

Original Research

Prevalence of Knee Injury in East Java's Puslatda Fencing Athletes

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ABSTRACT

Background: Fencing is one of many sports that are held in major sports events, both nationally and internationally. Fencing also has a high risk of injury, and knee injury is the most common injury site according to the authors' observations. Even so, studies on knee injuries in fencing athletes are very scarce, especially in Indonesia. **Aim:** To ascertain the prevalence of knee injuries and its intrinsic risk profile in fencing athletes at East Java Puslatda (regional training center).

Material and Methods: The method used in this study was descriptive observational based on athletes' health screening data, which were obtained from Sport Clinic Dr. Soetomo Academic General Hospital and athletes' fitness data obtained from KONI.

Results: This research involved 14 fencing athletes that were active in the East Java regional training center. Out of the 14 athletes who were included in this study, it was found that 1 athlete (7.1%) had a knee injury and 13 athletes (92.9%) had no knee injury. The athlete who had injured was a senior overweight female, had history of knee injury, average VO₂max, normal knee ROM and alignment, and did 1-2 times leg strengthening exercises every week.

Conclusion: The prevalence of knee injuries in fencing athletes at East Java regional training center is 1 in 14 athletes.

Keywords: *fencing, injury, knee, intrinsic risk factors, prevalence*

Introduction

Based on Observation made on a fencing club in Sidoarjo, it was found that many athletes had complaints of pain or discomfort in the knee, especially athletes who have participated in fencing for a long time. In addition, according to brief observation of earlier data in the sports clinic at Dr. Soetomo Academic General Hospital, most frequent complaints that fencing athletes had was related to the knee. In 2018, 5 out of 9 recorded fencing athletes complained about injury on their knees. An epidemiological study of professional fencing athletes in South Korea shows that lower extremities account for 47.2% of all recorded injuries, with the knee being one of the most common sites of injury.¹ Other studies have also found that knees are one of the most, if not the most common sites of injury in fencing athletes.^{2,3}

Based on documentary analysis study conducted on DKI Jakarta's Pelatda PON XVII athletes, injury prevalence increased in the span of 3 years from 2009-2012 in accordance with the addition of sport into Pelatda program and the increase in exercise intensity.⁴ In another study, Junaidi has found that 30% of DKI Jakarta's athletes who participate in PON XIX suffer injuries. Among those athletes, 38% had moderate injuries and 17% had serious injuries.⁵ This shows that sports injury is a significant problem and needs to be studied further, so that it can be understood and hopefully resolved.

Sport injuries can lead to functional impairment. The effects of injury ranges from discomfort to inability to participate in their respective sports. Injuries also affect the mental state of athletes. All these things can affect athlete's performance, both individually and in the team. To prevent this from happening, it is important to understand how significant certain injuries in sport are, how it occurs, and what factors influence it, especially in fencing. However, data from athletes outside Indonesia do not necessarily reflect the

situation in Indonesia, particularly in East Java. On the other hand, data and research on injuries to fencing athletes in Indonesia are very scarce. To take further steps, more data are certainly needed, so that the research can be conducted precisely and efficient. Therefore, this study is carried out to determine the prevalence of knee injury in professional fencing athletes who are members of East Java's Puslatda and the profile of intrinsic risk factors that may have a relationship with the incidence of knee injury. With this research, it is hoped that it can trigger further research to prevent the occurrence of knee injuries in fencing athletes.

Material and Methods

This was a descriptive observational study that included all fencing athletes registered in East Java's Puslatda, and were willing and able to participate in health screening held by Sports Clinic Dr. Soetomo Academic General Hospital and fitness test held by KONI in 2020. Athletes who couldn't participate in both screening and test were excluded from this study.

