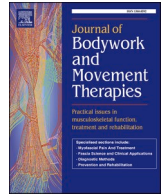




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Characteristics of injuries related to Kin-Ball sport in Japan: A questionnaire study

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ABSTRACT

Introduction: The number of Kin-Ball sport participants is expected to increase in the future. However, there is no report on the characteristics of the injuries associated with Kin-Ball sport. **Objective:** The purpose of this study was to describe the characteristics of injuries relate to Kin-Ball sport. **Design:** Observational study. **Setting:** A self-administered questionnaire was used for data collection. **Participants:** One hundred ninety Kin-Ball sport participants were included in this study. **Main Outcome Measures:** The questionnaire was designed based on physical characteristics, participation in Kin-Ball sport, and Kin-Ball sport injuries. Participation in Kin-Ball sport includes the length of time spent playing Kin-Ball sport as well as the playing categories (junior, friendly, champion challenge, champion, over 40). Kin-Ball sport injuries include the presence or absence of injury experience, the site, type, situation, and current injuries or pain associated with Kin-Ball sport. **Results:** One hundred fifty-two players (80%) of Kin-Ball sport participants were injured. The ankle was the most frequently visited body site (60; 22.1%), and the elbow was the second most visited body site (40; 14.8%). Sprains were the most common type of injury. **Conclusion:** This is the first study to describe the characteristics of injuries relate to Kin-Ball sport. The findings of this study could be beneficial for athletes, coaches, trainers, and clinicians to prevent, or treatment of the injuries.

1. Introduction

Kin-Ball sport is an alternative team sport invented by Mario Demers in Canada in 1986 (Federation, I.K.-B.S., 2023). Kin-Ball sport emphasize teamwork, cooperation, and sportsmanship and are distinguished by the fact that each game features four players from three teams, and using a 1.2 m diameter ball (Federation, I.K.-B.S., 2023a, Federation, I.K.-B.S., 2023b). A team with a ball can hit it as an offense, while the other team, designated by the offense team, is in charge of defense to keep the ball from touching the floor. When the defending team loses control of the ball and it touches the ground, the other two teams score (Federation, I.K.-B.S., 2023). Kin-Ball sport is now recognized as beneficial activities that promote physical activity (Lara-Sánchez AJ et al., 2010). According to Hastie et al. (2011), participants engaged in moderate-to-vigorous physical activity for 72.3% of the game time, regardless of age or sex. Kin-ball sport is an excellent physical education

activity. According to Ortega (Zurita-Ortega et al., 2020), Kin-Ball sport improves physical activity and motor skills in people with intellectual disabilities.

The Kin-Ball sport has an estimated 3.8 million participants worldwide (Federation, I.K.-B.S., 2023). Kin-Ball sport was introduced in Japan in 1997 (Federation, J.K.-B.S., 2023) and the Japan Kin-Ball sport federation has been reaching out to the public ever since, including induction into physical education in schools. As a result, the number of Kin-Ball sport participants is expected to increase in the future.

Information about the characteristics of injuries and safety in Kin-Ball sport is one of the most important factors for future outreach promotion. To the best of our knowledge, there is no report on the characteristics of the injuries associated with Kin-Ball sport. Information about injuries related to Kin-Ball sport is expected to be useful for further outreach safety promotion and the development of an injury prevention strategy. The purpose of this study was to describe the characteristics of

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injuries related to Kin-Ball sport.

2. Materials and methods

A self-administered questionnaire created in Google Forms (Google LLC, Mountain View, CA, USA) was used for data collection. Before answering the questionnaire, subjects were instructed to thoroughly read the information in this study, and informed consent was deemed obtained through the questionnaire response. The responses all the participants were anonymous and in accordance with Google’s privacy policies (<https://policies.google.com/privacy?hl=en>). Any personal information that could be used to identify a person was not allowed to be included in their response.

2.1. Questionnaire

The questionnaire was first drafted by a group consisting of three physiotherapists (FK, YK, and TH) including a Japan Women’s National Team player (KF). After the draft was created, several online meetings with Kin-Ball sport coaches were held to develop the questionnaire.

The questionnaire was designed based on physical characteristics, participation in Kin-Ball sport, and Kin-Ball sport injuries. Physical characteristics include age, sex, height, weight, and dominant arm and leg. Participation in Kin-Ball sport includes the length of time spent playing Kin-Ball sport as well as the playing categories (junior, friendly, champion challenge, champion, over 40). Kin-Ball sport injuries include the presence or absence of injury experience, the site, type, situation, and current injuries or pain associated with Kin-Ball sport. Participants could only answer four of these questions. Finally, the subjects were asked to provide any additional information or explanations that were required.

