

## Prevalence and Determinants of Sport Injuries among the Egyptian National Handball Players

Ahmed Mahmoud El Adl<sup>1</sup>, Abdel Hamied Mohamed Abdel Hamied\*<sup>2</sup>,  
Bernadette Sarraf<sup>1</sup>, Mohamed Azmy Khafagy<sup>1</sup>

Departments of <sup>1</sup>Public Health and Community Medicine and <sup>2</sup>Industrial Medicine and Occupational Health,  
Faculty of Medicine, Mansoura University, Egypt

\*Corresponding author: Abd El-Hamied Mohamed Abd El-Hamied, Mobile: (+20) 01001257474,  
E-Mail: abdelhamied\_com@yahoo.com

### ABSTRACT

**Background:** Worldwide, handball is one of the most popular sports played by all ages. Handball injuries result from intrinsic risk factors (as age, gender and previous injuries) and extrinsic risk factors (as playing position, floor type and equipment).

**Objective:** Study the distribution and determinants of sport injuries among the Egyptian National handball players.

**Patients and methods:** A descriptive cross-sectional study with analytic component was carried out upon all the Egyptian National handball players during the period from October 2016 to November 2017. According to the Egyptian Handball Federation, the total number of these players was 234 players. All these players were included in the present study.

**Results:** The present study revealed that 83.3% of the national handball players had one or more sport injury in the last season, 81% of them were injured once and 40.2% of total injuries were overuse injuries. The most frequent injured sites were knee (47.5 %) followed by ankle (18.9 %). Higher injury prevalence was reported by the first team players (93.1%) and players above 20 years (90.7%). Females reported a higher injury prevalence compared to males (90.5% and 78.4% respectively, OR= 2.6). In addition, the highest prevalence rates were reported among backcourt players (OR= 4.5) and wingmen (OR= 3.7), players on artificial floor (OR= 4.3) and those didn't use protective equipment (OR=2.3).

**Conclusion:** Older age, females, backcourt position, artificial floor and lack of protective equipment were significant predictors of sport injuries among the national handball players.

**Keywords:** Sport injuries, Risk factors, Egyptian national handball players.

### INTRODUCTION

Although physical activity has numerous health benefits, such as reducing risks for chronic diseases and mortality<sup>(1)</sup>, contribution to sports in addition comprises a risk of injury<sup>(2)</sup>. Sports injuries are a main issue for athletes, coaches and sports clubs. These injuries affect negatively the health of the injured athlete and might be associated with disability or even terminate his sports career<sup>(3)</sup>. In addition, these injuries burden the healthcare system<sup>(3)</sup> as the management of such injuries is usually expensive and time-consuming<sup>(4)</sup>. As a result, the International Olympic Committee (IOC) has designed a research center for the prevention of injuries in various sports<sup>(5)</sup>.

Handball is a pivoting team sport in which players are mainly affected by injuries. Compared to the remaining sports, it could be found in the top five with regard to the number and gravity of injuries. Owing to its speed nature, and players' frequent and severe collisions with each other, handball is considered traumatic and may lead to musculoskeletal injuries, which might be associated with suspensions of elite players from sport fields and maintains a lot of money loss to the club and community<sup>(6)</sup>. Several researchers have examined the predisposing factors and the most frequent types of handball injuries<sup>(6)</sup>. Most injuries take happen throughout matches in comparison with training<sup>(7)</sup>, and more injuries happen throughout the offensive stage of the game in comparison with the defensive stage<sup>(8)</sup>. Lower limbs represent the majority of the acute injuries, then injuries of the upper limbs and lastly head

injuries. Knee injuries represent the greatest share of extensive injuries, and females are clearly more liable for knee injuries, with regard to ACL tears. Backcourt players appear to sustain more injuries in comparison with other player positions, then wing players. Overuse injuries are the result of a cumulative process of tissue damage instead of prompt energy transfer<sup>(9)</sup>.

Handball injuries result from extrinsic and intrinsic risk factors. Intrinsic factors involve age, sex, body composition, physical fitness, prior injuries and sports-specific skills as well as psychological parameters<sup>(4)</sup>. Extrinsic predisposing factors could be divided into factors associated with exposure, training, equipment and environment. Exposure time, position in team and level of competition are exposure factors. Training factors involve type, amount, rate and intensity of training<sup>(4)</sup>. Equipment factors comprise protective equipment (such as helmets, shin guards). Environmental factors comprise type of a playing surface and weather condition as well as season<sup>(4)</sup>. Therefore, understanding the epidemiology of these injuries is the initial stage in creating efficient injury prevention methods. Injury epidemiology is the study of the distribution and causes of handball injuries with the goal of putting into action countermeasures to stop their growth and spread<sup>(10)</sup>.

