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Incidence Rate and Patterns of Sport Injury among College Students

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Abstract

The participation of college students in sport is quite large, which causes them to be at higher risk of injury. However, data on sport injury in college students are not always available at college or universities. Injury reports can be used to develop an injury reduction program in college. This study aims to determine the injury rate and patterns of injury among college students. This is a cross-sectional study followed by one hundred students of the faculty of medicine, Universitas Katolik Indonesia Atma Jaya, Jakarta. A self-administered questionnaire and physical examination were performed. Data were analysed using appropriate statistical tests in the Statistical Package for Social Science (SPSS) version 17. Significance was set at $p<0.05$. There were 107 injuries from seventy six students (76%) from four sport. The total injury rate was 99 per 1000 student-exposure. Males had higher injury rate and prevalence than females. Injured students were older and taller (20.03 vs 19.50, $p=0.02$; 168.83 vs 164.75, $p=0.05$, respectively). Ankle and sprain were the most common site and type of injury (34.6% and 56%, respectively). Logistic regression indicated that gender, age, BMI, and type of sport were not determinant factors for injury (odds ratio [OR] 2.07, $p=0.13$; [OR] 2.60, $p=0.11$; [OR] 0.63, $p=0.38$; [OR] 1.66, $p=0.31$, respectively). Many college students of Atma Jaya participating in sport suffered from injury. The most common injury was ankle sprain. Injury reduction programmes should emphasize ankle sprain.

Key words: *Injury rates, sport injury, injury patterns, students college*

Introduction

Students' involvement in sport exposes them to two contradicting situations. On the one hand, their health benefits due to a physically active lifestyle; on the other, involvement in sport is likely to bring about some health challenges, particularly sport-related injury (Merkel, 2013). Sport injury rates will continue to increase as the involvement of students in sport increases (Tolbert, Mc Ilvain, Giangarra, & Binkley, 2011; Sheu, Chen, & Hedegaard, 2016). A prior study (Rosa et al., 2014) reported that the prevalence of injury among college students in Brazil was almost 50%. A higher prevalence of collegiate injury was found in India (73.4%) as reported by Kumar, Singh, Yadav, Mangal, and Raut (2014). The difference of incidences of injury between genders is inconclusive as it depends on injury characteristics and injury surveillance reporting methods.

Reducing the sport injury rate of students is necessary to prevent school-time loss and to prevent catastrophic injury. Sport injuries can be largely prevented. Warming up and stretching, and using protective equipment are some injury prevention methods that have become well known (Schiff, Caine, & O'Halloran, 2010). Students may take these preventive measures. However, a more effective and comprehensive strategy should be developed and introduced to minimize sport injury among college students to the lowest level. This injury prevention program can best be accomplished by conducting injury surveillance to obtain information on injury prevalence or rate and characteristics of injury. However, any prevention program being developed should never discourage or hinder the students from taking part in physical activities.

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Indonesia is a large country with a large population. The number of college students was estimated to be about seven million, of which about 16.6% of them engage in physical activity (Data and Information Center for Science, Technology, and Higher Education, 2015; National Central Bureau of Statistics. Indonesian youth statistics, 2015). Some of them engage in sport organized by the university, while others belong to a sport club. Thus, there are more than a million college students exposed to injury. To the best of our knowledge, there has not been a study on injury among college students in Indonesia.

This study aimed to determine the injury rate and to provide detailed information about the injuries obtained by collegiate students of the Faculty of Medicine, Universitas Katolik Indonesia Atma Jaya. The results of this study will be used as preliminary data to conduct further injury surveillance in a larger sample.

Methods
Study design and subjects
This cross-sectional study was conducted at the Faculty of Medicine, Universitas Katolik Indonesia Atma Jaya, Jakarta, between May 2018 and July 2018. Subjects were students engaged in four types of sport organized by the campus: badminton, basketball, futsal, and volleyball. The inclusion criteria include being members of college sport teams and following practice and games regularly. Exclusion criteria were one of the following criteria: declined to participate in the study and did not submit the completed questionnaires during the study period. Informed consent was obtained from participants prior to the study by signing. Ethical clearance was approved by the Faculty Ethics Committee.

Study tool and measurements
Data were obtained via a questionnaire distributed to participants through the sport team coordinator. The questionnaire included age, type of sport engaged in, training program, competition schedule, and characteristics of injury sustained in the last 12 months, from August 2017 to July 2018. Clarification was performed by participants or researcher if the questions or answers in the questionnaire were unclear.

Weight and height were measured according to standard procedure. Body mass index (BMI) was obtained by dividing weight (kg) with the square of height (m). Body mass index was classified as normal if BMI<23 kg/m², and overweight if BMI≥23 kg/m² (Hsu, Araneta, Kanaya, Chiang, & Fujimoto, 2015; WHO Expert Consultation, 2004). Musculoskeletal physical examinations were performed to confirm sites and type of injury sustained.

