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ORIGINAL RESEARCH

Sports injuries in male goalball athletes: frequency, types, affected body parts, and return to sport in competition and training

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Abstract

Visually impaired individuals have higher risk of injuries particularly in sports like goalball. It is specifically designed for the visually impaired people. It is imperative to prevent injuries prior to their occurrence for avoiding negative effects on sporting success, financial losses, and motivation. This study was aimed to determine the frequency and injury types of male goalball athletes in competition and training, as well as regarding the affected body parts, treatment, and time for return to sports. A total of 163 visually impaired male athletes having participated in the Turkish Goalball National competitions were analysed. This cross-sectional descriptive study was the first to present injuries in Turkish male goalball athletes. It collected demographic information, details regarding frequency, type, and injury sites, post-injury treatment, and time for return to sports, in both competition and training. The study found that 50.31% participants sustained injuries in competition, while 44.79% in training. Wrist and hand were the most frequent injured areas with sprains being the dominant injury. Over 50% athletes did not receive treatment. The majority returned to sport in less than a week. A substantial number of male goalball athletes experienced sport injuries in competition or training. However, the rate of medical support after injuries was low. The injury risks did not only stem from visual impairment, but such factors also brought vulnerability toward injuries in male goalball athletes. It was thus vital to prevent injuries in visually impaired individuals and increase sporting success in goalball. Preventive strategies could be developed for injuries in goalball athletes via collaboration with multidisciplinary team.

Keywords

Male goalball athletes; Goalball; Sport injury

1. Introduction

Goalball is a Paralympic sport for visually impaired individuals. Two teams having three players each compete using a cymbal ball. The match lasts for 24 min. Objective is to throw the ball with hand and shoot accurately into the opponent team's goal [1].

Goalball provides physiological, social, and psychological support to visually impaired individuals. However, they are vulnerable to sports injuries like acute trauma and overuse injuries [2]. Preventing sports injuries is vital for the athletes as they cause time loss, decreased competition, and increased medical costs [3]. It is thus crucial to take measures for preventing injuries. Sports clubs and health professionals can develop and implement prevention strategies to identify possible injuries in goalball athletes [4, 5]. Research lacks on the incidence of sports injuries and the factors linked with injuries in goalball athletes despite growing interest and participation in Paralympic sports [2, 6–8]. Willick *et al*. [8] reported that the incidence of injuries in goalball was high at London 2012 Paralympic Games. Study by Gajardo *et al*. [2] included 39 goalball athletes with 12 female and 27 male who participated in national competitions of Southern Chile. Incidence of sports injuries before the competition was 64.1%. Study by Zwierzchowska *et al*. [9] included 43 goalball athletes with 24 female and 19 male who participated in Goalball European Championship. The most common injuries were in upper extremity and athletes had frequent skin laceration, contusion, and dislocation injuries. It was observed that the number of participants in existing studies were limited. Injuries were not examined according to their occurrence in competitions and training, and their types had no details. This study was aimed to determine frequency, type, and location of injuries in male goalball athletes during training and competition, as well as the duration of recovery, treatment received, and time for return to sports. Current research lacked on the sports injuries in Turkish male goalball athletes. This study had large sample size of male goalball athletes with detailed information of sports injuries. The study findings highlighted preventive measures for health professionals and club managers to avoid sports injuries in goalball athletes prior to their occurrence.

2. Materials and methods

2.1 Procedures and participants

This was a cross-sectional and descriptive study. The sample pool had 250 male goalball players from 1st, 2nd, 3rd and 4th league teams. All participants had practiced goalball for minimum one year and competed in national competitions of Turkey. The study required 152 participants with 95% confidence interval and 5% error margin. Thus, 163 male goalball athletes were included using convenience sampling method as the non-probability technique, wherein 58 participants (35.58%) had B1 visual impairment level, 62 had B2 (38.04%), and 43 (26.38%) had B3. The classification was as follows: B1: unable to recognize single tumbling E 100M at 25 cm, visual acuity less than Logarithmic Value of Minimum Resolution Angle (LogMAR) 2.6; B2: unable to recognize single tumbling E 25M at 1 m, visual acuity ranged as LogMAR 1.5–2.6; and B3: unable to recognize LogMAR 0.9 on chart = 32M LogMAR chart at 4 m, visual acuity ranged as LogMAR 1–1.4 [10].