According to research by Andersson and colleagues<sup>(11)</sup>, practicing a set of exercises throughout the warm-up can cut the incidence of shoulder overuse injuries in handball by 28%. Zebis *et al.*<sup>(12)</sup> implemented neuromuscular training throughout a full

soccer and handball league season to experimentally assess the neuromuscular adaptation mechanisms provoked by that training during a standardized side cutting approach well-known to be accompanied by non-contact ACL injury.

A lot of researches have been carried out evaluating injuries at the top international level for males in the Olympic Games <sup>(2, 13)</sup>, world championships <sup>(6, 14)</sup>, African Clubs Championships <sup>(15)</sup>, and Asian Handball Championships <sup>(11)</sup>. However, reviewing the available literature, reveals lack of Egyptian studies of the epidemiology of sport injuries among Egyptian National handball players. Therefore, this research study was undertaken to cover this gap.

**Objectives:** The specific objectives of this study were: (1) Evaluate the prevalence and types of sport injuries among the studied players. (2) Determine the risk factors affecting these injuries among the studied players.

**SUBJECTS AND METHODS**

A descriptive cross-sectional study with analytic component, throughout the period from 1<sup>st</sup> of October 2016 to 1<sup>st</sup> of November 2017. All the Egyptian National handball players were comprised in the present study. According to the Egyptian Handball Federation, the total number of these players was 234 players. Table (1) showed their distribution according to gender and age.

**Table (1):** Total number of Egyptian National handball players in different National teams

Teams	Number of players		
	Male teams	Female teams	Total
Under 16 years	0	26	26
Under 18 years	39	36	75
Under 20 years	42	33	75
First Team	58	0	57
Total	139	95	234

**Study Tools:**

**(I) Structured Questionnaire:** A questionnaire was designed to collect the next data:

**1. Personal data** which include age, sex, marital status, smoking, education and socioeconomic level.

**2. Sport-related data:** Age to start competitive sports, field position, number of practices every week, frequency of contribution to games, the risk factors such as type of the ground, type of the shoes, using protective equipment, use and duration of stretching exercises.

**3. History of sport-related injuries including:** type, site, time (during training or competition), severity, cause.

For the aim of this study an injury was described as ‘One sustained during training or a game and which

prevented the injured player from participation in normal training or games for at least 48 hours, not including the day of injury’. The severity of injury used in this study was defined as minor (less than one week), moderate (1-3weeks), and severe (more than three weeks).

All reported injuries were confirmed by reviewing health records of the players and personal interviewing of the team’s physiotherapist.

**(II) Measurement of height and weight, and calculation of BMI.**

**Ethical consideration:** An approval of the study was obtained from Mansoura University Academic and Ethical Committee. Approval of the president of Egyptian Handball Federation was obtained. Approval of the managers of the National Egyptian Handball teams was obtained. Informed written consent was obtained from each participating player following assuring confidentiality. Confidentiality and privacy were respected.

**Statistical analysis**

Data were fed to the computer and analysed by utilizing IBM SPSS software package version 20.0. Qualitative data were defined by utilizing number and percent. Quantitative data were described using median (minimum and maximum) for non-parametric data and mean, standard deviation for parametric data after testing normality using Kolmogorov-Smirnov test. Significance of the obtained results was judged at the 5% level and all tests were 2 tailed. Chi-square test, Fischer exact test and Monte Carlo test were utilized for categorical variables, to compare between various groups as appropriate. Student-t test was utilized for parametric quantitative variables, for comparison among 2 groups. One Way ANOVA was utilized for parametric quantitative variables, for comparison between at least two groups with post Hoc LSD test. Kruskal Wallis test; for non-parametric quantitative variables, for comparison between at least two groups and Mann Whitney test was utilized for non-parametric quantitative variables, to compare between two studied groups. Binary stepwise logistic regression analysis was utilized for prediction of independent variables of injury. Significant predictors in the Univariate analysis were entered into regression model by utilizing forward Wald method. AOR and their 95%CI were measured.

**RESULTS**

Table (2) shows that, among the national handball players, 59.4% were males and 91.5% of them had BMI between 18 – 24.99 (Kg/m<sup>2</sup>). As regards the playing characteristics, 70.1% of the studied players trained 3-4 times per week and 55.6% of them spent more than 10 hours of training each week. In addition, 17.1% of the players reported using protective equipment and 96.2% of them play on artificial floor.

