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Prevalence of Upper and Lower Extremity Injuries in Elite Iranian Handball Players: A Cross-Sectional Study

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Abstract

Background: Upper and lower limb injuries in handball significantly challenge athletes' performance.

Objectives: This study investigated the prevalence, type, and location of upper and lower limb injuries in elite male and female Iranian handball players.

Methods: This epidemiological study on sports injuries was conducted retrospectively as a cross-sectional study on 276 elite handball players (164 men with a mean age of 25.73 ± 7.77 years, height 181.96 ± 10.14 cm, and weight 84.88 ± 17.39 kg, and 112 women with a mean age of 19.30 ± 4.79 years, height 168.29 ± 5.20 cm, and weight 63.79 ± 9.64 kg). Data were collected using a demographic questionnaire and the injury report form developed by Fuller et al. to examine the prevalence of injuries among handball players. The study used an independent *t*-test and chi-square test to compare continuous and categorical variables between genders. Descriptive statistics were also applied, and data analysis was conducted using SPSS software.

Results: The findings revealed that 95.65% of handball players reported experiencing serious sports injuries, with men having a higher frequency of prior injuries (46.95%) compared to women (23.21%). Women experienced more contact injuries (51.78%), whereas men had more non-contact injuries (60.36%). Injuries in women occurred more frequently during practice sessions (53.57%), while men sustained more injuries during competitions (49.39%). The majority of injuries in both genders happened without the use of supportive equipment (65.57%). Lower limb injuries were the most common (60.14%), followed by upper limb (30.43%), trunk (25%), and head/face injuries (13.41%). Additionally, the chi-square test showed significant gender differences in injury location (P = 0.022) and experience of serious injuries (P = 0.0001), but no significant differences were found in injury type, timing, or use of supportive equipment.

Conclusions: This study revealed that 95.65% of elite Iranian handball players have sustained serious sports injuries. Men experienced more recurrent injuries, while women reported more contact-related injuries. Injuries were more common during practice sessions for women and during competitions for men. The frequent absence of protective equipment highlights the need for effective preventive measures.

Keywords: Handball, Sports Injuries, Prevalence, Upper Limb, Lower Limb, Gender

1. Background

Handball is a dynamic and highly physical sport recognized as one of the most popular team sports worldwide (1). It involves throwing the ball into the opponent's goal, passing, dribbling, jumping, and spinning, which places significant physical demands on players. Consequently, handball players face a considerable risk of injury. Handball is considered a high-risk sport compared to other team and individual sports (2). Its high-intensity nature, rapid gameplay, and the growing number of matches per season impose greater physical and physiological demands on the musculoskeletal system (3). Injuries in handball can profoundly impact players' careers, team performance, and overall health, often leading to prolonged recovery periods and interruptions in training and competition.

Elite players competing at the highest levels are particularly vulnerable to injuries due to the intense physical stress and complex movements required in the

sport, including explosive jumps and rapid changes in direction (4). Scientific evidence highlights a higher prevalence of injuries to the lower limbs compared to the upper limbs, head, and neck, with knee and ankle injuries being the most common (5, 6). For example, studies have reported an injury incidence ranging from 2 to 20 injuries per 1,000 hours of exposure, with match-related injuries being significantly higher (14.3 per 1,000 match hours) than training-related injuries (0.6 per 1,000 hours) (6).

Further research indicates that most injuries in handball occur in non-contact situations, such as sudden movements, landings, or changes in direction, rather than due to direct player collisions (4, 7). These non-contact injuries are often severe, particularly when they involve the knee joint or muscles in the thigh and calf, resulting in prolonged recovery periods (8). Other factors influencing injury patterns include gender, competition level, and fatigue during high-intensity moments in matches, such as the latter stages of each half (9, 10). Gender-specific differences are notable, as studies have shown that women are more likely to sustain anterior cruciate ligament (ACL) injuries than men due to anatomical and biomechanical variations (11).

The unilateral nature of handball movements, coupled with the instability and high-speed muscular contractions required, further increases the risk of both acute injuries (e.g., ligament sprains, fractures) and chronic injuries (e.g., muscle strains, overuse syndromes) (6, 12). While previous research has significantly contributed to understanding injury patterns in handball, most studies have focused on male players or specific injury types, leaving gaps in understanding injuries in female players and comprehensive injury patterns. Moreover, limited research exists on injuries specific to Iranian handball players, despite potential differences in playing styles, training regimens, and environmental factors that may influence injury prevalence and patterns.

