



Original Article

## Determining a preventive strategy for ankle sprain injury through a questionnaire survey of coaches of junior high school basketball teams

KOSUKE ONO, RPT, MSc<sup>1)</sup>, KIYOKAZU AKASAKA, PRT, PhD<sup>2)\*</sup>, TAKAHIRO OTSUDO, PRT, PhD<sup>2)</sup>, YUKI HASEBE, RPT, MSc<sup>1)</sup>, HIROSHI HATTORI, RPT, PhD<sup>3)</sup>, YASUAKI MIZOGUCHI, RPT, MSc<sup>4)</sup>, MITSURU YAMAMOTO, MD, PhD<sup>1)</sup>, MIKIO FUJIMOTO, MD<sup>1)</sup>

<sup>1)</sup> Saitama Medical University Saitama Medical Center, Japan

<sup>2)</sup> Saitama Medical University Graduate School of Medicine: 981 Kawakado, Moroyoya, Iruma, Saitama 350-0496, Japan

<sup>3)</sup> Saitama Medical University Kawagoe Clinic, Japan

<sup>4)</sup> Saitama Medical University Hospital, Japan

**Abstract.** [Purpose] The purpose of this study was to determine a preventive strategy for ankle sprain injury through a questionnaire survey of coaches of junior high school basketball teams. [Participants and Methods] The questionnaire comprised questions concerning coaches' characteristics, prevention-related content, and collaboration with medical staff. We distributed the questionnaire to 108 coaches, of which 48 (41.7%) responded. [Results] The results revealed that none of the participant coaches had ever collaborated with medical staff. [Conclusion] Additional effort from medical staff is needed to hold seminars and contact coaches of junior high school teams in order to conduct an injury prevention program.

**Key words:** Ankle sprain, Prevention, Basketball

(This article was submitted Sep. 3, 2021, and was accepted Oct. 5, 2021)

### INTRODUCTION

The most common injury in recreational and athletic activities is the ankle sprain<sup>1)</sup>. In Japan, approximately 70,000 ankle sprains occur per year in school-age basketball players, which exceeds the number among soccer and baseball players<sup>2)</sup>. Basketball requires high stress movements, including jumping, abrupt deceleration, and frequently repeated cutting over prolonged periods. Therefore, sudden unexpected shear forces are applied to the ankle joints in basketball, putting such athletes at risk of injury<sup>3)</sup>.

The injury rate varies depending on the age of the players. A previous study investigating the incidence of injury in student basketball players reported that 52% of the total injuries occurred in junior high school players in Japan<sup>4)</sup>. Ankle sprains in junior high school students were reported in 36,133 cases (13.0%) in one year, which is the highest among those classified by injury site and disease type. Neuromuscular training, such as hopping with a low center of gravity centering on squats, standing on one leg, and training using a balance board, has been reported to be effective in preventing ankle sprains<sup>5-9)</sup>. The Japan Basketball Association (JBA) has posted on its official website a "Junior Injury Prevention Program" (JBA Program) for the "prevention of lower limb trauma in basketball" and "improvement of performance in correct body movements<sup>10)</sup>". This program includes training that is effective in preventing ankle sprain<sup>11, 12)</sup>.

While studies have reported the effectiveness of several techniques of preventive training<sup>5-9)</sup>, there exists no survey reports on preventive training status or prevention training awareness among coaches. The actual situation regarding the

\*Corresponding author. Kiyokazu Akasaka (E-mail: akasaka-smc@umin.ac.jp)

©2022 The Society of Physical Therapy Science. Published by IPEC Inc.



This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial No Derivatives (by-nc-nd) License. (CC-BY-NC-ND 4.0: <https://creativecommons.org/licenses/by-nc-nd/4.0/>)

preventive measures employed in the field remains unclear.

In Japanese junior high school basketball, coaches are usually schoolteachers that may not be experienced basketball players. Therefore, the JBA holds injury prevention seminars in each region so that even coaches with no basketball experience can safely teach players. However, previous studies report gaps in injury knowledge and behavior for both coaches and athletes in youth sports<sup>13</sup>). Another report showed that some coaches, who were licensed or qualified to understand these training and injury prevention programs, allowed their players to play even when injured if there was no pain or discomfort<sup>14</sup>). In junior high school club activities, the number of players is small and practice time is limited. As a result, tactical practice is prioritized and awareness of injury prevention may be low. Therefore, the purpose of this study was to investigate efforts to prevent ankle sprains based on teaching experience and basketball experience, problems that coaches have regarding ankle sprain prevention, and coaches' expectations of medical staff.