Variables analyzed were findings of knee injury and intrinsic risk factors consisting of age, sex, Body Mass Index (BMI), history of knee injury, VO₂max, knee range of motion (ROM), laxity, alignment, and leg strengthening exercises frequency. The variables consisted of: 1) Knee injury is defined as current damage to the structures making up the knee joint and was found during the screening. It is classified into present and not present; 2) Age is classified based on fencing's competition age class in Indonesia, which consists of pre-cadet (under 13 years old), cadet (14-17 years old), junior (18-20 years old), and senior (over 20 years old); 3) Sex is defined as biological and physiological characteristics that define male and female; 4) BMI is defined as a measure of body fat based on height and weight, and is classified based on *Pedoman Gizi Nasional 2014*; 5) History of knee injury is defined as the

existence of a long-standing knee injury or knee injury experience; 6) VO₂max is defined as a measure of the maximum amount of oxygen a person can use during intense or maximal exercise measured using a beep test. VO₂max is classified into very poor, poor, fair, average, good, very good, and excellent based on age, sex, and performance on the test; 7) Knee ROM is defined as the full movement potential of knee joint and is classified as normal or not normal based on the examiner; 8) laxity is defined as connective tissue problems characterized by excessive joint flexibility. It is determined by the Beighton score, and can be classified into two categories: normal and generalized joint laxity; 9) alignment is defined as the longitudinal position of the bone or limb in relation to the knee, and is classified into three categories by the examiner: normal, valgum and varum; 10) leg strengthening exercises frequency is defined as frequency of leg

strengthening exercises performed by athletes in the span of one week.

Data on variables were gathered from athlete's health screening and fitness data. Intrinsic risk factors data were then cross-tabulated with knee injury data. The results are presented in a frequency distribution table.

Results

There were 14 athletes who participated in both the screening and the test. Table 1 presents the distribution of athletes based on intrinsic risk factors. Out of these athletes, there was only 1 (7.1%) athlete who had current knee injury. The athlete is a senior, female, overweight, has a history of knee injury, has average VO₂max, has normal knee ROM and alignment, and does 1-2 times leg strengthening exercises every week.

Table 1. Distribution of athletes based on intrinsic risk factors

| Characteristics | Knee Injury (n (%)) | |
|--|--------------------------------|-----------|
| | Yes | No |
| Age | | |
| Cadet | 0 (0) | 2 (14.3) |
| Junior | 0 (0) | 8 (57.1) |
| Senior | 1 (7.1) | 3 (21.4) |
| Minimum | 17 years old | |
| Maksimum | 22 years old | |
| Mean± SD | 19,43 ± 1,70 years old | |
| Sex | | |
| Female | 1 (7.1) | 7 (50.0) |
| Male | 0 | 6 (42.9) |
| BMI | | |
| Skinny | 0 (0) | 1 (7.1) |
| Normal | 0 | 9 (64.3) |
| Overweight | 1 (7.1) | 3 (21.4) |
| Minimum | 18,31 kg/m ² | |
| Maksimum | 26,54 kg/m ² | |
| Mean± SD | 22,99 ± 2,47 kg/m ² | |
| History of Knee Injury | | |
| Yes | 1 (7.1) | 3 (21.4) |
| No | 0 | 10 (71.4) |
| VO2max | | |
| Poor | 0 | 2 (14.3) |
| Fair | 0 | 5 (35.7) |
| Average | 1 (7.1) | 3 (21.4) |
| Good | 0 | 1 (7.1) |
| Very Good | 0 | 2 (14.3) |
| Knee ROM | | |
| Normal | 1 (7.1) | 13 (92.9) |
| Not Normal | 0 | 0 |
| Laxity | | |
| Normal | 0 | 9 (64.3) |
| Generalized joint laxity | 1 (7.1) | 4 (28.6) |
| Alignment | | |
| Normal | 1 (7.1) | 13 (92.9) |
| Not Normal | 0 | 0 |
| Leg Strengthening Exercises Frequency | | |
| 1-2 times per week | 1 (7.1) | 4 (28.6) |
| 3-5 times per week | 0 | 7 (50.0) |
| >5 times per week | 0 | 2 (14.3) |