Understanding these differences is essential to tailoring prevention and rehabilitation strategies effectively.

2. Objectives

This study aims to address these gaps by providing a comprehensive analysis of injury patterns in elite male and female Iranian handball players. It explores the prevalence, severity, and gender differences in upper and lower extremity injuries and identifies specific risk factors associated with injuries. The findings will assist coaches, physiotherapists, and sports medicine professionals in developing evidence-based injury prevention and rehabilitation programs tailored to the needs of Iranian handball players at all levels.

3. Methods

This study was approved by the Ethics Committee of the Institute of Physical Education and Sport Sciences under the code IR.SSRC.REC.1403.068. The research was designed as a descriptive cross-sectional and retrospective epidemiological study of sports injuries among elite male and female handball players in Iran, conducted between October 22 and December 25, 2024.

The statistical population included professional Iranian handball players. The sample size was estimated using the Morgan table: One hundred and sixty-nine male participants (out of approximately 300 players in the Premier League and Division One) and 132 female participants (out of approximately 210 players in the premier league and division one). A total of 164 elite male and 112 elite female players voluntarily completed the online Sports Injury Prevalence Questionnaire.

Data were collected using a demographic questionnaire and the injury reporting form developed by Fuller et al. to assess the prevalence of injuries among handball players (13).

3.1. Inclusion Criteria

The study included elite Iranian handball players, both male and female, who actively participated in professional handball leagues. These leagues included the premier league, division one, and division two. Additionally, participants were required to voluntarily complete the online questionnaire designed for the study.

3.2. Exclusion Criteria

Participants were excluded from the study if they did not fully complete the online questionnaire. Furthermore, individuals who did not meet the definition of an elite handball player — defined as active participation in one of the specified professional leagues — were also excluded.

3.3. Procedure

Initially, the demographic questionnaire and injury reporting form developed by Fuller et al. were distributed to players through social media platforms and email to ensure a wide reach and accessibility (13). Participants were required to provide informed consent before completing the questionnaire. The study defined

elite players as those actively competing in the premier league, division one, or division two handball leagues in Iran, or those with experience representing national teams.

Data collection was conducted over two months, during which participants were reminded to complete the questionnaire through personalized follow-up messages to enhance the response rate. The data were collected exclusively through self-reported online questionnaires, which captured detailed information about demographics, injury history, type and severity of injuries, and training and competition details. Once collected, the data were systematically organized and entered into SPSS software for statistical analysis.

3.4. Statistical Analysis

Descriptive statistics, including percentages, means, and standard deviations, were used to summarize the demographic and injury-related data. Independent samples *t*-tests were conducted to compare continuous variables between groups, while chi-square tests were used to examine associations between categorical variables. A significance level of 0.05 was applied for all analyses. All statistical analyses were performed using SPSS version 22.

4. Results

4.1. Descriptive Characteristics of Participants

The results of the independent samples *t*-test revealed significant differences between male and female handball players in terms of age, height, and weight ($P < 0.05$) (Table 1).

4.2. Sports Injury Patterns

A high percentage of participants (95.65%) reported having sustained serious sports injuries, with men reporting a higher frequency of prior injuries (46.95%) compared to women (23.21%). Women experienced more contact injuries (51.78%), while men reported a higher rate of non-contact injuries (60.36%). Women were more likely to sustain injuries during practice (53.57%), whereas men experienced more injuries during competitions (49.39%). In both genders, most injuries occurred without the use of supportive equipment (Table 2).

4.3. Prevalence of Specific Injury Types

Muscular injuries were the most common (68.29%), followed by joint injuries (56.52%) and bone injuries (39.28%). Men accounted for a significantly higher percentage of all injury types compared to women, particularly muscular injuries (82.31%) (Table 3).

4.4. Injury Location

Lower limb injuries were the most prevalent in both men (69.51%) and women (46.43%), accounting for 60.14% of all injuries. Upper limb injuries occurred at a similar frequency in both genders (30.43%), while trunk injuries were slightly more common in men (26.22%) than in women (23.21%) (Table 4).