The inclusion criteria were as follows: participants had practiced goalball for minimum one year, participated in goalball competitions, visually impaired, and no musculoskeletal disorders. The exclusion criteria were as follows: noncompliance with inclusion criteria, incomplete filling of study data and study completion. Data collection tools included the Participant Demographic Form and Sports Injury Identification Form. Researchers used forms for the participants individually. Participants were informed about sports injuries before asking questions. Researchers read questions to visually impaired participants and marked answers.

2.2 Data collection

Participant Demographic Form had information of age, visual impairment level, chronic disease status, education, active participation years in goalball, and national athlete status and duration.

Sports Injury Identification Form gathered information of the number and type of sports injuries in training and competition, affected body parts, treatment type, and duration of return to sports after treatment. Athletes selected multiple options for the type and site of injury. This questionnaire was developed by considering the questions used in studies about identifying sports injuries [9, 11–13].

2.3 Statistical analysis

The data were analysed using Statistical Package for the Social Sciences (version/statistics) 25.0 software (SPSS, Inc., Chicago, IL, USA). Analysis included the frequency distributions of nominal and categorical data such as disability level, goalball branch year, and injury data. Descriptive statistics examined the basic tendencies (mean) and distribution (standard deviation) data regarding age, age of starting sports, *etc*.

Pearson Chi Square Analysis determined the frequencies of sports injuries in competition and training, and athletes receiving post-injury treatment according to branch year. The statistical significance was set as $p > 0.05$. The degree of significant relationships was determined by Cramer's V statistic [14].

3. Results

A total of 163 male goalball athletes were the study participants with mean age of 27.21 ± 8.72 years. Mean age of beginning the sports was 15.84 ± 6.69 years. Table 1 provides the demographic information of participants. The study asked participants if they experienced sports injury in goalball competitions, where 82 (50.31%) male goalball players answered "yes", and 73 (44.79%) reported sports injury in goalball training (Table 1).

TABLE 1. Demographic information of the participants.

Variables	n	%
Visual impairment level		
B1	58	35.6
B2	62	38.0
B3	43	26.4
Chronic disease		
Yes	15	9.2
No	148	90.8
Education		
Primary education	9	5.5
High school	63	38.7
University	91	55.8
Goalball branch years		
1–4 years	91	55.8
5 years and above	72	44.2
National athlete		
Yes	27	16.6
No	136	83.4
National athlete duration		
1–4 years	12	7.4
5 years and above	16	9.8
Not a national athlete	135	82.8
Injury in goalball competition		
Yes	82	50.3
No	81	49.7
Injury in goalball training		
Yes	73	44.8
No	90	55.2

Note. n = 163.

The study analysed and reported number of injuries, post-injury treatment status, return to sport, injury type, and injury site distribution with sports injuries in competition (82 (50.31%)) and training (73 (44.79%)). Table 2 provides the frequency of injuries in training and competition, distribution of post-injury treatment, and the duration of return to sport.

TABLE 2. The data regarding frequency of sports injuries, post-injury treatment, and return to sports.

Variables	In competition		In training	
	n	%	n	%
Number of sports injuries				
1 time	23	28.1	29	39.7
2 times	21	25.6	16	21.9
3 times	16	19.5	13	17.8
4 times	3	3.7	2	2.7
5 and above	19	23.2	13	17.8
Total	82	100.0	73	100.0
Treatment type after sports injury				
Physical therapy and rehabilitation	8	9.8	6	8.2
Physical therapy, rehabilitation, and drug	25	30.5	14	19.2
Surgery, physical therapy, and rehabilitation	2	2.4	2	2.7
No treatment taken	47	57.3	51	69.9
Total	82	100.0	73	100.0
Return to sports after injury				
Less than 1 week	36	43.9	38	52.1
1–3 weeks	22	26.8	22	30.1
4–6 weeks	8	9.8	9	12.3
Over 6 weeks	16	19.5	4	5.5
Total	82	100.0	73	100.0

Note. n = 163 (n = 82, injured in competitions; n = 73, injured in training). Only the response frequencies of questions answered by male goalball athletes with sports injuries.

