Prevalence of Training-related Knee Injuries among Jazan University Students with Determining Possible Related Risk Factors

Ramiz J. Moafa [a*], Hassan Mashbari [a], Ezzuddin A. Okmi [b], Marwan Osaili [a], Abdulrahem Shubair [a], Mohammed Arishi [a], Anas Alnami [a], Ahmad Shugairi [a], Ayman Altherwi [a], Abdulaziz Kaal [a], Amirah J. Moafa [a], Abdulrahman Kailani [a], Khaled Khormi [a], Alhassan Alhazemi [a] and Abdulaziz Alhazmi [a]

[a] College of Medicine, Jazan University, Jazan 45142, Saudi Arabia.
[b] Public Health Authority, Riyadh, 13345, Saudi Arabia.

Authors' contributions

This work was carried out in collaboration among all authors. Author writing the first draft: RM, AA and HM. Performing data analysis: Author HM, EO, Editing, reviewing, and revising the manuscript AA. Participating in data analysis, reviewing the manuscript, and contributing to the concept and design of the study Author MO, AS, MA, AA, AS, AA, AK, AM, AK, KK and AA. Supervising the study: Author HM and AA. All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work. All authors read and approved the final manuscript.

Article Information

Original Research Article

ABSTRACT

Background: The articulating surface of the knee is the most commonly injured joint in athletes. However, there is a lack of proper prevalence and determinant estimations for knee injury among Jazan University students.
Materials and Methods: This cross-sectional study aimed to determine the prevalence of knee injury among students at Jazan University, Saudi Arabia and to identify the associated risk factors. An online self-administered modified Arabic version of the Knee Injury and Osteoarthritis Outcome Score questionnaire was distributed to collect data from the students. 884 participants were included and met our inclusion criteria.
Results: The overall prevalence of knee injuries was 18% (n = 156). Ninety-two injuries were due to

_____

*Corresponding author: E-mail: ramizmoafa@gmail.com;

sports activity. Men were 2.7 more likely to have a knee injury than women. Performing 2–3 hours of training every week increased the likelihood of knee injury by 1.7 times more than being inactive or performing only 1 hour of activity per week. An increase in the body mass index was associated with knee injury.

Conclusion: Our study highlights the high prevalence of knee injury among male students with a high body mass index, especially those studying in medical colleges. Further large-scale research is needed to address the limitations of this study and generalize the results to a larger population.

1. INTRODUCTION

The articulating surface of the knee is the greatest of all joints. This weight-bearing joint can support two to five times a person's body weight depending on the activity and is the most commonly injured joint among young athletes [1,2]. Such injury can impair one's quality of life and limit one's ability to compete, work, or perform daily tasks [3]. Knee injuries range from ligamentous to cartilaginous, tendinous, and bony. The major knee ligaments, including the anterior cruciate ligament, are most commonly injured. Both athletes and non-athletes suffer from these injuries; as a rule, non-contact knee injuries are the most common [4-6]. Ligaments, such as the posterior cruciate ligament, lateral collateral ligament, and medial collateral ligament, might also be involved. Furthermore, the medial and lateral menisci, which act as shock absorbers and play a secondary role in joint stabilization, can be ripped or partially implicated in the cartilaginous structure [7]. With growing awareness about the importance of sports health, especially with different types of sporting facilities currently available for the youth to practice various types of sports, the risk of sport-related injuries will increase in this population. There are many risk factors for knee injury, and many previous studies have assessed the risk factors associated with knee injuries [8-18]. However, there is a lack of proper prevalence and determinant estimations for knee injury in Jazan region. Therefore, this study aimed to estimate the prevalence of knee injuries in Jazan University students and to assess the prevalence and risk factors of knee injury among students at Jazan University.

2. METHODS

2.1 Study Design and Participants

This cross-sectional study was conducted at Jazan University, located in Jazan town, southwest of the Kingdom of Saudi Arabia. It has satellite campuses in Jazan, Sabya, Abu Arish, Farasan, Ad-darb, Samtah, Al-Daer, and Al-Ardah. Additionally, it houses more than 56 273 students (men, 21 492; women, 34 793) in 23 faculties.

This study included students from Jazan University who were selected randomly from different colleges. The following inclusion criteria were used: minimum age of 18 years and Jazan University students who provided informed consent. Students with congenital deformities, degenerative disorders, or those who refused to participate were excluded.

The internal consistency and external reliability of the survey were assessed. Internal consistency was conducted using Cronbach's alpha and resulted in values over 0.80. The external reliability was evaluated using test-retest with a score over 0.80. Prior to the distribution of the questionnaire, a pilot sample (n = 20) was used to evaluate the clarity questionnaire items, and answers from this pilot sample were excluded from the analysis.