**Table (2):** Demographic and Playing characteristics of the national handball players

A. Demographic Characteristics	No.	%
Total	234	100.0
<b>Sex</b>		
Males	139	59.4
Females	95	40.6
<b>Age (in years)</b>		
Less than 16	26	11.1
Less than 18	75	32.1
Less than 20	75	32.1
First team	58	24.7
<b>BMI (Kg/m<sup>2</sup>)</b>		
Less than 18	0	0
18-24.99	214	91.5
25-29.99	17	7.3
30-35	3	1.3
B. Playing characteristics		
<b>Playing position</b>		
Goalkeeper	16	6.8
Pivot	22	9.4
Wingman	55	23.5
Backcourt	74	31.6
Center	67	28.6
<b>Training frequency / week</b>		
3-4 times	164	70.1
5-6 times	68	29.1
More than 6 times	2	0.9
<b>Training hours per week</b>		
4-7 hours	26	11.1
8-10 hours	78	33.3
More than 10 hours	130	55.6
<b>Using protective equipment:</b>		
Yes	40	17.1
No	194	82.9
<b>Floor type:</b>		
Artificial	225	96.2
Wooden	9	3.8

\*The mean age of the studied players was  $19.7 \pm 3.8$  years and the mean BMI (Kg/m<sup>2</sup>) was  $23.2 \pm 1.8$ . \*Median (range) playing duration among the studied players was 9.0 (4.0-20.0).

**Figure (1):** show that 83.3% of the national handball players had one or more sport injury in the last season.

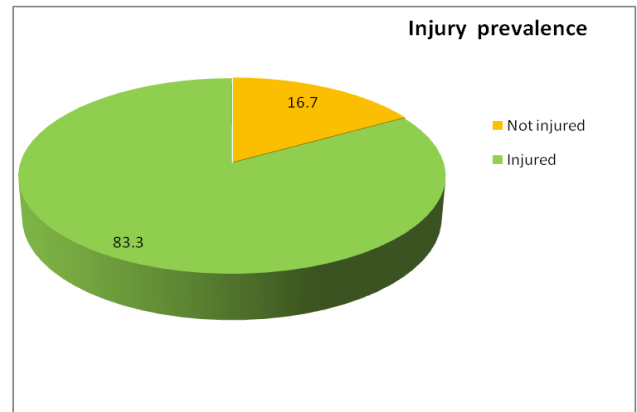


Table (3) showed that, among the 195 players who reported sport injury during the last season, 81% were injured once, 13.3% were injured twice and only 5.7% were injured 3 or more times. The total number of reported sport injuries was 244, with 38.5% of these injuries occurred during training, while 61.5% of injuries occurred during competition time (39.3% of them occurred in the 1<sup>st</sup> half and 60.7% in the 2<sup>nd</sup> half). Most of sport injuries were minor injuries (72.5%), while severe injuries represented only 5.7% of injuries.

**Table (3):** Characteristics of injuries among the injured national handball players during last season

Characteristics of injury	No	%
<b>Number of injuries per player (195 players reported injuries)</b>		
Once	158	81.0
Twice	26	13.3
Three times or more	11	5.7
<b>Total number of injuries:</b>	<b>244</b>	<b>100.0</b>
<b>Injury time</b>		
During competition	150	61.5
During training	94	38.5
<b>Time of injury during competition: (Total = 150 players)</b>		
First half	59	39.3
Second half	91	60.7
<b>Injury Severity (absence period)</b>		
Minor (0-4 weeks)	177	72.5
Moderate (4-7 weeks)	53	21.8
Severe (7-10 weeks)	14	5.7

Table (4) showed that 40.2% of the reported sport injuries were overuse injuries, 38.1% were acute injuries, and 21.7% were recurrent injuries. Contact injuries were more common than non-contact injuries (62.7 % and 37.3 %, respectively). The most frequent injured sites were knee (47.5 %) followed by ankle (18.9 %) and shoulder (13.5%), while head and neck injuries were the least reported sites (0.8%). Ligament lesions (tear, strain or rupture) were the most common type of sport injuries (77.1%), while skin injury was the least (0.4%).