Source: Research Data, Processed

Table 2. Characteristics of athletes

| Subject Alphabet | Age | Sex | BMI | History of Knee Injury | VO ₂ max | ROM knee | Laxity | Alignment | Leg Strengthening Exercises Frequency |
|-----------------------------------|--------|-----|------------|------------------------|---------------------|----------|--------------------------|-----------|---------------------------------------|
| Knee Injury(s) Present | | | | | | | | | |
| SAL | Senior | F | Overweight | Yes | Average | Normal | Generalized joint laxity | Normal | 1-2 |
| Knee Injury(s) Not Present | | | | | | | | | |
| BDA | Junior | M | Overweight | Yes | Fair | Normal | Normal | Normal | 3-5 |
| SK | Senior | M | Normal | No | Very good | Normal | Normal | Normal | 1-2 |
| DMP | Senior | F | Skinny | No | Fair | Normal | Normal | Normal | 3-5 |
| APD | Senior | F | Normal | No | Average | Normal | Generalized joint laxity | Normal | 1-2 |
| MH | Junior | M | Normal | No | Very good | Normal | Normal | Normal | 3-5 |
| SB | Junior | F | Overweight | Yes | Poor | Normal | Normal | Normal | >5 |
| DB | Junior | M | Normal | No | Average | Normal | Normal | Normal | 3-5 |
| NDN | Cadet | F | Normal | Yes | Fair | Normal | Normal | Normal | >5 |
| FAW | Junior | F | Normal | No | Fair | Normal | Generalized joint laxity | Normal | 3-5 |
| AM | Cadet | F | Normal | No | Average | Normal | Generalized joint laxity | Normal | 1-2 |
| JR | Junior | M | Normal | No | Good | Normal | Normal | Normal | 3-5 |
| KCN | Junior | F | Normal | No | Poor | Normal | Generalized joint laxity | Normal | 1-2 |
| MR | Junior | M | Overweight | No | Fair | Normal | Normal | Normal | 3-5 |

Source : Research Data, Processed

Discussion

We aim to achieve better understanding about the occurrence and importance of knee injuries in Indonesian professional fencers, especially in East Java. There were no structured data or studies in Indonesia found to compare with our study. Thus, hopefully this study can incite further studies about the topic.

Prevalence of knee injuries in fencers around the world

Prevalence of knee injuries varies from study to study. Park and Byung¹ have reported that among 1176 injuries recorded at the National Training Center in South Korea from 2008-2015, 119 (10.1%) are knee injuries, making it the second most common site of injury in the lower extremity after ankle. Similar result is also found in a prospective cohort study of the Hong Kong national team, where knee sprains account for 11.3% of all injuries². Harmer³ has also collected data from FIE major events during 2010-2014 seasons and has found that knee injuries account for 46 out of 174 injuries. A study in India consisting of 113 fencing athletes with at least 2 years of experience, and in the age range of 18-26 years has found that there are 2 athletes who have knee injuries with a percentage of 1.8% of the total sample, and 14.28% of all athletes who experienced or had been injured in the past 2 years.⁶

Intrinsic risk factors

The notion of age as a risk factor for injury sounds plausible because the older the athlete is, the more exposure over time to their risky activities than younger athletes. However, it is not always the case. In relation to fencing, it is found that senior athletes

experience more injuries than any other age class, but there is no significant influence between age and injury incidence³.

Harmer finds that female athletes in general have a higher risk of injury than male athletes. Beside, female athletes also have higher rates of injury for specific types of injury, particularly puncture and rupture injuries (6.2 and 3.1 times greater than male athletes, respectively) and fracture (2.6 times higher). However, according to the location of the injury, female athletes have fewer knee injuries and more hip injuries⁴. In his other studies, it is found that male athletes have a 42.6% greater risk of injury than female athletes. The incidence of injury most often occurs in senior male athletes, followed by senior female athletes. By weapon type, male sabre athletes have the highest overall injury rates. Meanwhile, according to Park and Byung¹, there are significant differences between female and male athletes in terms of the location and severity of injuries. In general, male athletes are injured more frequently. However, when classified by type of weapon, female athletes who play *epee/degén* have a significantly higher incidence of injury than male athletes.