2.2 Data Collection

Data were collected using an online self-administered modified Arabic version of the Knee Injury and Osteoarthritis Outcome Score questionnaire. The students' data were checked, verified, and entered into a data sheet. The completed questionnaires were reviewed to avoid mistakes.

2.3 Statistical Analysis

Stratified random sampling was used in this study. Jazan University has 23 faculties, of which six were chosen randomly. We used Raosoft sample size calculator (Raosoft Inc., Seattle, WA, USA, www.raosoft.com). We determined that 384 participants were enough to reach a

95% CI and 5% margin of error. However, the sample size was increased to 884 to increase the significance power. The Statistical Package for Social Sciences version 28 software program (IBM Corp.) was used to perform data analysis. Frequency distributions were obtained, and descriptive statistics were calculated. The chi-square test was used to further analyze some associations. Statistical significance was set at P<0.05.

The dependent variables were binominal (Yes or No) to answer the question about the history of knee injuries. The independent variables were either continuous, ordinal, or nominal including the following:

- Age and BMI were continuous
- Activity level was ordinal
- Nominal variables were the following:

- Gender
- Type of college
- How many hours per week do you train?
- Living area
- Do you have a hereditary disease?
- How many hours per week do you train?

3. RESULTS

In total, 884 students responded to the survey (response rate: 97.5%). Most participants were women (Table 1). The overall prevalence of knee injury was 18% (*n*=156). Ninety-two injuries were due to sports activity.

Univariate analysis was performed to determine the association between sociodemographic determinants, participant characteristics, and knee pain (Tables 2 and 3). Among all characteristics, there was a statistically significant association between sex, type of college, level of activity, duration of training, body mass index (BMI), and knee pain (Tables 2 and 3).

We further adjusted the model using multivariate logistic regression. Based on the results, the adjusted odds ratio confirmed that sex, the type of college, level of activity, and duration of training were independent determinants of knee pain. However, the level of activity was not statistically significant. The results also showed that men were 2.7 times more likely to have a knee injury than women. Moreover, performing 2-– hours of training every week increased the likelihood of knee injury by 1.7 times more than being inactive or performing only 1 hour of activity per week. In addition, the number of participants who studied in medical or health colleges was 1.5 times higher than that of participants studying in non-medical colleges. Finally, an increase in the BMI was associated with knee injury (Table 4).

Table 1. General characteristics of the study participants (n=884)

Variable	
Age, years (mean; SD)	22.1:3.25
Male sex, n (%)	428 (48%)
Have you ever had a knee injury? n (%)	
Yes	156 (18%)
No	728 (82%)
Abbreviation: SD, standard deviation.	

Table 2. Association between participants' characteristics and the presence of knee injury

Variable		Have you ever had a knee injury?			
		No	Yes	Chi-square	P-value
Sex	female	417	47	37.53	.000*
	male	320	111		
Type of college	medical	541	102	5.04	.025*
	non-medical	196	56		
Living area	north	276	53	7.18	.127
	south	134	40		
	center	130	24		
	west	138	34		
	east	59	7		

Variable		Have you ever had a knee injury?			
		No	**Yes**	**Chi-square**	**P-value**
Do you have hereditary disease?	yes	44	14	1.78	.182
	no	736	158		
How many hours per week do you train?	0–1 h	427	56	28.60	.000*
	2–3 h	199	61		
	4–6 h	82	27		
	>7 h	29	14		
Activity level	No-sport	250	27	25.06	.000*
	Sometimes	378	88		
	Frequent	88	37		
	Always	21	6		

*The P-value is significant (<.05).
The data are presented as n unless indicated otherwise.

Table 3. Results of univariate analysis for predicting the present of knee injury**

Variable	B	P-value	OR	95% CI	
				Lower	**Upper**
Age	.006	.82	1.01	.956	1.059
BMI	.017	.02*	1.02	1.003	1.032

Abbreviations: B: The B coefficients. OR, odds ratio; CI, confidence interval. *The P-value is significant (<.05).
** Univariate logistic regression

Table 4. Results of the multivariate logistic regression model of whether the participants had knee pain

Variable					95% CI	
		B	**P-value**	**OR**	**Lower**	**Upper**
BMI		.02	.02*	1.02	1.00	1.03
Sex						
	Female (r)			1		
	Male	1.02	<.001*	2.77	1.88	4.10
Activity level						
	No-sport (r)		.51	1		
	Sometimes	.34	.24	1.40	.80	2.45
	Frequent	.41	.31	1.50	.69	3.30
	Always	-.10	.87	.91	.27	3.01
How many hours per week do you train?						
	0–1 h (r)		.14	1		
	2–3 h	.54	.03*	1.72	1.04	2.82
	4–6 h	.60	.09	1.81	.91	3.60
	>7 h	.81	.08	2.25	.90	5.60
Type of college						
	non-medical(r)			1		
	Medical	.42	.04*	1.52	1.03	2.23

Abbreviations: B: The B coefficents OR: odds ratio; CI: confidence interval. (r): reference. h: Hours
* The P-value is significant (<0.05).