**Table (4):** Types and sites of sport injuries among the injured national handball players during last season

Types and sites of injury	No	%
<b>Total</b>	<b>244</b>	<b>100.0</b>
<b>Injury types</b>		
Acute	93	38.1
Overuse	98	40.2
Recurrent	53	21.7
<b>Contact versus non-contact:</b>		
Non-Contact	91	37.3
Contact	153	62.7
<b>Site of injury</b>		
Knee	116	47.5
Ankle	46	18.9
Shoulder	33	13.5
Elbow	13	5.3
Hand wrist	23	9.4
Thumb	7	2.9
Head and neck	2	0.8
Trunk	4	1.7
<b>Diagnosis of injuries reported by the studied players:</b>		
Muscle lesion (strain/ tear/rupture)	17	6.9
Tendon (rupture)	10	4.1
Ligament lesion (strain/ tear/rupture)	188	77.1
Ankle Sprain	3	1.3
Dislocation	4	1.6
Fracture	2	0.8
Bruise	19	7.8
Skin injury	1	0.4

Table (5) showed that national handball players aged less than 16 years reported the lowest injury prevalence (50%). Higher injury prevalence was reported by the first team players (93.1%) and players aged less than 20 years (90.7%).

Compared to players aged less than 16 years, odds ratios were 4.0, 9.7 and 13.5 for players aged less than 18 years, players aged less than 20 years and first team players respectively.

In addition, females reported a higher injury prevalence compared to males (90.5% and 78.4% respectively, OR= 2.6).

Previous injuries showed statistically significant relation with reported sport injuries as 89.5% of cases had positive history of previous injury (OR = 3.8). Regarding extrinsic risk factors, the reported injury prevalence was significantly related to the training hours per week, the playing duration, the player position, the type of the floor and the use of protective equipment.

The highest prevalence rates of sport injuries were recorded by players with less training hours (4-7 hours weekly) in comparison with players trained more than 10 hours per week (OR=10.8).

The playing duration was higher (9 years) among the injured handball players than the non-injured players. Also, the highest prevalence rates were reported among backcourt players (OR= 4.5) and wingmen (OR= 3.7) compared to goalkeepers, players on artificial floor compared to wooden floor (OR= 4.3) and players neglect usage of protective equipment (OR=2.3)

**Table (5):** Intrinsic and Extrinsic risk factors among injured and non-injured national handball players

Risk factors	Total (234)	Injured players (195) N (%)	Non-injured players (39) N (%)	Test of significance		Odds ratio (95%CI)
				$\chi^2$	P	
<b>A. Intrinsic risk factors</b>						
<b>Age/years</b>						
Less than 16	26	13(50.0)	13(50.0)	28.3	< 0.001*	1 (Reference)
Less than 18	75	60(80.0)	15(20.0)			4.0(1.54-10.39)
Less than 20	75	68(90.7)	7(9.3)			9.7(3.25-29.0)
First Team	58	54(93.1)	4(6.9)			13.5(3.78-48.3)
<b>Sex</b>				5.9	0.015*	1 (Reference) 2.6 (1.2-5.8)
Males	139	109(78.4)	30(21.6)			
Females	95	86(90.5)	9(9.5)			
<b>BMI (Kg/m2)</b>				MC	0.73	1 (Reference) 0.9 (0.3-3.3) 0.4(0.03-4.4)
18-24.99	214	179(83.6)	35(16.4)			
25-29.99	17	14(82.4)	3(17.6)			
30-35	3	2(66.7)	1(33.3)			
<b>Previous injury in previous seasons</b>				14.4	<0.001*	1 (Reference) 3.8(1.9-7.6)
Absent	72	50(69.4)	22(30.6)			
Present	162	145(89.5)	17(10.5)			
<b>B. Extrinsic risk factors</b>						
<b>Training hours/Week</b>				27.5	<0.001*	10.8 (4.0-29.0) 4.2 (1.6-10.9) 1 (Reference)
4-7 hours	130	119(91.5)	11(8.5)			
8-10 hours	78	63 (80.8)	15 (19.2)			
More than 10 hours	26	13(50)	13(50)			
<b>Median (Min-Max) playing duration (years):</b>	234	9.0 (4.0-20.0)	8.0 (4.0-20.0)	Z=4.2	<0.001*	NA
<b>Players' position</b>				11.5	0.02*	1 (Reference) 2.0(0.5-9.2) 3.7(0.9-14.4) 4.5(1.2-16.9) 1.3(0.4-4.1)
Goalkeeper	16	11(68.8)	5(31.2)			
Pivot	22	18(81.8)	4(18.2)			
Wingman	55	49(89.1)	6(10.9)			
Backcourt	77	70(90.9)	7(9.1)			
Center	64	47(73.4)	17(26.6)			
<b>Floor type</b>				5.2	0.02*	4.3(1.1-16.9) 1 (Reference)
Artificial	225	190(84.4)	35(15.6)			
Wooden	9	5(55.6)	4(44.4)			
<b>Using protective equipment**:</b>				44.6	<0.001*	1 (Reference) 2.3 (1.2-4.4)
Yes	40	19 (47.5)	21(52.5)			
No	194	176 (90.7)	18 (9.3)			