TABLE 3. The distribution of sports injury types in goalball athletes during competition and training.

Type of sports injury	In competition		In training	
	n	%	n	%
Contusion	11	11.0	32	26.4
Sprain	40	40.0	46	38.0
Fracture	5	5.0	2	1.7
Dislocation	2	2.0	2	1.7
Rupture	2	2.0	1	0.8
Strain	20	20.0	28	23.1
Tears	12	12.0	4	3.3
Tendinitis	8	8.0	6	5.0
Total	100	100.0	121	100.0

Note. n = 163. Participants had the right to choose more than one option for asked questions. (n = 100 for injury type in competition, n = 121 for injury type in training).

TABLE 4. The distribution of sports injury sites among participants of goalball competitions and training.

Injured sports area	In competition		In training	
	n	%	n	%
Head and neck	13	6.1	9	5.1
Shoulder	26	12.2	20	11.2
Elbow	24	11.3	24	13.5
Arm and forearm	19	8.9	12	6.7
Wrist and hand	35	16.4	35	19.7
Hip	17	8.0	13	7.3
Thigh	3	1.4	3	1.7
Knee	24	11.3	15	8.4
Calf	21	9.9	18	10.1
Foot and ankle	26	12.2	22	12.4
Upper back	1	0.5	2	1.1
Low back	4	1.9	5	2.8
Total	213	100.0	178	100.0

Note. n = 163. Participants had the right to choose more than one option for asked questions. (n = 213 for body parts injured in competition, n = 178 for body parts injured in training).

Table 3 provides distribution of sports injuries sustained by male goalball players in training and competition. Athletes did not have contusion injuries in competition however experienced number of sprain injuries. Sprain injuries were the most common while rupture injuries were the least in training (Table 3).

Table 4 provides the distribution of sports injuries in male goalball players during competition and training. Hand and wrist were the most injured, while upper back was the least.

Table 5 revealed highly significant relationship between the branch years and injury frequencies of goalball athletes (in competition: $\chi^2 = 27.587$, $p < 0.001$, Cramer's $V = 0.411$; in training: $\chi^2 = 16.799$, $p = 0.005$, Cramer's $V = 0.321$). There were differences in injury frequencies according to branch year ($p < 0.05$). Athletes with more branch years had more injuries.

Table 6 depicted moderate relationship between the branch years and post-injury treatment received by goalball athletes (in competition: $\chi^2 = 13.808$, $p < 0.001$, Cramer's $V = 0.291$; in training: $\chi^2 = 9.573$, $p = 0.002$, Cramer's $V = 0.242$). There were differences between the post-injury treatment of goalball athletes according to branch years ($p < 0.05$). Athletes with higher branch years received higher post-injury treatments compared to those with lower branch years.

TABLE 5. Distribution of injury frequencies according to branch years.

Branch years		Injury frequencies						Total	χ^2	p	Cramer's V
		1 time	2 times	3 times	4 times	5 and above	No injury				
In competition											
1–4 years	n	13	11	8	1	1	57	91			
	%	14.3	12.1	8.8	1.1	1.1	62.6	100.0			
5 years and above	n	10	10	8	2	18	24	72	27.587	<0.001	0.411
	%	13.9	13.9	11.1	2.8	25.0	33.3	100.0			
Total	n	23	21	16	3	19	81	163			
	%	14.1	12.9	9.8	1.8	11.7	49.7	100.0			
In training											
1–4 years	n	17	6	5	1	2	60	91			
	%	18.7	6.6	5.5	1.1	2.2	65.9	100.0			
5 years and above	n	12	10	8	1	11	30	72	16.799	0.005*	0.321
	%	16.7	13.9	11.1	1.4	15.3	41.7	100.0			
Total	n	29	16	13	2	13	90	163			
	%	17.8	9.8	8.0	1.2	8.0	55.2	100.0			