## PARTICIPANTS AND METHODS

This non-comparative study was conducted in accordance with the Declaration of Helsinki and approved by the Medical Ethics Committee (number M-74) of Saitama Medical University. The study was registered in the university hospital's Medical Information Network Center at the University of Tokyo (UMIN000027667) ([https://upload.umin.ac.jp/cgi-open-bin/ctr\\_ctr\\_view.cgi?recptno=R000031691](https://upload.umin.ac.jp/cgi-open-bin/ctr_ctr_view.cgi?recptno=R000031691)).

The population sample for this study comprised coaches who belonged to the JBA, instructed junior high school students, and participated at a conference in the western area of Saitama Prefecture. The chief researcher of this study explained the research purpose and distributed the questionnaire to 108 coaches who attended a coaching meeting in west Saitama Prefecture.

Research respondents were instructed to not disclose the questionnaire results to anyone outside the research team. Written informed consent was obtained from all individual participants included in the study. We asked each participant to provide a signed consent form and mail it back in a sealed envelope. We also assured respondents that they would not face any repercussions if they chose not to provide consent and that they could withdraw their consent at any time. To protect the respondents' personal information, we created a character string for each participant combining letters and numbers and anonymized it so that only the person in charge of this research could identify individual respondents by using the correspondence table. The study examined the characteristics of the coaches (age, years of basketball instruction, and years of playing basketball), JBA program content, team injury management content, preventive training content, preventive equipment content, and materials related to cooperation with the medical staff (Table 1). Questions 1–4 and 6 could be answered with a “Yes” or “No” response, while Question 5 was a multiple-choice question with three response options: “training”, “stretching”, and “training and stretching”. The word “training” in the questionnaire was based on the JBA Program. Questions 1–4 and 6 were also accompanied by space provided for comments. The questionnaire was distributed together with the consent form, consent withdrawal form, and reply envelope. The questionnaire was collected by mail using a reply envelope. The questionnaire

**Table 1.** Survey results (*n*=45, 41.7%)

	Yes	No
Question 1		
Do you know what the JBA program is about?	8 (17.8%)	37 (82.2%)
Question 2		
Please answer only if you responded “Yes” to the above question.		
Do you implement the JBA program in your team’s practices?	0 (0.0%)	8 (18.0%)
Question 3		
Do you manage the injury of all players in your team?	19 (42.2%)	26 (57.8%)
Question 4		
Are you working on injury prevention for ankle sprains?	30 (66.7%)	15 (33.3%)
Question 5		
Please answer only if you responded “Yes” to the above question.		
What kind of injury prevention technique are you following?		
Training	4 (8.9%)	
Stretching	18 (40.0%)	
Training & stretching	8 (17.8%)	
Question 6		
Is there a medical staff member who you can collaborate with and consult about injury prevention?	0 (0%)	45 (100%)

JBA: Japan Basketball Association.

examined three categories of coaches, and each category was further divided into two subcategories. The first category was divided into coaches who knew the JBA program and those who did not. The second category was divided into coaches who managed the team's injuries and those who did not. The third category was divided into coaches who included ankle sprain prevention in their team practice and those who did not.

Among the JBA programs, the ages were normally distributed. However, the years of basketball instruction and of playing basketball were non-normally distributed. Therefore, the t-test was used for age, while the Mann–Whitney U test was used for years of basketball instruction and of playing basketball. All injury management comparisons were non-normally distributed; therefore, the Mann–Whitney U test was used. Regarding comparison of prevention of ankle sprain injury, the ages were normally distributed, but the years of basketball instruction and of playing basketball were non-normally distributed. Hence, the t-test was used for age, while the Mann–Whitney U test was used for years of basketball instruction and of playing basketball. The IBM SPSS statistical package for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA), was used to analyze data, and the threshold for statistical significance was set at  $p < 0.05$ .

## RESULTS

The response rate was 41.7% (45/108). All questionnaires received were completed correctly. The age of the respondents was  $37.1 \pm 9.9$  years, the number of years of basketball instruction was  $10.7 \pm 9.6$ , and the number of years of playing basketball was  $5.2 \pm 3.5$  (Table 2).