MC: Monte Carlo test FET: Fischer exact test \*statistically significant (p<0.05) CI: Confidence interval Z: Mann Whitney U test NA: Not applicable \*\*Protective equipment (e.g., helmet, knee pads, shin guards, ankle braces)

## DISCUSSION

An injury occurs when injury exceeds the tissue's capability for absorbing the stress acutely or chronically (16). Sports injuries are all forms of injury developing throughout sporting activities and include injuries which result in loss of time from training or competition (17). According to the Egyptian Handball Federation, the total number of the Egyptian National handball players was 234 players. All these players were comprised in

the current research. Their mean age was 19.7 ± 3.8 years, 59.4% of them were males and 91.5% of them had BMI between 18 and 24.99 kg/m<sup>2</sup>. As regards the playing characteristics, 70.1% of the studied players trained 3-4 times per week and 55.6% of them spent more than 10 hours of training each week. In addition, 17.1% of the players reported using protective equipment and 96.2% of them play on artificial floor.

In the current study, 83.3% of the national handball players recorded sufferings from injury during the last season with the majority of them (81%) were injured once. Similar results are reported by a study conducted among elite adolescent athletes of different sports including handball in Sweden, and the reported 1-year injury rate was 91.6%<sup>(18)</sup>. During the two weeks period of the 24<sup>th</sup> Men's Handball World Championship in 2015, 27.1% of the players were injured<sup>(14)</sup>.

The current study revealed that the total number of reported sport injuries was 244, with 38.5% of these injuries occurred during training, while 61.5% of injuries occurred during competition time. This is most probably because athletes are more liable for aggressive behaviors throughout competition, which might be associated with a higher possibility for injury.

In the same line, **Seil et al.**<sup>(7)</sup> have reported that, among European handball players, the injury incidence during competition was twenty four times more than during training sessions. Similarly, **Wedderkopp et al.**<sup>(8)</sup> estimated sport injuries to be 11.2-14.3/1000 hours in matches and 0.6-2.4/1000 hours in training. **Langevoort et al.**<sup>(6)</sup> stated that this is accentuated in the highest-level competitions such as Olympic tournament and European and World Championship.

The current study revealed that 60.7% of handball players were injured during the 2<sup>nd</sup> half of the match while 39.3% were injured during the 1<sup>st</sup> half. This is in agreement with other study that reported greater injury incidence during the 2<sup>nd</sup> half<sup>(15)</sup>. This may be related to increasing both the player's fatigue and the intensity of the playing before the end of the match. On the contrary, **Bere et al.**<sup>(14)</sup> analyzed data from 2015 men's world championship and reported that more injuries were during the 1<sup>st</sup> half of the matches in comparison with the 2<sup>nd</sup> half (126.7 vs. 63.4 injuries/1000 player-hours correspondingly).

In the current study, the commonest types of injuries were overuse, acute and recurrent injuries (40.2%, 38.1% and 21.7% respectively). Overuse injuries were owing to a cumulative process of tissue damage instead of direct energy transfer<sup>(9)</sup>. This is in accordance with **Tyrdal and Bahr**<sup>(19)</sup> who stated that 41 % of 729 male and female goalkeepers reported current elbow injuries termed "handball goalie's elbow" resulting from repeated elbow hyperextension traumas. On the contrary, **Rafnsson et al.**<sup>(20)</sup> have recorded that, 62% of sport injuries among Icelandic elite male handball players were acute.

In the current study, contact injuries reported by the national handball players were more common than non-contact injuries (62.7 % and 37.3 %, respectively). Similarly, **Bere et al.**<sup>(14)</sup> recorded that 61.4% of injuries occurred as the result of contact between players during the 2015 men's world championships. On the contrary, **Giroto et al.**<sup>(21)</sup> recorded 41.4% non-contact injuries among Brazilian elite-level players while 34.6% were contact injuries. The high proportion of the contact injuries in the present study can be attributed to the

unlimited number of fouls allowed, which, within the game's rules, are considered good defense and aims to disturb the attacking team's rhythm. Aggressive contact has been considered as an essential component of the game, occasionally utilized to prevent the opponent as well as to intimidate opponents from approaching the goal (**International Handball Federation, 2010**)<sup>(22)</sup>.