4.5. Statistical Analysis

The chi-square test revealed significant differences between male and female handball players in terms of injury location ($P = 0.022$) and the experience of serious sports injuries ($P = 0.0001$). However, no significant differences were found for the type of injury ($P = 0.179$), time of injury ($P = 0.088$), or use of supportive equipment ($P = 0.507$) (Table 5).

4.6. Injuries During Menstrual Periods

The results showed that 10.7% of female athletes sustained injuries during their menstrual periods, while 89.3% of injuries occurred outside of their menstrual periods. This highlights the potential impact of hormonal fluctuations on injury risk in female athletes (Table 6).

4.7. Gender-Specific Comparisons

Men were significantly more likely to experience muscular injuries (82.31%) compared to women (14.02%). Injuries to the lower limbs were more common in men (69.51%) than in women (46.43%), making them the most frequent injury location in both groups. Men reported a higher rate of non-contact injuries (60.36%), while women experienced more contact injuries (51.78%). Women were more likely to sustain injuries during practice (53.57%), whereas men were more likely to sustain injuries during competitions (49.39%). In both genders, the majority of injuries occurred without the use of supportive equipment (62.50% in women and 67.68% in men).

5. Discussion

This study aimed to investigate the prevalence and characteristics of upper and lower extremity injuries in elite Iranian handball players, revealing that 95.65% of both male and female athletes reported having sustained serious sports injuries during their careers.

Table 1. Descriptive Characteristics of the Participants [a]

Variables	Number	Age (y)	Height (cm)	Weight (kg)
Gender				
Men	164	25.73 ± 7.77	181.96 ± 10.14	84.88 ± 17.39
Women	112	19.30 ± 4.79	168.29 ± 5.20	63.79 ± 9.64
P-value	276	1.29×10^{-13}	6.94×10^{-31}	8.51×10^{-26}

[a] Values are expressed as mean ± SD.

Table 2. Comparison of Sports Injury Variables Between Male and Female Handball Players [a]

Variables	Women	Men	Total
A: Have you ever had a serious sports injury?			
Yes	110 (98.21)	154 (93.90)	264 (95.65)
No	2 (1.78)	10 (6.09)	12 (4.34)
B: Did the injured limb have any prior injuries or pain?			
Yes	26 (23.21)	77 (46.95)	103 (37.31)
No	86 (76.78)	87 (53.04)	173 (62.68)
C: Type of Injury			
Contact injury	58 (51.78)	65 (39.63)	123 (44.56)
Non-contact injury	54 (48.21)	99 (60.36)	153 (55.43)
D: When did the injury occur?			
During practice	60 (53.57)	66 (40.24)	126 (45.65)
During competition	44 (39.28)	81 (49.39)	125 (45.28)
Outside of a sports setting	8 (7.14)	17 (10.36)	25 (9.05)
E: Was there any support for the injured limb?			
With support	41 (37.50)	53 (32.31)	94 (34.05)
Without support	70 (62.50)	111 (67.68)	181 (65.57)

[a] Values are expressed as No. (%).

Table 3. Prevalence of Types of Sports Injuries (Bony, Muscular, and Joint) [a]

Type of Injury	Bony	Muscular	Joint
Women	18 (16.07)	54 (14.02)	44 (14.85)
Men	23 (48.21)	135 (82.31)	112 (68.47)
Total	41 (39.28)	189 (68.29)	156 (56.52)

[a] Values are expressed as No. (%).

Table 4. Injury Location in Different Body Parts [a]

Injury Location	Women	Men	Total
Upper limb	34 (30.36)	50 (30.49)	84 (30.43)
Lower limb	52 (46.43)	114 (69.51)	166 (60.14)
Trunk	26 (23.21)	43 (26.22)	69 (25.00)
Head and face	12 (10.71)	25 (15.24)	37 (13.41)

[a] Values are expressed as No. (%).