To protect their rights and diminish misinterpretations of the questions, respondents under 18 years of age were required to obtain parental or guardians consent for their responses. To be considered, participants had to play Kin-Ball sport on a local club team. Participants could not have participated in Kin-Ball sport for more than 6 months, regularly, or less than once per month, according to the exclusion criteria.

The Osaka University of Human Sciences Institutional Review Board approved this study (approval number: 2021–23). Subjects were recruited between December 2021 to June 2022 via mailings from the Japan Kin-Ball sport federation, announcements on the federation’s homepage, and personal contacts.

3. Results

A total of 190 Kin-Ball sport players responded to the questionnaire. **Table I** depicts participant characteristics and Kin-Ball sport participation. The average age was 30.5 ± 12.9 , and 96 (50.5%) of the participants were champions. The most common play was defense (82; 43.2%), with the hit coming in second (74; 38.9%). These plays make up 82% of all plays. Close, on the other hand, is 14 (7.4%).

Table II shows injuries related to Kin-Ball sport. One hundred fifty-two players (80%) of Kin-Ball sport participants were injured. The ankle was the most frequently visited body site (60; 22.1%), and the elbow was the second most visited body site (40; 14.8%). Sprains were the most common type of injury (94; 37.5%), with contusions and others accounting for 36 (14.3%) and 64 (25.5%), respectively. Defense was the most common injury situation (133; 51.2%), and hitting was the second most common (80; 30.5%), accounting for 81.9% of all injury situations. While participating in the Kin-Ball sport, 84 (44.2%) of the participants were injured or in pain. The most common is the low back (35; 23.0%), followed by the knee (33; 21.7%) and the shoulder (22; 14.5%).

Table 1

Participant demographics, Age, Height, Weight, and playing experience were all expressed as mean \pm SD, yo, Years of age.

	n = 190
Age (y)	30.5 \pm 12.9
<9	1
Teens	39
Twenties	71
Thirties	17
Forties	36
Fifties	19
60 <	2
Sex (number)	103/86/1
man/woman/no answer	
Height (cm)	166.2 \pm 9.4
Weight (kg)	61.4 \pm 12.2
Dominant arm (number)	175/11/4
Rt/Lt/no answer	
Dominant leg (number)	146/24/20
Rt/Lt/no answer	
Playing experience (years)	8.1 \pm 4.7
Level of competition (number)	
Junior	5 (2.6%)
Friendly	39 (20.5%)
Champion challenge	13 (6.8%)
champion	96 (50.5%)
Over 40	21 (11.1%)
Others, no answer	16 (8.4%)
Frequent play (number, percentage)	
Hit	74 (38.9%)
Defence	82 (43.2%)
Close	14 (7.4%)
Others	17 (8.9%)
No answer	3 (1.6%)

4. Discussion

The main findings of this study are as follows: 1) ankle is the most frequently injured body site, with elbow coming in second; 2) sprain is the most common injury type; 3) defense is the most frequently play, with hitting coming second. The ankle is the most commonly injured body site in sports. Hootman et al. (Hootman JM et al., 2007) used the NCAA database to conduct a survey of injury incidence across multiple sports and discovered that ankle sprains are the most common injury across all sports. Nelson et al. (Nelson AJ et al., 2007) reported that the ankle sprains are more common in sports that require jumping and quick changes of direction. Kin-Ball sport is distinguished by the fact three teams compete on the same court at the same time, necessitating jumping and quick changes of direction. As a result, the Kin-Ball sport has a feature that makes ankle sprains more likely to occur, which is consistent with other sports such as basketball or soccer. In this study, the elbow is the second most frequently injured body site (40; 14.8%). According to Hootman et al. (Hootman JM et al., 2007) the upper extremity accounts for 18.3%–21.4% of all injuries, while the lower extremity accounts for 50%. This finding could imply that the elbow is a common site of injury in Kin-Ball sport. Kin-Ball sport is played with a 1.2 m diameter, 1 kg weight ball, and the elbow is extended while hitting. Furthermore, during defense, the elbow is forcedly extended and close to the hit ball. Repetitive elbow extension load is commonly thought to be a cause of elbow pain, including triceps tendon pathology, synovitis in the posterior ulnotrochlear articulation, and stress fracture of the olecranon (Furushima et al., 2014; Rahusen et al., 2009; Rettig et al., 2006; van den Bekerom and Eygendaal, 2014). Elbow injuries may be caused by mechanical stresses on the elbow, and elbow injuries are more common in Kin-Ball sport. In terms of acute injuries, fractures and joint dislocations occurred at a rate of 7.2% and 2.4%, respectively. According to Collins et al. (Collins and Comstock, 2008) the incidence of fractures in baseball, which is commonly thought to have a low acute injury incidence rate, is 14.2%; this is a two-fold higher rate than in Kin-Ball sport in this study. This finding indicates that Kin-Ball sport is a