The current study revealed that the main injury sites for handball players in Egyptian national teams were located in the lower extremities; knee (47.5%) and ankle (18.9 %). The higher proportion of knee injuries among the players can be attributed to the high friction with artificial floor. Similarly, **Laver et al.**<sup>(23)</sup> stated that knee injuries (traumatic and overuse) are frequent in handball, and represent the highest proportion of severe injuries. In contrary, **Achenbach et al.**<sup>(24)</sup> recorded that knee injuries were the 2<sup>nd</sup> most frequent injuries in handball players team after the ankle.

In the current study, shoulder injuries represented 13.5% of whole injuries. This is in agreement with other studies reported that, shoulder injuries represent between 4% and 27% of all handball injuries<sup>(6, 14, 20, 25)</sup>. In contrary, in a study included 179 Norwegian female elite handball players (all the 12 teams of the elite league), 57% of them recorded prior or current shoulder pain<sup>(26)</sup>. The current study revealed that ligament lesions (tear, strain or rupture) were the commonest type of sport injuries (77.1%). Similarly, **Giroto et al.**<sup>(21)</sup> on their study among Brazilian elite handball players detected 8 critical ligament injuries in the knee (such as ACL injury) which required surgery.

The current study reported higher injury prevalence among the first team players (93.1%) and players aged less than 20 years (90.7%). This is in agreement with a study conducted by **Pasanen**<sup>(27)</sup> who reported increased risk of sport injuries among adult athletes compared to adolescents. However, **Chéron et al.**<sup>(28)</sup> on his study in Denmark to evaluate the effect of sports contribution to children aged 6–13 years, recorded that handball was most strongly associated with overuse injuries of the lower limbs in such age group.

In the current study, the high prevalence of sport injuries among the 1<sup>st</sup> team players and those under 20 years of age may be explained by an increase frequency and intensity of playing within training and competitions compared to under 16 and under 18 age groups. The current study revealed that females recorded a higher injury prevalence in comparison with males (90.5% and 78.4% respectively, OR= 2.6). Similarly, **Giroto et al.**<sup>(21)</sup> conducted a study on Brazilian elite handball players and found that female athletes were accompanied by a higher risk of traumatic injury. Moreover, **Aman et al.**<sup>(29)</sup> conducted a study on Sweden athletes in the seven sport federations including handball and found that females had greater risk of sport injuries. In contrary, **Moeller et al.**<sup>(30)</sup> reported that, among elite handball players in Denmark, the under 18

male players had an overall 1.76 times higher risk of sport injury compared to females. However, **Junge et al.** <sup>(2)</sup> have assessed sports injuries throughout the summer Olympic Games 2008 and demonstrated no change in injury incidences among men and women.

The current study showed that previous injuries had statistically significant relation with reported sport injuries as 89.5% of cases had positive history of previous injury (OR = 3.8). Similarly, **Giroto et al.** <sup>(21)</sup> found that, among Brazilian elite handball players, previous injury was accompanied by a greater risk of overuse injury. However, **Fousekis et al.** <sup>(31)</sup> indicated that prior thigh muscle injury was protective instead of predisposing to novel injuries. If preceding injuries treated by adequate rehabilitation programs, they may not necessarily cause repetition of injuries.

The present study demonstrated that, the highest prevalence rates of sport injuries were reported by the players with less training time (4-7 hours weekly) in comparison with players trained more than 10 hours weekly (OR=10.8). However, **Giroto et al.** <sup>(21)</sup> stated that one additional hour of handball training per week raised the possibility of novel traumatic injuries by 9% in Brazilian elite handball athletes throughout a season. This may be explained by the overload of musculoskeletal structures without preparation of the body to handle the higher training volume implemented.

The current study revealed that the reported injury prevalence was significantly related to the playing duration of the national team players. It was higher (9 years) among the injured than the non-injured players. In the same line **Jost et al.** <sup>(32)</sup> found structural lesions in the throwing shoulder in 90% of players with nine years mean duration of competition at the elite level. However, **Chomiak et al.** <sup>(33)</sup> in their studies on different types of sport injuries and its relation to skill level, found that athletes in low skill level groups are at a higher possibility for injury suffering.

As regards the players' position, the present study showed that backcourt players and wingmen were the most injured (90.9% and 89.1% respectively, OR= 4.5 and 3.7 respectively). Similarly, **Laver and Myklebust**<sup>(34)</sup> recorded a greater risk of sport injuries for back and wing players. The possible explanation of the increase in the possibility of sport injuries among backcourt players and wingmen in the present study is that most of offense movements is carried out by back players who perform a considerable amount of planting and cutting movements and jump shots. Additionally, they are included in more aggressive contact in comparison with players at other positions, normally facing the biggest and strongest defenders in the opposing team. However, **Bere et al.** <sup>(14)</sup> noticed in the 2015 men's World Championship that the greatest total risk of injury was for line players, then wings, backs and goalkeepers.