Regarding the JBA program, 8 (17.8%) knew the contents of instruction, while 37 (82.2%) respondents confessed to not being aware of the training contents (Table 1). However, among the coaches who knew the training contents, none had implemented the JBA program. Some of the reasons given for this were “I don't know how to implement a JBA program” or “Training time is short and tactical training time is more important”. In addition, the answers for the JBA cognitive program was not significantly different with respect to the age of the coach ( $p > 0.53$ ), years of basketball instruction ( $p > 0.53$ ), and years of playing basketball ( $p > 0.71$ ; Table 3). Regarding the management of injury, 19 (42.2%) coaches reported having managed players' injuries, while 26 (57.8%) had not (Table 1). The team's injury management did not significantly differ by the age of the coach ( $p > 0.34$ ), years of basketball instruction ( $p > 0.41$ ), or years of playing basketball ( $p > 0.54$ ; Table 4). Finally, concerning ankle sprain prevention, 30 coaches (66.7%) had exercised some preventive intervention, while 15 (33.3%) had provided no preventive intervention (Table 1). Regarding preventive intervention, respondents reported conducting training 4 (8.9%), stretching 18 (40.0%), and combined training and stretching 8 (17.8%). Most of the coaches left the stretching to the individual player, with only 12 (26.7%) coaches training effectively to prevent ankle sprain. Ankle sprain prevention did not significantly differ by the age of the coach ( $p > 0.78$ ), years of basketball instruction ( $p > 0.87$ ), or years of playing basketball ( $p > 0.38$ ; Table 5).

No coach surveyed in this study reported collaborating with medical staff.

**Table 2.** Characteristics of coaches ( $n=45$ , 41.7%)

Age (years)	$37.1 \pm 9.9$
Years of basketball instruction (years)	$10.7 \pm 9.6$
Years of playing basketball (years)	$5.2 \pm 3.5$
Mean $\pm$ SD.	

**Table 3.** Years of basketball instruction and of playing basketball by recognition of Japan Basketball Association program

	Yes ( $n=8$ )	No ( $n=37$ )
Age (years)	$35.2 \pm 8.4$	$37.4 \pm 10.2$
Years of basketball instruction (years)	8.0 (4.0–19.0)	5.0 (4.3–14.0)
Years of playing basketball (years)	5.0 (2.0–9.0)	6.5 (3.0–8.5)

Values are presented as the mean  $\pm$  standard deviation and median (25–75%tile).

**Table 4.** Years of basketball instruction and of playing basketball by management of injury

	Yes ( $n=19$ )	No ( $n=26$ )
Age (years)	40.0 (24.0–47.0)	32.0 (29.0–40.5)
Years of basketball instruction (years)	10.0 (6.0–20.0)	6.5 (4.0–12.8)
Years of playing basketball (years)	6.0 (3.0–9.0)	4.0 (2.0–9.0)

Values are presented as the median (25–75%tile).

**Table 5.** Years of basketball instruction and of playing basketball by prevention of ankle sprain injury

	Yes ( <i>n</i> =30)	No ( <i>n</i> =15)
Age (years)	36.7 ± 9.6	37.6 ± 10.7
Years of basketball instruction (years)	7.5 (4.0–17.0)	7.0 (4.0–18.0)
Years of playing basketball (years)	6.0 (2.8–9.0)	3.0 (2.0–7.0)

Values are presented as the mean ± standard deviation and median (25–75%tile).

## DISCUSSION

In Japan, the number of JBA registrants is increasing, and in 2017, about 630,000 athletes were registered. There are about 633,000 basketball players in Japan, including 141,500 junior high school boys and 112,400 girls. The number of registrants has increased by about 30,000 over the past ten years. Since the number of registrants for junior high school students is the highest, it is likely that the number of injuries among this age group is expected to increase<sup>10</sup>. The reason junior high school basketball players often experience sprained ankles is physical factors due to their growth. The adolescent body is reported to be at risk of ankle sprain because it changes rapidly with increasing weight and height<sup>15</sup>. In addition, it has been reported that ligament tightness due to the difference in growth rate from the bone contributes to the risk of ankle sprain<sup>16</sup>. However, not only physical factors but also environmental factors may have an effect. In Japan, three rules change when players enter junior high school: the height of the ring changes from 260 cm to 305 cm; the circumference of the ball changes from 74.0 cm to 78.0 cm; and the game time expands from four quarters of 6 minutes to four quarters of 8 minutes. Although there are many influential factors, the change in body size and the extra demands of higher jumps and landing technique are the most influential on adolescent ankle injuries incidence. An increase in the number of athletes in the age group with a higher risk of injury may have a tremendous impact on the number of injured players. Therefore, the attitude of coaches is essential to preventing injury to junior high school basketball players.