Note. χ^2 *= Pearson Chi-square value. p value found by Pearson Chi Square Test. *p* < 0.05. *Degrees of freedom (df) = 5; Cramer's V value above 0.22 according to df, showing large effect level.*

TABLE 6. Distribution of receiving treatments after injury according to branch years.

Branch years		Receiving treatments after injury		Total	χ^2	p	Cramer's V
		Yes	No				
In competition							
1–4 years	n	34	57	91			
	%	37.4	62.6	100.0			
5 years and above	n	48	24	72	13.808	<0.001	0.291
	%	66.7	33.3	100.0			
Total	n	82	81	163			
	%	50.3	49.7	100.0			
In training							
1–4 years	n	31	60	91			
	%	34.1	65.9	100.0			
5 years and above	n	42	30	72	9.573	0.002*	0.242
	%	58.3	41.7	100.0			
Total	n	73	90	163			
	%	44.8	55.2	100.0			

Note. χ^2 *= Pearson Chi-square value. p value found by Pearson Chi Square Test. *p* < 0.05. *Degrees of freedom (df) = 1; Cramer's V value in the range of 0.10–0.50 according to df, showing medium effect level.*

4. Discussion

The injuries frequency is high among goalball athletes [15, 16]. Changes in proprioception may alter movement patterns [17] and postural stability [18] which increase the injury risk in visually impaired individuals. Preventing injuries in goalball has benefits including athletes' performance, improving the success of athlete and club, and reducing healthcare costs. It is imperative to analyse risk factors and consider past injury reports to prevent sports injuries and anticipate future injuries. This study was conducted to obtain information about frequency, type, injury site, and post-injury treatment process of sports injuries in male goalball players during training and competition.

The study depicted that every goalball athlete suffered minimum one injury in competition and training. Willick *et* *al*. [8] ranked the goalball as third among branches with the highest number of injuries in 2012 Summer Paralympic Games. Gajardo *et al*. [2] found that 64.1% goalball players experienced sports injuries. In current study, the injuries percentages among male goalball players in competitions and training were 50.31% and 44.79%, respectively. These high injury rates could be due to the lack of visual environmental stimuli in goalball activities which made athletes more vulnerable to injuries. Studies had shown that injuries in goalball occurred because of collisions, overuse, and poor physical condition [19]. Athletes were vulnerable to injuries due to lack of physical condition, postural disorder, muscle shortness, no conditioning training, and no adequate warm-up and cool-down [20–22]. For instance, stretching exercises increased the joint range of motion [23] as well as endurance of myofascial stretching of the muscle [24]. Stretching exercises thus prevented the muscle strains [25]. Moreover, the muscle strength training improved muscle, tendon, ligament, and bone health. It had role in preventing sports injuries [26]. The high probability of strain and sprain in goalball athletes of current study exhibited that these factors must be prioritised to prevent sports injuries. Relationship of these factors with frequency and types of injuries could not be fully revealed as this study had limitations like lack of information about athletes' condition, weekly training numbers, conditioning training, stretching exercises, warm-up and cooling down, *etc*. However, these factors had established indirect role in preventing injuries. It was thus essential to develop physical training programs for Turkish goalball athletes to improve physical condition and prevent injuries. They might include strengthening stretching exercises, warm-up and cool-down periods, *etc*.

The current study depicted relationship between branch year and injury frequencies of goalball athletes. There was increase in injuries frequency and decrease in rate of uninjured athletes as the number of years increased in the field for goalball athletes. Studies exhibited that the intense physical activity not the duration of physical activity increased the number of injuries [27]. This result obtained in current study was due to higher training intensity of athletes with high experience years compared to with low experience years.