In their review, Amoako, Nassim and Keller⁷ have found that knee injury may be more likely to occur in high BMI athletes during change of direction and momentum, and it directly affects knee stability. A systematic review and other meta-analysis have concluded that there are no strong or moderate risk factors for patellar tendinopathy. In fact, they find that there is only limited evidence that indicates the increased BMI is a risk factor for patellar tendinopathy.⁸ There appears to be an association between higher BMI and chondral injury.⁹ Sources that link other types of knee injury related to sports are outdated. Therefore, further discussion is needed.

A study published in *The Journal of Rheumatology* has investigated whether knee pain or a history of knee injury can be associated with knee injury in the following 12 months. The study is conducted by means of longitudinal knee-based analysis between knees at the Osteoarthritis Initiative, a government-owned health institution in the United States. This study has concluded that knee pain and injury history are associated with new knee injuries.¹⁰ In relation to fencing, Harmer³ states that intensification of the injury history is associated with 27.6% of recorded injuries. In line with that, Prakash and Sinha⁶ have found that out of 14 injured athletes, 28.5% have previous injuries. Regardless of the percentage, there is no significant association with the occurrence of injury.

Success in fencing may be related to cardiorespiratory fitness parameters.¹¹ However, the authors did not find any literature discussing the effect of cardiorespiratory endurance on injury incidence, generally nor specifically, in fencing. A systematic review has concluded that poor performance on several fitness parameters is a predictor for musculoskeletal injury risk, namely set distance run for time test (strong evidence in male and female), timed shuttle run (strong evidence in male) and step test (moderate evidence in males and limited evidence in females).¹²

Quoting from a systematic review, several studies support an association between abnormal ROM and the incidence of injury.¹³ Steinberg et al.¹⁴ studied a group of recreational dancers and concluded that joint range of motion and scoliosis might be a potential risk factor for possible injury in the future. Authors couldn't find more recent studies regarding the relationship of knee ROM and knee injuries in fencing.

There are several studies linking laxity with knee injuries, specifically ACL

injuries, but none of them are related to fencing. Excessive laxity may lead to hypermobility, which can be a direct risk factor for acute and chronic musculoskeletal injuries affecting joints in the extremities.¹⁵ A study involving 226 adolescent male athletes of 15 sports in the Middle East examined the association of generalized joint laxity and injury rate. The study design was prospective observational, and sports were divided into contact and non-contact sports. The result of the study is that the broader generalized joint laxity (defined by the Beighton Score gradient) along with involvement in contact sports influences the risk of injury in young athletes.¹⁶

Literature regarding the relationship between alignment and knee injuries are scarce. The authors found 1 relevant study but it was outdated. Therefore, it is necessary to do more studies regarding this topic.

Leg strengthening exercises frequency was chosen to represent leg strength because of the lack of data. According to Hietamo et al.¹⁷ who have studied lower limb muscle strength as a potential risk factor for all ACL injuries in young athletes, only lower maximal hip abduction strength is significantly associated with an increased risk of all knee injuries in males. Other studies have concluded that there is no significant association between leg strength and all knee injuries.^{18,19}

Conclusion

The prevalence of knee injuries in fencing athletes at East Java regional training center is 1 in 14 athletes (7.1%).