4. DISCUSSION

The most common sports-related injuries in United States emergency departments were due to football and basketball [19-22]. A study conducted in Saudi Arabia found that knee injuries were common in 23% of patients. Most of them were injured while participating in sports, particularly soccer, and 68.7% were injured through a non-contact mechanism [8]. This study aimed to measure the prevalence of knee injury among Jazan University students and to identify the associated risk factors. Many factors were included, such as age, sex, the BMI, activity level, and type of college, either medical or non-medical. The prevalence of knee injury was 18%, which is close to another recent study conducted in Riyadh (23%) [8], and it is in the upper limit of that in a systematic review conducted in Australia [18]. The results of the present study showed that male sex, performing 2–3 hours of training every week, studying in one of the medical or health colleges, and having a higher BMI were associated with knee injury. However, area of residency, and hereditary diseases were not independent determinants of knee injury [23]. Although most previous studies showed that women are more likely to have knee injuries than men, our study showed that men were 2.7 more likely to have knee injuries than women. This dissimilarity can be explained by the low exercise rate among women in Saudi Arabia compared to that among men [11] [12] [24]. Strenuous physical activity is a risk factor for knee injuries, as stated in a cross-sectional study conducted at the University of Central Lancashire, Preston, which estimated the prevalence and characteristics of knee injuries in adults. This finding is similar to the result of our study. Performing 2–3 hours of training every week increases the likelihood of knee injury by 1.7 times more than being inactive or performing only 1 hour of activity per week [9]. Furthermore, the present study found that participants with a higher BMI were at a higher risk of knee injury. This result was congruent with the findings of a cross-sectional study conducted in Israel [17]. Previous studies have found that age is a risk factor for knee injury [17]. In contrast, our study showed no statistically significant association between age and knee injury. This finding could be related to the very narrow age range of participants in this study, which did not include the elderly population. The results of the present study indicated that medical and health college students are at a higher risk of knee injury than non-medical college students. However, there was no clear explanation for this association. Many medical and health students are aware of the benefits of physical activity, which may cause them to be more involved in physical activity than other students. The knee joint is one of the largest and most complex joints in the body, and it is one of the most important joints connecting the femur to the tibia. It also plays an essential role in supporting the body's weight and facilitating movement, allowing bending of the knee. Therefore, the results of this study are important for prioritizing health services and identifying the characteristics of patients with knee injuries. Moreover, health care providers must be aware of methods that can decrease the rate of knee injuries, and more attention is needed to prevent the consequences of these injuries.

5. CONCLUSION

Knee injuries are common among university students, with a higher prevalence among male students with a high BMI, especially those studying in medical colleges. Based on these results, the level of awareness and knowledge about knee injuries should be improved among this age group. Further large-scale research is needed to address the limitations of this study and to generalize the results to a larger population.

6. STUDY LIMITATIONS

The generalizability of this study's findings is limited due to the non-probability sampling of the study and the inclusion of only university students. Moreover, participants with knee injuries were more willing to participate than others because they needed to receive more care than others, which may have affected the prevalence of knee injury.

DATA AVAILABILITY STATEMENT

The data presented in this study are available upon request from the corresponding author.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of

knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT AND ETHICS APPROVAL

ACKNOWLEDGMENTS

COMPETING INTERESTS

REFERENCES

1. Louw Q, Grimmer K, Vaughan K. Knee injury patterns among young basketball players in Cape Town. South African J Sports Med. 2003;15:9-15.

2. Clayton RA, Court-Brown CM. The epidemiology of musculoskeletal tendinous and ligamentous injuries. Injury. 2008;39:1338-1344.

3. Kujala UM, Taimela S, Antti-Poika I, Orava S, Tuominen R, Myllynen P. Acute injuries in soccer, ice hockey, volleyball, basketball, judo, and karate: analysis of national registry data. BMJ. 1995;311:1465-1468.