Study found that the three most prevalent sports injuries in male goalball athletes during competition were sprains (47 (47%)), strains (25 (25%)), and tears (12 (12%)). Similarly, sprains (46 (38%)), contusions (32 (26.4%)), and strains (28 (23.1%)) were the most common in training. These findings were consistent with the observation that most injuries in Paralympic environment occurred in muscles and tendons [28]. Contusion injuries were common in training because athletes were vulnerable to hitting obstacles and objects on the field because of visual impairment [29, 30].

This study found that areas of injury among participants were the wrist and hand (35 (16.4%)), shoulder (26 (12.2%)), foot and ankle (26 (12.2%)), elbow (24 (11.3%)), knee (24 (11. 3%)), calf (21 (9.9%)), arm and forearm (19 (8.9%)), hip (17 (8.0%)), head and neck (13 (6.1%)), low back (4 (1.9%)), thigh (3 (1.4%)), and upper back (1 (0.5%)). In goalball training, injured body parts among athletes were the wrist (35 (19.7%)) followed by elbow (24 (13.5%)), foot and ankle (22 (12.4%)), shoulder (20 (11.2%)), knee (24 (11.3%)), calf (15 (8.4%)), hip (13 (7.3%)), arm and forearm (12, (6.7%)), head and neck (9 (5.1%)), low back (5 (2.8%)), thigh (3 (1.7%)) and upper back (2 (1.1%)). Male goalball athletes sustained more injuries to wrists compared to other body parts, while upper back was the least injured area. The analysis of sports injuries in goalball athletes revealed high incidence of injuries in upper extremities. A study on sports injuries in visually impaired athletes from sports including athletics, swimming, judo, soccer, and goalball found that the most injured body parts were thigh, knee, and shoulder [30]. Differences in the sample might have contributed to variations in results. Studies confirmed that the injury site was related to sports branch and playing technique [31, 32]. This was supported by the reality that use of upper extremity in goalball was higher than the lower extremity [33]. Current study included only the male goalball athletes. Studies on injuries in goalball athletes had consistently found that upper extremity was the most affected [2, 9]. The study herein supported this finding with fingers and hand-wrist being the most injured in male goalball athletes. This could be attributed to the frequent usage of upper extremity in throwing and catching the ball.

Upon analysing the distribution of treatments received by male goalball athletes after sustaining injuries, it was found that 69.86% did not receive treatment after competition. The most prevalent treatments were physical therapy and medication. Similarly, 57.32% athletes did not receive treatment after injuries in training. The deviance of medical support for significant number of goalball athletes after sustaining injuries highlighted the inadequate health support in clubs. This vulnerability to re-injury put athletes at risk. The sports injury frequency of over 44% in this study further supported this notion. The infrequency of surgical treatment for injuries in athletic competition and training suggested that the severity of athlete's injury was not significant. However, the study did not question the severity of sports injuries suffered by athletes. So, this could not be determined. Future studies must determine the severity of injuries and separately investigate physical therapy, rehabilitation, and drug treatment received by athletes.

In this study, it was determined that athletes with higher branch years were more likely to receive post-injury treatments compared to those with lower branch years. Studies showed that there were differences in the types of treatment athletes received after injury, which depended on experience. These studies supported that with the increase in athletes' experience, tendency to receive physical therapy was increased after injury [34, 35]. In current study, the possibility of receiving treatment was higher in athletes as their sport years increased. Depending on athlete's experience, the risk of re-injury might persuade him to manage treatment process at the professional level.