Table 2
Information about injuries.

	n = 190
Injuries relate to Kin-Ball sport presence/absence	152/38
Body part (multiple choices allowed)	
Neck	5 (1.8%)
Shoulder	14 (5.2%)
Upper arm	1 (0.4%)
Elbow	40 (14.8%)
Forearm	2 (0.7%)
Wrist	16 (5.9%)
Finger	27 (10.0%)
Low back	9 (3.3%)
Hip	6 (2.2%)
Thigh	8 (3.0%)
Knee	33 (12.2%)
Calf	16 (5.9%)
Ankle	60 (22.1%)
Foot/toe	7 (2.6%)
Others	27 (10.0%)
Injury type	
Contusion	36 (14.3%)
Fracture	18 (7.2%)
Dislocation	6 (2.4%)
Sprain	94 (37.5%)
Abrasion	5 (2.0%)
Incision	1 (0.4%)
Stress fracture	4 (1.6%)
Muscle torn	23 (9.2%)
Others	64 (25.5%)
Injured situation	
Hit	80 (30.8%)
Defence	133 (51.2%)
Close	16 (6.2%)
Contact	9 (3.5%)
Others	22 (8.5%)
Current pain presence/absence/no answer	84/71/35
Body part (multiple choices allowed)	
Neck	7 (4.6%)
Shoulder	22 (14.5%)
Upper arm	2 (1.3%)
Elbow	18 (11.8%)
Forearm	1 (0.7%)
Wrist	5 (3.3%)
Finger	2 (1.3%)
Low back	35 (23.0%)
Hip	0 (0%)
Thigh	3 (2.0%)
Knee	33 (21.7%)
Calf	4 (2.6%)
Ankle	14 (9.2%)
Foot/toe	2 (1.3%)
Others	4 (2.6%)

relatively safe sport.

Approximately 44.2% of those polled reported experiencing pain while participating in Kin-Ball sport. Kerr et al. (Kerr ZY et al., 2017) conducted a survey to determine the incidence of injury in high school athletes in the United States and discovered that 49.9% have non-time loss injuries. As a result, it is assumed that the incidence of injury in this study follows a similar pattern to that of high school athletes in the United States. One possible explanation is that 50.5% of the participants in this study are champions, implying that half of the participants in this study are in the most competitive category. In general, the rate of injury has increased in tandem with the level of competition. Furthermore, the specifics of this injury, such as the severity of the pain or whether the injury was caused by playing Kin-Ball sport or not, are unknown. A large number of individuals (31.7%) in Japan experience chronic musculoskeletal pain (Bouhassira D et al., 2008), especially from 30s to 50s (Nakamura M et al., 2011). In this study, 44.2% of the participants experienced musculoskeletal pain, which was related to the Kin-Ball sport. The cause of this difference may be an additional overload on the body based on the common chronic musculoskeletal pain.

The strength of this study is that this was the first to describe the characteristics of injuries related to Kin-Ball sport. Therefore, the findings of the current study could contribute as fundamental information for further study and taking preventive measures. Secondly, data could be collected from a wide range of ages throughout Japan because this study was conducted in cooperation with the Japan Kin-Ball Sport Federation.

The following are the study’s limitations: First, the diagnosis of injuries reported is unclear. Second, since the type of injury is self-reported, the possibility that it may differ from the actual type of injury cannot be excluded. Finally, because the precise frequency or playing time is unknown, the injury incidence rate, such as player-hour or athlete-exposure, cannot be calculated. For determining the safety of Kin-Ball sport, further investigations with detailed data are needed.

In conclusion, this is the first study to describe the characteristics of injuries related to Kin-Ball sport. The findings of this study could be beneficial for athletes, coaches, trainers, and clinicians in preventing, or treatment of injuries.

5. Institutional review board

This study has been approved by the ethics committee of Osaka University of Human Sciences (approval number: 2021–23)

6. Clinical Relevance

- Eighty percent of Kin-Ball sport participants were injured.
- The ankle was the most common injured body site, and the elbow was the second common body site.
- Kin-Ball sport is thought relatively safe sport because the occurrence of acute sever injuries were low.

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CRediT authorship contribution statement

Kokoro Fukushima: Conceptualization, Data curation, Investigation, Methodology, Writing – original draft. **Yuji Kanazawa:** Validation, Writing – review & editing. **Moemi Matsuo:** Validation, Writing – review & editing. **Takashi Higuchi:** Conceptualization, Investigation, Methodology, Project administration, Supervision, Writing – original draft.

Declaration of competing interest

The authors have no competing interests to disclose.

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