Both coaches and athletes in youth sports report gaps in injury knowledge and behavior<sup>13</sup>. Previous studies have reported that a coach licensed or qualified to understand training and injury prevention programs will be aware of injury risks to players when they play games<sup>14</sup>. In Japan, ankle sprains are the most common injury in basketball, but it is often a minor injury compared to anterior cruciate ligament injuries and Osgood Schlatter's disease. The potential for these injuries reflects the coach's strong influence, in addition to the individual player's judgment. These injuries impact the sporting potential of youth athletes and can also lead them to drop out of sports<sup>17</sup>. Therefore, efforts to prevent injuries through coaching the younger generation are indispensable in developing top players. A previous study of national trauma statistics in Japan reported that ankle sprains were the most common injuries among junior high school students involved in sporting activities. The study recommended the implementation of ankle sprain prevention in junior high schools<sup>18</sup>. However, according to the results of the questionnaire survey conducted here, the implementation rate of ankle sprain prevention training was 27%. A previous study of high school basketball coaches reported that 50% of coaches were trained to prevent ankle injuries<sup>19</sup>. Coaches who did not prevent of ankle sprain indicated barriers that included lack of time, expertise, and awareness to implement them. Comparing this study with previous studies, the rate of ankle injury prevention training was low. On the other hand, the reasons for coaches who do not provide ankle injury prevention training are the same as in previous studies, and it is thought that the resolution of these reasons will affect the improvement of the implementation rate<sup>19</sup>.

The opinion of coaches who do not have preventive training is vital to remedy this problem. The most common reasons given by coaches who did not conduct training were "I do not know how to perform preventive training" and "Tactical practice time is more important because I have less practice time". We hypothesized that the coaches' experience in teaching and playing basketball would have an influence on whether they perform preventive training. However, this study found that there was no significant difference between teaching experience and the number of years playing basketball in the prevention of ankle sprains and JBA program recognition. This demonstrates that an injury prevention program is useful for all coaches regardless of teaching or playing experience. Additional effort on the part of medical staff is also needed to publicize the seminar and to contact coaches of junior high school teams to conduct injury prevention programs.

The JBA sponsors classes on injury prevention, but attendance is not mandatory. Many schoolteachers in Japan also serve as coaches. Therefore, it is possible that some teachers may be too busy to attend the seminars. The presence of medical staff in schools would be useful, as coaches working at the school could benefit from discussing injury prevention and training with medical staff. However, this study's results revealed that none of the coaches surveyed had ever cooperated with medical personnel. Increasing the opportunities for collaboration with medical personnel may improve the dissemination and acquisition of knowledge of injury prevention and, therefore, alleviate injury problems.

Regarding the collaboration between coaches and medical staff, 44.7% and 9.6% of physiotherapists are involved in high school and junior high school club activities, respectively<sup>20</sup>. The early practice sessions after school make it too early for a physiotherapist working in a hospital or clinic to be involved in team practice. Moreover, the time issue is a problem not only for medical staff but also for coaches. In public schools, teachers not only teach specialized subjects but also teach sports activities. Public teachers change their workplace every few years, so some schools are taught by teachers who have

no experience playing basketball or coaching basketball. Therefore, such inexperienced coaches need to learn the basics of injury and basketball. However, as their main job is that of a teacher, they have limited time to be involved in sports activities and study practice regimens. Thus, it is necessary to consider means for both medical staff and coaches to implement effective time utilization. Previous studies reported that most coaches, when studying, prefer using tools such as digital video discs<sup>19</sup>). Therefore, we consider it essential to enhance the use of the Internet, videos, and images by instructors to deepen the understanding of ankle sprain prevention.

Further, coaches do not conduct preventive training because junior high school students have short practice times for sports, and many coaches focus on tactical practice rather than injury prevention. Another study reported that the lack of time and space should not be underestimated as significant barriers affecting the implementation of ankle injury prevention programs<sup>9</sup>). Preventive training for an ankle sprain is a simple exercise, suggesting that it needs to be readily available to adolescent athletes. One study participant responded that he could not conduct an ankle joint prevention program of about 20 min during practice time. While studies have reported that preventive training at home is effective against this problem<sup>19</sup>), it is challenging to continue unsupervised training for junior athletes for an extended period. Therefore, to effectively perform tactical exercises with less practice time, it is essential to prevent injury and practice without rest. Playing basketball safely and for longer periods requires the prevention of lower limb trauma, including sprained ankles. Thus, rather than instructing the coach on the need for injury prevention, it is necessary to discuss with the coach and players how to incorporate an individual prevention program tailored to each team's practice environment.

The results of this study showed that the sample size was relatively small, and all participants lived in Japan. Therefore, future studies should be conducted with more participants and in other regions to see if our study's results can be reproduced elsewhere.