The study depicted that 43.9% returned in less than 1 week, 26.83% in 1–3 weeks, 9.76% in 4–6 weeks, and 19.51% in more than 6 weeks after sustaining injury in competition. For injuries in training, 52.05% returned in less than 1 week, 30.14% in 1–3 weeks, 12.33% in 4–6 weeks, and 5.48% in more than 6 weeks. Ferrara and Buckley [36] classified the injury severity in disabled individuals as mild (0–7 days missed), moderate (8–21 days missed), and severe (22 or more days missed). They reported that 52% injuries were mild, 29% moderate, and 19% severe which was consistent with the results herein. Zwierzchowska *et al*. [9] found in the study on goalball athletes that 76% injuries were mild and consisted of abrasions and contusions. The short return to sports period in this study might be attributed to low severity of injuries, being consistent with Zwierzchowska *et al*. [9]. However, in contrast to Zwierzchowska *et al*. [9], the present study found that visually impaired athletes sustained injuries like strains, sprains, tears, and contusions, indicating that the severity of their injuries was not low. The present study also found that visually impaired male athletes received inadequate medical support after injury, experienced delayed treatments, return to sports earlier than necessary, and did not receive preventive rehabilitation for sports injuries. This was confirmed that over 50% male goalball players did not receive treatment after injury which made them vulnerable to re-injury. So, more than 50% male goalball athletes were affected. Shorter return to sport had been linked with re-injury [37, 38], and preventive rehabilitation practices had reduced sports injuries [39, 40]. However, this study had limitations as it did not investigate the treatments received by participants, the factors affecting return to sport process, and whether athletes underwent preventive rehabilitation. This lack of information prevented conclusive determinations. Furthermore, the study revealed that injuries with return-to-sport period of over 6 weeks were more frequent in competitions, indicating that athletes were susceptible to serious injuries in such environments. This could be attributed to the basis that athletes played aggressively with higher levels of performance. Furthermore, it highlighted the importance of athletes being adequately prepared for competition process including injury prevention programs. Exceeding the loading limit during competition could cause serious injuries and prolong athlete's return to sport. It was thus vital to ensure that athlete's endurance was not exceeded.

One limitation of this study was that it did not investigate how the participants were treated after injury or what factors influenced the return to sports process following the treatment. Future studies must provide detailed post-treatment process to identify deficiencies in treatment and prevent injuries. Another potential deficiency was that it did not differentiate between medication and physical therapy received after injury. Future studies could improve by providing details of the type of treatments received after injury. Another shortcoming was that the frequency of physical training, conditioning training, and stretching exercises were not questioned in this study. It was thus essential that such data be questioned and correlated with injury frequency in future studies. Furthermore, comparative studies should be conducted on injuries of male and female goalball athletes.

5. Conclusions

This study reveals injury histories, sites and types of injuries sustained by male goalball athletes in training and competition. This work is the first of its kind to examine past injuries of male goalball athletes in such detail and with high number of participants. The findings indicate that over half of male goalball athletes sustain injuries in competition and training. Over 50% male athletes do not receive treatment after injury. The periods are kept very short for those receiving treatment and mainly consist of medication and physical therapy. Most male goalball athletes do not receive medical support after injury, and are at increased risk of re-injury because of short return to sports. The injury rates among male goalball athletes may thus be high. The absence of multidisciplinary team to enhance the performance of male goalball athletes may increase susceptibility of injuries. To prevent injuries in athletes, it is important to consider factors that affect physical condition such as conditioning training, stretching exercises, postural status, warm-up and cool-down periods, *etc.*, and to put them in practice under the guidance of multidisciplinary team. These factors should be associated with relevant injuries in future studies. Based on the information received in current study, medical support can be provided to prevent injuries and enhance performance of athletes participating in goalball branch. The athletes' health team, coaches and sport managers can develop preventive strategies. Sporting achievements can in turn be enhanced as multidisciplinary team. These findings and recommendations are essential for supporting visually impaired individuals in their lives and goalball sport. The preventive and protective strategies can help them in developing skills and achieving success in this field.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article.

AUTHOR CONTRIBUTIONS

SAK and BK—designed the research study; performed the research. SAK—analyzed the data; wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Study complied with the principles of Declaration of Helsinki. It was approved by the Yalova University Ethics Committee Coordinators on 15 November 2023 with protocol number 2023/43. An informed consent form was given to the athletes. The athletes selected trusted individual to read information and consent form aloud before signing. Athletes or their parents/guardians signed a written consent form.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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