Men exhibited a higher frequency of prior injuries (46.95%) compared to women (23.21%), suggesting a greater history of repetitive or recurring injuries. The type and context of injuries also varied between

Table 5. Chi-square Test Results for Comparison of Injury Variables Between Male and Female Handball Players

Variables	Chi^2	df	P-Value
Type of injury	3.44	2	0.179
Injury location	9.66	3	0.022
Experienced serious injuries	15.03	1	0.0001
Time of injury	4.85	2	0.088
Support for injured limb	0.44	1	0.507

Table 6. Prevalence of Injuries During Menstrual Periods Among Female Athletes

Was Your Injury During Your Menstrual Period?	Frequency (%)	Valid (%)	Cumulative (%)
Menstrual period	12 (10.7)	10.7	10.7
Outside of menstrual period	100 (89.3)	89.3	100.0
Total	112 (100.0)	100.0	100.0

genders; women experienced more contact injuries (51.78%), while men reported a higher proportion of non-contact injuries (60.36%). Furthermore, women were more likely to sustain injuries during practice sessions (53.57%), whereas men reported a greater occurrence of injuries during competitions (49.39%). Notably, most injuries in both genders occurred without the use of supportive equipment (65.57%), emphasizing the need for proper protective measures to prevent injuries.

The findings of this study align with some previous research while diverging from others, depending on the injury context. For instance, the high prevalence of injuries among female handball players is consistent with the findings of Lindblad et al., who reported that women are twice as likely to sustain injuries as men in handball due to hormonal, anatomical, and neuromuscular differences (14). These factors make women more susceptible to ligament injuries, particularly in the knee.

However, the present study's observation that men suffer more joint and muscle injuries is consistent with the findings of Giroto et al., who reported that male players frequently experience knee and ankle injuries due to the high physical demands of handball, such as sprinting and jumping (5). Additionally, the higher rate of non-contact injuries among men in this study may be attributed to their aggressive playstyle, which involves rapid changes in direction, increasing the risk of ligament tears and muscle strains.

Interestingly, the observation that women experience more contact injuries during practice sessions aligns partially with the study by Nielsen and Yde, which indicated that contact injuries are common in handball due to frequent collisions with opponents (15). The higher rate of injuries in practice sessions among women could be due to less strict officiating during training, leading to more physical confrontations.

However, some discrepancies exist when comparing previous research. For example, Monaco et al. emphasized that age and player position influence injury rates more significantly than gender. This difference might be attributed to variations in sample sizes, competition levels, and data collection methods across studies (11).

Another notable finding of this study is the lack of protective equipment use, a critical factor in injury prevention. Previous studies, such as those by Wedderkopp et al., have demonstrated that implementing injury prevention programs, including the use of protective gear, can significantly reduce injury incidence (16).

Seyedahmadi et al. highlighted that re-injury anxiety is prevalent among elite handball players, particularly in men and those with a history of previous injuries. This anxiety can slow down rehabilitation and delay the return to sport. While our study focused on physical injuries, their findings underscore the importance of addressing re-injury anxiety in rehabilitation programs to help athletes regain confidence and return to play more effectively (17).

The findings of this study have practical implications for designing injury prevention programs tailored to the specific needs of male and female handball players. Coaches and medical professionals can utilize these results to develop targeted training protocols, incorporating proprioceptive, strength, and balance exercises while promoting the consistent use of protective equipment to reduce injury risk.

However, one of the primary limitations of this research is the reliance on retrospective self-reported data, which may lead to recall bias and inaccuracies in reporting past injuries. Additionally, the study's cross-sectional design provides only a snapshot of injuries at a single point in time, which may not accurately reflect long-term trends or changes in injury patterns.

To address these limitations, future research should employ longitudinal designs and incorporate medical records and objective injury reports to gain more accurate insights into injury mechanisms and risk factors. Moreover, future studies should examine environmental factors such as playing surfaces, training intensity, and match conditions to identify specific risk factors and develop more comprehensive injury prevention strategies.

5.1. Conclusions

The findings of this study demonstrate a high prevalence of serious injuries among elite Iranian handball players, with distinct gender-specific patterns in injury frequency, type, and context. Men reported a greater history of repetitive injuries, while women experienced more contact-related injuries and were more likely to sustain injuries during practice sessions. The lack of protective equipment use during most injuries highlights the need for improved preventive measures to reduce injury risk among handball athletes.

Footnotes

Authors' Contribution: A. O. and N. B. designed the study and collected data. M. S. A. and F. K. developed the methodology, conducted statistical analysis, and drafted the manuscript. All authors reviewed, refined, and approved the final manuscript.

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Informed Consent: Informed consent was obtained from all participants prior to completing the questionnaire.

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