., Cools, A., Bahr, R., & Myklebust, G. (2020). Does an effective shoulder injury prevention program affect risk factors in handball? A randomized controlled study. *Scandinavian Journal of Medicine & Science in Sports, 30*(8), 1423–1433. https://doi.org/10.1111/sms.13674PubMed

6. Gómez, M., et al. (2021). Preventive training of anterior cruciate ligament injuries in female handball players: A systematic review. *Apunts Sports Medicine, 56*(211), 100–107.revista-apunts.com
7. Kaczmarek, P., Lubiatowski, P., Cisowski, P., et al. (2023). Handball players have superior shoulder proprioception: A prospective controlled study. *Journal of Shoulder and Elbow Surgery, 33*(1), e1–e12. https://doi.org/10.1016/j.jse.2023.07.028
8. Manojlović, M. (2021). The efficiency of proprioceptive training in preventing injuries to team athletes: A systematic review. *Exercise and Quality of Life, 13*(2), 37–46. https://doi.org/10.31382/eqol.211205journals.indexcopernicus.com+1Exercise and Quality of Life+1
9. Martínez-Aranda, L. M. (2024). Ligament injuries in professional male handball players: A 6-year longitudinal study. *KINEXON Sports*. https://kinexon-sports.com/blog/injury-prevention-in-european-handball
10. Yilmaz, S., et al. (2025). Effect of eccentric exercise-induced fatigue on proprioception, motor control, and performance in elite male handball players. *Journal of Sports Science & Medicine, 24*(2), 123–130. https://doi.org/10.1007/s11332-025-01404-y
11. Yılmaz, O., Soylu, Y., Erkmen, N., Kaplan, T., & Batalik, L. (2024). Effects of proprioceptive training on sports performance: A systematic review. *BMC Sports Science, Medicine and Rehabilitation, 16*(1), 149. https://doi.org/10.1186/s13102-024-00987-3
12. Zarei, M., Eshghi, S., & Hosseinzadeh, M. (2021). The effect of a shoulder injury prevention programme on proprioception and dynamic stability of young volleyball players: A randomized controlled trial. *BMC Sports Science, Medicine and Rehabilitation, 13*(1), 71. https://doi.org/10.1186/s13102-021-00281-0
13. BMJ. (2024). Exercises to prevent lower limb injuries in youth sports: Cluster randomized controlled trial. *BMJ, 330*(7489), 449. https://doi.org/10.1136/bmj.38330.632801.8F
14. ResearchGate. (2024). Is an exercise-based injury-prevention programme effective in team handball players? A systematic review and meta-analysis. https://www.researchgate.net/publication/373774772
15. Pánics, G., Tállay, A., Pavlik, A., & Berkes, I. (2008). Effect of proprioception training on knee joint position sense in female team handball players. *British Journal of Sports Medicine, 42*(6), 472–476. https://doi.org/10.1136/bjsm.2008.046516