Injury report
Injury incidence was reported in terms of percentage among all participants and as injury rate. The injury rate was reported as 1000 students' exposure (S-E). Students' exposure was defined as one student engaging in one practice or competition in which he or she is exposed to the possibility of obtaining an athletic injury (Phillips, 2000; Dick, Agel, & Marshall, 2007). Data regarding exposures were obtained from the weekly attendance list for practice and the list of team members for competition. The competitions followed by college students were regional competition, inter-faculty competition, and inter-level competition. The injury rate was reported according to sport and gender.

Statistical analysis
Data were presented as mean ± standard deviation (SD) for numeric and frequency (percentage) for categorical data. The independent t-test was applied to compare the mean between two groups. Chi-square was used to analyse the association between variables. Determinant factors for sport injury were computed using a binary logistic regression. Significance was set at p≤0.05. Statistical analysis was computed using the Statistical Package for Social Sciences (SPSS) version 17.

Results
The distribution of the participants according to the sociodemographic, BMI, and injury are presented in Table 1. One hundred college students (64 male, 36 female) of the Faculty of Medicine, Universitas Katolik Indonesia Atma Jaya were eligible to engage in this study. Most of the students were twenty years old or younger (70%) and had normal BMI (53%). Students engaging in futsal had the highest number, whereas students engaging in basketball had the lowest. Most of the students suffered from injuries (76%), with a total number of injuries being 107.

Table 1. Distribution of sociodemographic, BMI, and injury of the participants

Variables		Number	Percentage
Gender	Male	64	64%
	Female	36	36%
Age (years)	≤20	70	70%
	>20	30	30%
BMI (kg/m²)	Normal	53	53%
	Overweight	47	47%
Sport event	Badminton	26	26%
	Basketball	21	21%
	Futsal	30	30%
	Volleyball	23	23%
Students injured (n)		76	76%
Number of injury		107	107%

Legend: BMI - body mass index

Comparison of the characteristics and number of students were presented according to the injury status of the students (Table 2). Mean age and height of the students with injury were higher than students with no injury (20.0 vs 19.5, p=0.02; 168.8 vs 164.7, p=0.05). There was no association between sport event and injury frequency (p=0.07).

Table 2. Comparison of characteristics and number of students according to injury status

	Students with injury (n=76)	Students with no injury (n=24)	p
Age (years)	20.03±0.94	19.50±0.98	0.02
Height (cm)	168.83±7.98	164.75±10.68	0.05
Weight (kg)	66.42±13.75	64.96±14.21	0.65
BMI (kg/m2)	23.15±3.66	23.83±4.32	0.45
Badminton	15	11	
Basketball	16	5	0.07
Futsal	26	4	
Volleyball	19	4	

Nine injury sites and five types of injury were identified. Table 3 shows the distribution of body parts and the types of injury in all sports. Injury to the ankle accounted for almost 35% of all injuries, and it is the most frequent injury in three sport events, except in volleyball. Injury to the hand and wrist is the most frequent type of injury in volleyball. The most common type of the injury sprain (56%). The buttocks and dislocation were the least affected site and type of injury, respectively (both 1.9%)

Table 3. Distribution of body part and types of injury among the various sports

Site of injury	Badminton	Basketball	Futsal	Volleyball	Overall
Ankle	7	10	13	7	37 (34.6%)
Hand & wrist	2	3	1	10	16 (14.9%)
Leg	3	3	5	3	14 (13.1%)
Knee	3	3	6	2	14 (13.1%)
Trunk	2	4	2	2	10 (9.3%)
Shoulder	3	1	1	2	7 (6.6%)
Foot	1	1	2	-	4 (3.7%)
Arm	2	-	-	1	3 (2.8%)
Buttock	-	2	-	-	2 (1.9%)
Types of injury					
Sprain	11	16	19	14	60 (56.0%)
Strain	6	5	6	5	22 (20.6%)
Contusion	4	3	4	7	18 (16.8%)
Muscle cramps	2	2	1	-	5 (4.7%)
Dislocation	-	1	-	1	2 (1.9%)
Total	23	27	30	27	107 (100%)

Legend: "Hands & wrist" includes fingers; "Foot" includes toes.

The overall injury rate was 9.9 (per 1000 students-exposure). Male students had higher injury rates than females did (11.0 vs 8.1 per 1000 students-exposure). The injury rate in badminton was the highest (13.8), whereas futsal had the lowest (7.8). According to gender in each sport, the highest injury rate in males was recorded in badminton (18.2) and in females was basketball (18.2%) (Table 4).

Table 4. Injury rate according to the sport and gender

	Number of students	Number of injury	Exposures	Injury rate (per 1000 student-exposure)
Badminton	26	23	1,664	13.8
Female	8	2	512	3.9
Male	18	21	1,152	18.2
Basketball	21	27	2,016	13.4
Female	4	7	384	18.2
Male	17	20	1,632	12.3

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	Number of students	Number of injury	Exposures	Injury rate (per 1000 student-exposure)
Futsal	30	30	3,840	7.8
Female	10	7	1,280	5.5
Male	20	23	2,560	9.0
Volleyball	23	27	3,312	8.2
Female	14	18	2,016	8.9
Male	9	9	1,296	6.9
Overall	100	107	10,832	9.9
Female	36	34	4,192	8.1
Male	64	73	6,640	11.0

Possible determinant factors for injury were identified. Gender, age, BMI, and type of sport were included as possible determinant variables for injury rate. Binary logistic regression was applied to examine the association between injury incidence and the determinant factors. For statistical purpose, the determinant factors were set into two groups.