4. Swenson TM, Harner CD. Knee ligament and meniscal injuries. Current concepts. Orthop Clin North Am. 1995;26:529-546.

5. Fu FH, Bennett CH, Lattermann C, Ma CB. Current trends in anterior cruciate ligament reconstruction. Am J Sports Med. 1999;27:821-830.

6. Rahnemai-Azar AA, Yaseen Z, van Eck CF, Irrgang JJ, Fu FH, Musahl V. Increased lateral tibial plateau slope predisposes male college football players to anterior cruciate ligament injury. J Bone Joint Surg. 2016;98:1001-1006.

7. Belzer JP, Cannon WD. Meniscus tears: treatment in the stable and unstable knee. J Am Acad Othop Surg. 1993;1:41-47.

8. Almaawi A, Awwad W, Bamugaddam A, Alasheikh M, Muaddi M, Almutair O, Alomar AZ. Prevalence of knee injuries among male college students in Riyadh, Kingdom of Saudi Arabia. J Orthop Surg Res. 2020;15:1-8.

9. Ibeachu C, Selfe J, Sutton CJ, Dey P. Knee problems are common in young adults and associated with physical activity and not obesity: the findings of a cross-sectional survey in a university cohort. BMC Musculoskelet Disord. 2019;20:1-7.

10. Aslam S, Khan S, Iqbal Y. The Prevalence of Sports Related Knee Joint Injuries among Students of Physical Education. The Shield. 2019;13:27-35.

11. Baugh CM, Weintraub GS, Gregory AJ, Djoko A, Dompier TP, Kerr ZY. Descriptive epidemiology of injuries sustained in National Collegiate Athletic Association men's and women's volleyball, 2013-2014 to 2014-2015. Sports Health. 2018;10(1):60-69.

12. Arendt E, Dick R. Knee injury patterns among men and women in collegiate basketball and soccer: NCAA data and review of literature. The American Journal of Sports Medicine. 1995;23(6):694-701.

13. Murphy DF, Connolly DAJ, Beynnon B. Risk factors for lower extremity injury: a review of the literature. Br J Sports Med. 2003;37:13-29.

14. Ireland, M.L.; Hutchinson, M.R. Upper extremity injuries in young athletes. Clin Sports Med. 1995;14:533-569.

15. Junge T, Runge L, Juul-Kristensen B, Wedderkopp N. Risk factors for knee injuries in children 8-15 years: the CHAMPS-Study DK. Med Sci Sports Exerc. 2015;48:655-662.

16. Davey AP, Vacek PM, Caldwell RA, Slauterbeck JR, Gardner-Morse MG, Tourville TW, Beynnon BD. Risk factors associated with a noncontact anterior cruciate ligament injury to the contralateral knee after unilateral anterior cruciate ligament injury in high school and college female athletes: A Prospective Study. Am J Sports Med. 2019;47:3347-3355.

17. Thein R, Hershkovich O, Gordon B, Burstein G, Tenenbaum S, Derazne E, Tzur D, Shamis A, Afek A, Kreiss Y. The prevalence of cruciate ligament and

meniscus knee injury in young adults and associations with gender, body mass index, and height a large cross-sectional study. J Knee Surg. 2017;30:565-570.

18. Baker ML, Epari DR, Lorenzetti S, Sayers M, Boutellier U, Taylor WR. Risk factors for knee injury in golf: A systematic review. Sports Med. 2017;47:2621-2639.

19. Vad VB, Bhat AL. The athlete with early knee arthritis. Phys Med Rehabil Clin. 2000;11:881-894.

20. Kujala UM, Kettunen J, Paananen H, Aalto T, Battié MC, Impivaara O, Videman T, Sarna S. Knee osteoarthritis in former runners, soccer players, weight lifters, and shooters. Arthritis Rheum. 1993;38: 539-546.

21. Baugh CM, Weintraub GS, Gregory AJ, Djoko A, Dompier TP, Kerr ZY. Descriptive epidemiology of injuries sustained in National Collegiate Athletic Association men's and women's volleyball, 2013-2014 to 2014-2015. Sports Health. 2018;10:60-69.

22. Gray AM, Buford WL. Incidence of patients with knee strain and sprain occurring at sports or recreation venues and presenting to United States emergency departments. J Athl Train. 2015;50:1190-1198.

23. Louw QA, Manilall J, Grimmer KA. Epidemiology of knee injuries among adolescents: a systematic review. Br J Sports Med. 2008;42:2-10.

24. Al-Hazzaa HM. Physical inactivity in Saudi Arabia revisited: A systematic review of inactivity prevalence and perceived barriers to active living. International Journal of Health Sciences. 2018;12(6):50.