The present study demonstrated that the highest prevalence rates of injuries were reported by players on artificial floor compared to wooden floor (OR= 4.3).

Similarly, **Olsen et al.** <sup>(25)</sup> have recorded that in handball, the risk of ACL injury was 2.4 times greater when playing on artificial floors in comparison with wooden floors. This may be attributed to the high friction caused by the artificial floors. The present study revealed that lack of protective equipment was a significant risk factor associated with higher frequency of sport injuries (OR= 2.3). This comes in the same line with **Surve et al.** <sup>(35)</sup> who have recorded that the usage of ankle braces decreases the possibility of ankle sprain development.

## CONCLUSION

- Most of the national handball players reported suffering from sport injury during the last season (83.3%) with the majority of them (81%) were injured once.
- The total number of reported sport injuries was 244, with 61.5% of injuries occurred during competition time and 60.7% of handball players were injured during the 2<sup>nd</sup> half of the match.
- The most common types of injuries were overuse injuries (40.2%), followed by acute injuries (38.1%) and recurrent injuries (21.7%).
- Contact injuries were more common in comparison with non-contact injuries (62.7 % and 37.3 %, correspondingly).
- The main injury sites were located in the lower extremities; knee (47.5%) and ankle (18.9 %).
- Older age, female sex, presence of previous injury, backcourt position, artificial floor and lack of protective equipment were significant predictors of sport injuries among the national handball players.

## REFERENCES

1. **Garber C, Blissmer B, Deschenes M et al. (2011):** American college of sports medicine position stand. Quantity and quality of exercise for developing and maintaining cardio-respiratory, musculo-skeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc.*, 43: 1334-59.
2. **Junge A, Engebretsen L, Mountjoy M et al. (2009):** Sports injuries during the Summer Olympic Games 2008. *Am J Sports Med.*, 37: 2165-2172.
3. **Darrow C, Collins C, Yard E et al. (2009):** Epidemiology of severe injuries among United States high school athletes. *Am J Sports Med.*, 37: 1798-805.
4. **Parkkari J, Kujala U, Kannus P (2001):** Is it possible to prevent sports injuries? Review of controlled clinical trials and recommendations for future work. *Sports Med.*, 31: 985-995.
5. **Steffen K, Soligard T, Engebretsen L (2011):** The IOC's endeavor to protect the health of the athlete continues. *Br J Sports Med.*, 45: 551-552.
6. **Langevoort G, Myklebust G, Dvorak J et al. (2007):** Handball injuries during major international tournaments. *Scand J Med Sci Sports*, 17: 400-407.
7. **Seil R, Rupp S, Tempelhof S et al. (1998):** Sports injuries in team handball. A one-year prospective study of sixteen men's senior teams of a superior non-professional level. *Am J Sports Med.*, 26: 681-687.
8. **Wedderkopp N, Kalfot M, Holm R et al. (2003):** Comparison of two intervention programmes in young