Reference value (1.00) was determined for each group; female for gender, age≤20 years, BMI<23 kg/m², and non-contact sports for the type of sport. Logistic regression indicates that gender, age, BMI, and type of sport had no association with incidence of injury (all $p>0.05$) (Table 5).

Table 5. Logistic regression analysis for determinant variables

	Determinant variables	Sport injury (%) Yes	Sport injury (%) No	Adjusted OR (95% CI)	p
Gender	Female	24	12	1.00	0.13
	Male	52	12	2.07 (0.80 - 5.34)	
Age (years)	≤20	50	20	1.00	0.11
	>20	26	4	2.60 (0.80 - 8.41)	
BMI (kg/m2)	<23	42	11	1.00	0.38
	≥23	34	13	0.63 (0.23 - 1.75)	
Type of sport	Non-contact	34	15	1.00	0.31
	Contact	42	9	1.66 (0.62 - 4.44)	

Discussion

The epidemiology of injury has been widely studied. The present study might be the first on the injury rate among college students in Indonesia. Seventy-six students (76%) from four sports suffered from injury with a total injury rate of 9.9 per 1000 students-exposure. Male students had higher injury rates than female students did, with the most dominant injury being ankle sprain. In our study, the injury rate was not affected by age, gender, BMI, or type of sport.

The frequency of injury in this study is high. Several previous studies also reported high injury prevalence among college students. A similar result was reported by Kumar et al. (2014), which found a 73.4% frequency of injury among Indian college students. A higher frequency (80%) of injury was reported by Ayanniyi, Oluwasegun, and Adekanla (2015) among Nigerian college students. Rosa et al. (2014) found a lower frequency (49.9%) of injury among college students in Brazil. Variation in injury prevalence between studies is caused by several factors. Contact or non-contact sport, the level of competition and definition of sport injury are possible factors that could affect the results of injury surveillance.

The present study also reported injury by calculating exposure, according to time or appearances. This type of report can be used to predict the occurrence of injury. The present study reported an injury rate of 9.9 per 1000 S-E. The

highest injury rate was in badminton, which recorded 13.8 per 1000 S-E. Asperti, Fernandes, Pedrinelli, and Hernandez (2017) reported that injury rates among amateur athletes at a Brazilian university to be 13 per 1000 athlete-exposure (A-E). A report from 16 years of the National Collegiate Athletic Association (NCAA) injury surveillance found an injury rate of 13.8 per 1000 athlete-exposure, with football having the highest risk (Hootman, Dick, & Agel, 2007). Factors influencing differences in the prevalence of injuries may also affect the variation in injury rate.

Sprained ankle is the most common injury in this study, accounting for almost 35% of all injuries. This result was similar to those of several previous studies conducted which also found sprained ankle to be the most common injury in some sports, including football, basketball (Drakos, Domb, Starkey, Callahan, & Allen, 2010), futsal (Varkiani, Alizadeh, & Pourkazemi, 2010; Angoorani, Haratian, Mazaherinezhad, & Younespour, 2014; Serrano, Shahidian, Voser, & Leite, 2013) and volleyball (Sattler, 2011; Massada, Aido, Magalhaes, & Puga, 2011; Pimenta, Junior, Neto, & Lope, 2017). In contrast to previous studies, hand and wrist injury, not sprained ankle, was the most frequent injury in volleyball in a recent study. A possible explanation is that most volleyball players in our study were female. They were not high-level athletes, and they play the games in a different way than elite athletes do. They

tend to use their hands more often to hit the ball than the legs to jump. Injury incidence patterns in badminton were also different in a study by Shariff, George, and Ramlan (2009), which found knee injury to be the most frequent. Differences in the level of competition may also be associated with different injury patterns.

Some variables in this study were suspected as determinant factors for sport injury. However, none of the variables were proved to determine the injury occurrence. We observed that sport types with lower-level exposure tend to have higher injury rates. Low exposure level could mean that time for practice or game was low. Low time for practice can reduce muscle performance and, therefore, increase the possibility of injury.

This study also has some limitations. First, the sample size was too small for an injury study. Many students were unable to attend the study because of various reasons. Second, bias in injury rate was present due to retrospective exposure data collection. The students' attendance list was not completely reported. Third, bias in diagnosis due to the absence of additional examination such as ultrasound or x-ray was also present.

Injury surveillance is essential to any institution, body, groups or individuals dealing with sport or exercise activity to develop an injury reduction programme. This study showed that injury frequency and rate among college students were high, with ankle sprain being the most common injury. In this study, gender, age, BMI, and sport type did not contribute to the incidence of injury. The injury reduction strategy should emphasize on the need to increase practice sessions (include strength and conditioning) and reducing ankle sprain. A further study with large sample size in many more colleges is needed to confirm the results and to obtain a complete and comprehensive sport injury report.

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