### *Funding and Conflict of interest*

The authors declare that they do not have any conflicts of interest.

## REFERENCES

- 1) Brand RL, Black HM, Cox JS: The natural history of inadequately treated ankle sprain. *Am J Sports Med*, 1977, 5: 248–249. [Medline] [CrossRef]
- 2) Japan Sports Council: In: News. Disaster at school. <https://www.jpnsport.go.jp/anzen/Tabid/1928/Default.aspx>. (Accessed Dec. 12, 2020) (in Japanese)
- 3) McKay GD, Goldie PA, Payne WR, et al.: Ankle injuries in basketball: injury rate and risk factors. *Br J Sports Med*, 2001, 35: 103–108. [Medline] [CrossRef]
- 4) Suyama T, Akasaka K: Prevention of ankle injury. In: *Handbook of sports medicine and science sports injury prevention*. Tokyo: Igaku-Shoin, 2015. pp 31–49.
- 5) Emery CA, Rose MS, McAllister JR, et al.: A prevention strategy to reduce the incidence of injury in high school basketball: a cluster randomized controlled trial. *Clin J Sport Med*, 2007, 17: 17–24. [Medline] [CrossRef]
- 6) Janssen KW, van der Zwaard BC, Finch CF, et al.: Interventions preventing ankle sprains; previous injury and high-risk sport participation as predictors of compliance. *J Sci Med Sport*, 2016, 19: 465–469. [Medline] [CrossRef]
- 7) LaBella CR, Huxford MR, Grissom J, et al.: Effect of neuromuscular warm-up on injuries in female soccer and basketball athletes in urban public high schools: cluster randomized controlled trial. *Arch Pediatr Adolesc Med*, 2011, 165: 1033–1040. [Medline] [CrossRef]
- 8) Löfvenberg R, Kärrholm J, Sundelin G, et al.: Prolonged reaction time in patients with chronic lateral instability of the ankle. *Am J Sports Med*, 1995, 23: 414–417. [Medline] [CrossRef]
- 9) McGuine TA, Keene JS: The effect of a balance training program on the risk of ankle sprains in high school athletes. *Am J Sports Med*, 2006, 34: 1103–1111. [Medline] [CrossRef]
- 10) Japan Basketball Association: About the injury prevention program for juniors. In: News. Japan Basketball Association. 2017. <http://www.japanbasketball.jp/news/8728>. (Accessed May 3, 2017) (in Japanese)
- 11) de Loës M, Dahlstedt LJ, Thomée R: A 7-year study on risks and costs of knee injuries in male and female youth participants in 12 sports. *Scand J Med Sci Sports*, 2000, 10: 90–97. [Medline] [CrossRef]
- 12) Hewett TE, Lindenfeld TN, Riccobene JV, et al.: The effect of neuromuscular training on the incidence of knee injury in female athletes. A prospective study. *Am J Sports Med*, 1999, 27: 699–706. [Medline] [CrossRef]
- 13) McKay CD, Steffen K, Romiti M, et al.: The effect of coach and player injury knowledge, attitudes and beliefs on adherence to the FIFA 11+ programme in female youth soccer. *Br J Sports Med*, 2014, 48: 1281–1286. [Medline] [CrossRef]
- 14) Adirim TA, Cheng TL: Overview of injuries in the young athlete. *Sports Med*, 2003, 33: 75–81. [Medline] [CrossRef]
- 15) Ludwig O: Interrelationship between postural balance and body posture in children and adolescents. *J Phys Ther Sci*, 2017, 29: 1154–1158. [Medline] [CrossRef]
- 16) Hawkins D, Metheny J: Overuse injuries in youth sports: biomechanical considerations. *Med Sci Sports Exerc*, 2001, 33: 1701–1707. [Medline] [CrossRef]
- 17) Okuwaki T: Sports injury surveillance in Japanese junior and senior high school students. In: *Sports injuries and prevention*. Tokyo: Springer, 2015, pp 15–38.
- 18) Sakamoto M, Kobayashi H, Urabe U: Questionnaire survey about the realities and needs of physical therapist's activities in sports field. *J Jpn Phys Ther Assoc*, 2013, 40: 33–37.
- 19) McGuine TA, Hetzel S, Pennuto A, et al.: Basketball coaches' utilization of ankle injury prevention strategies. *Sports Health*, 2013, 5: 410–416. [Medline] [CrossRef]
- 20) Ohashi Y, Nakase J, Taratani T, et al.: A prevention program for sports injuries as needed in the field: a questionnaire survey. *Jpn J Clin Sports Med*, 2013, 21: 771–775.