- female players in European handball—with and without ankle disc. *Scand J Med Sci Sports*, 13: 371–375.
9. **Roos K, Marshall S (2014):** Definition and usage of the term “overuse injury” in the US high school and collegiate sport epidemiology literature: a systematic review. *Sports Med.*, 44 (3): 405-21.
10. **Sadeghi-Bazargani H (2012):** Injury epidemiology and publishing injury research. *J Inj Violence Res.*, 4 (1): 1-5.
11. **Andersson S, Bahr R, Clarsen B et al. (2016):** Preventing overuse shoulder injuries among throwing athletes: a cluster-randomized controlled trial in 660 elite handball players. *Br J Sports Med.*, 51 (14): 1073-80.
12. **Zebis M, Andersen L, Brandt M et al. (2016):** Effects of evidence-based prevention training on neuromuscular and biomechanical risk factors for ACL injury in adolescent female athletes: a randomized controlled trial. *Br J Sports Med.*, 50 (9): 552-7.
13. **Seil R, Laver L, Landreau P et al. (2018):** ESSKA helps making a change: the example of handball medicine. *Knee Surg Sports Traumatol Arthrosc.*, 26 (7): 1881-1883.
14. **Bere T, Alonso J, Wangenstein A et al. (2015):** Injury and illness surveillance during the 24th Men's Handball World Championship 2015 in Qatar. *Br J Sports Med.*, 49 (17): 1151-6.
15. **Asembo J, Wekesa M (1998):** Injury pattern during team handball competition in east Africa. *East Afr Med J.*, 75: 113-116.
16. **McBain K, Shrier I, Shultz R et al. (2012):** Prevention of sports injury I: a systematic review of applied biomechanics and physiology outcomes research. *Br J Sports Med.*, 46: 169–73.
17. **Brooks J, Fuller C (2006):** The influence of methodological issues on the results and conclusions from epidemiological studies of sports injuries: illustrative examples. *Sports Medicine*, 36: 459-72.
18. **von Rosen P, Heijne A, Frohm A et al. (2018):** High Injury Burden in Elite Adolescent Athletes: A 52-Week Prospective Study. *J Athl Train.*, 53 (3): 262-270.
19. **Tyrdal S, Bahr R (1996):** High prevalence of elbow problems among goalkeepers in European team handball – ‘handball goalie’s elbow’. *Scand J Med Sci Sports*, 6: 297-302.
20. **Rafnsson E, Valdimarsson Ö, Sveinsson T et al. (2017):** Injury pattern in Icelandic Elite Male Handball players. *Clin J Sport Med.*, 29 (3): 232-237.
21. **Giroto N, Hespanhol Junior L, Gomes M et al. (2017):** Incidence and risk factors of injuries in Brazilian elite handball players: a prospective cohort study. *Scand J Med Sci Sports*, 27 (2): 195-202.
22. **International Handball Federation (2010):** History of the International Handball Federation. <https://www.ihf.info/>
23. **Laver L, Landreau P, Seil R et al. (2018):** Handball Sports Medicine: Basic science, injury management and return to sport. Springer. Pp: 1-24. <https://link.springer.com/content/pdf/bfm:978-3-662-55892-8/1.pdf>
24. **Achenbach L, Krutsch V, Weber J et al. (2018):** Neuromuscular exercises prevent severe knee injury in adolescent team handball players. *Knee Surgery, Sports Traumatology, Arthroscopy*, 26 (7): 1901-1908.
25. **Olsen O, Myklebust G, Engebretsen L et al. (2003):** Relationship between floor type and risk of ACL injury in team handball. *Scand J Med Sci Sports*, 13 (5): 299-304.
26. **Myklebust G, Hasslan L, Bahr R et al. (2013):** High prevalence of shoulder pain among elite Norwegian female handball players. *Scandinavian Journal of Medicine & Science in Sports*, 23 (3): 288-294.
27. **Pasanen K (2009):** Football injuries. Epidemiology and injury prevention by neuromuscular training. University of Tampere. *Acta Universitatis Tamperensis*, 9: 1448- 50.
28. **Chéron C, Leboeuf-Yde C, Le Scanff C et al. (2017):** Leisure-time sport and overuse injuries of extremities in children age 6-13, a 2.5 years prospective cohort study: the CHAMPS-study DK. *BMJ Open*, 7 (1): e012606. doi: 10.1136/bmjopen-2016-012606.
29. **Aman M, Forssblad M, Larsén K (2018).** Incidence and body location of reported acute sport injuries in seven sports using a national insurance database. *Scandinavian Journal of Medicine & Science in Sports*, 28 (3): 1147-1158.
30. **Moeller M, Attermann J, Myklebust G et al. (2012):** Injury risk in Danish youth and senior elite handball using a new SMS text messages approach. *Br J Sports Med.*, 46 (7): 531-537.
31. **Fousekis K, Tsepis E, Poulmedis P et al. (2011):** Intrinsic risk factors of non-contact quadriceps and hamstring strains in soccer: a prospective study of 100 professional players. *Br J Sports Med.*, 45: 709-14.
32. **Jost B, Zumstein M, Pfirrmann C et al. (2005):** MRI findings in throwing shoulders: abnormalities in professional handball players. *Clin Orthop Relat Res.*, 434: 130-7.
33. **Chomiak J, Junge A, Peterson L et al. (2016):** Severe injuries in football players. [https://doi.org/10.1177/28.suppl\\_5.s-58](https://doi.org/10.1177/28.suppl_5.s-58)
34. **Laver L, Myklebust G (2014):** Epidemiology and injury characterization. In: Doral M, Karlsson J, editors. *Sports injuries: prevention, diagnosis, treatment and rehabilitation*. Berlin: Springer, Pp. 1–27. <https://www.amazon.com/Sports-Injuries-Prevention-Diagnosis-Rehabilitation/dp/364236568X>
35. **Surve I, Schwellnus M, Noakes T et al. (1994):** A fivefold reduction in the incidence of recurrent ankle sprains in soccer players using the Sport-Stirrup orthosis. *Am J Sports Med.*, 22 (5): 601-6.