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References

1. Park KJ, Byung SB. Injuries in elite Korean fencers: an epidemiological study. *Br J Sports Med.* 2017;51(4):220–5.
2. Chung WM, Yeung S, Wong AYL, Lam IF, Tse PTF, Daswani D, et al. Musculoskeletal injuries in elite able-bodied and wheelchair foil fencers—a pilot study. *Clin J Sport Med.* 2012;22(3):278–80.
3. Harmer PA. Epidemiology of time-loss injuries in international fencing: a prospective, 5-year analysis of Fédération Internationale d’Escrime competitions. *Br J Sports Med.* 2019;53(7):442–8.
4. Junaidi J. CEDERA OLAHRAGA PADA ATLET PROVINSI DKI JAKARTA (PENGARUH PEMAHAMAN PELATIH, SARANA & PRASARANA OLAHRAGA DAN METODE LATIHAN TERHADAP TERJADINYA CEDERA OLAHRAGA). *Gladi J Ilmu Keolahragaan.* 2013;7(2):746–64.
5. Junaidi J. PROFIL CEDERA OLAHRAGA ATLET DKI JAKARTA PADA PEKAN OLAHRAGA NASIONAL XIX JAWA BARAT. In: *Prosiding Seminar dan Lokakarya Fakultas Ilmu Keolahragaan Universitas Negeri Jakarta.* 2017. p. 88–90.
6. Prakash N, Sinha AGK. Injury pattern among fencing players in India. *Physiother J Indian Assoc Physiother.* 2019;13(2):84.
7. Amoako AO, Nassim A, Keller C. Body mass index as a predictor of injuries in athletics. *Curr Sports Med Rep.* 2017;16(4):256–62.
8. Van der Worp H, van Ark M, Roerink S, Pepping G-J, van den Akker-Scheek I, Zwerver J. Risk factors for patellar tendinopathy: a systematic review of the literature. *Br J Sports Med.* 2011;45(5):446–52.
9. Kluczynski MA, Marzo JM, Bisson LJ. Factors associated with meniscal tears and chondral lesions in patients undergoing anterior cruciate ligament reconstruction: a prospective study. *Am J Sports Med.* 2013;41(12):2759–65.
10. Driban JB, Lo GH, Eaton CB, Price LL, Lu B, McAlindon TE. Knee pain and a prior injury are associated with increased risk of a new knee injury: data from the osteoarthritis initiative. *J Rheumatol.* 2015;42(8):1463–9.
11. Abd-Elaziz MA-EI. Physiological Responses During Epee Fencing Fight in Junior Egyptian Fencers: An Indication for Fencing Training. *Int J Sport Sci Phys Educ.* 2016;1(2):17–20.
12. Lisman PJ, Sarah J, Gribbin TC, Jaffin DP, Murphy K, Deuster PA. A systematic review of the association between physical fitness and musculoskeletal injury risk: part 1—cardiorespiratory endurance. *J Strength Cond Res.* 2017;31(6):1744–57.
13. Storm JM, Wolman R, Bakker EWP, Wyon MA. The relationship between range of motion and injuries in adolescent dancers and sportspersons: A systematic review. *Front Psychol.* 2018;9:287.
14. Steinberg N, Aujla I, Zeev A, Redding E. Injuries among talented young dancers: findings from the UK Centres for Advanced Training. *Int J Sports Med.* 2014;35(03):238–44.
15. Wolf JM, Cameron KL, Owens BD. Impact of joint laxity and hypermobility on the musculoskeletal system. *JAAOS-Journal Am Acad Orthop Surg.* 2011;19(8):463–71.
16. Rajeb A, Whiteley R. BEIGHTON SCORING OF JOINT LAXITY AND INJURY INCIDENCE IN ATHLETIC ADOLESCENT MALES. *Br J Sports Med.* 2014;48(7):653.
17. Hietamo J, Parkkari J, Leppänen M, Steffen K, Kannus P, Vasankari T, et al. Association between lower extremity muscular strength and acute knee injuries in young team-sport athletes. *Transl Sport Med.* 2020;3(6):626–37.
18. Nilstad A, Andersen TE, Bahr R, Holme I, Steffen K. Risk factors for lower extremity injuries in elite female soccer players. *Am J Sports Med.* 2014;42(4):940–8.
19. Steffen K, Nilstad A, Kristianslund EK, Myklebust G, Bahr R, Krosshaug T. Association between lower extremity muscle strength and noncontact ACL injuries. 2016;