www.nclinmed.com
Novelty in Clinical Medicine. 2023; 2(4): 180-186
https://doi.org/10.22034/NCM.2023.406892.1105

Research Article Open Access

Prevalence of sports injuries and related causes among male students aged 7–15 years in Yazd, Iran, 2022

Mohammad Seyedahmadi [*1], **Mohammad Javad Razi** [2], **Hadi Akbari** [3]

[1] Assistant Professor of Sports Injury, Department of Sport Sciences, Velayat University, Iranshahr, Iran
[2] PhD in Sports Biomechanics, Farhangian University of Yazd, Yazd, Iran
[3] Assistant Professor of Athletic Training, Department of Sport Sciences, Faculty of Literature and Humanities, University of Zabol, Zabol, Iran

[*] **Corresponding author:** Mohammad Seyedahmadi, Assistant Professor of Sports Injury, Department of Sport Sciences, Velayat University, Iranshahr, Iran. **Email:** Mseyedahmadi@velayat.ac.ir

Received: 2 August 2023 **Revised:** 4 September 2023 **Accepted:** 8 September 2023 **e-Published:** 30 September 2023

Abstract

Background: Understanding the reasons for injuries in athletes is crucial, and this is particularly important for adolescent athletes since they possess unique physical, motor, and psychological traits requiring special attention.

Objectives: The present study aimed to investigate the frequency of sports injuries and their related causes among male student-athletes participating in the 30th male-student sports festival held across the country.

Methods: This cross-sectional descriptive study included 425 male student-athletes (mean age 12.1±7.82, range 7–15 years) with an athletic history of 3.3±0.18 years, randomly selected from 1927 male student-athletes competing in the four sporting areas. Rope skipping, athletics, swimming, and gymnastics competed at the 30th National Sports Festival for Male Students (Yazd, September 2022). Injury information was collected using the Fuller and colleagues (2006) injury report form.

Results: The results showed that 54% of athletes in track and field, 23.30% in skipping rope, 13.5% in gymnastics, and 9.2% in swimming had a history of sports injuries. The severity of injuries in different sports fields was 83.2% mild, 10.5% moderate, and 6.3% severe. The types of injuries were 54% muscular tendon, 3.32% bone joint, and 7.13% skin. The injured body parts were 44.5% lower limbs, 36.3% upper limbs, and 19.2% trunk and spine. 36% of injuries were due to incorrect exercise movements, 30% were due to inadequate warm-up, 20% were due to insufficient physical preparation, and 14% were due to inappropriate environmental conditions.

Conclusion: The study highlights that sports injuries in Iran occur more frequently due to incorrect exercise movements and inadequate warm-up. It is necessary to provide specialized practical training for teachers and coaches to prevent these incidents and promote safe athletic training practices for adolescent athletes.

Keywords: Athletes, Students, Athletic Injuries, Sports.

Introduction

Sports injuries are a frequent consequence of competitions, resulting in a decrease in exercise and activity levels and requiring specialized and costly medical management. Neglecting injury prevention measures in students may lead to various negative outcomes, such as physical and psychological problems, decreased motivation, missed practical classes, absenteeism, and negative attitudes towards physical education.[1] Despite the existence of numerous studies on this topic in recent years, less attention has been given to investigating sports injuries in students during their participation in school competitions.[2] Nevertheless, sports are considered a primary cause of injury among adolescents in schools, so it is vital to identify and prevent sports injuries in this population, as no systematic approach exists for secondary prevention and treatment within schools.[3] In Europe and North America, sports are one of the primary causes of

injury among those aged 11 to 18, with 62% of injuries occurring in organized sports, 20% in physical education classes, and 18% in unorganized sports.[4-6] The prevention, treatment, and investigation of injuries are crucial for ensuring athletes' participation in competitions.

A study by Murphy et al., on "Risk Factors for Lower Limb Injuries" found that external factors, such as the type of sports shoes, knee pads, competition surface, level of competition, and skill level, have a greater impact on the occurrence of injuries compared to internal factors such as age, gender, previous injuries, insufficient flexibility, muscle strength, balance, and reaction speed.[7] Nelson et al. also reported that the type of sports shoes and unsuitable playing surfaces are key external factors contributing to student injuries in high schools.[8] Moreover, collision injuries, which account for 5.81% of sports injuries, cause significant harm to athletes and force them to withdraw from sports fields during the competition season.[9] Nejati conducted a study among female students on the prevalence of sports injuries and related causes, revealing that the highest injury rates were reported in volleyball (35%), with the most affected body parts being the lower limbs (43%), upper limbs (38%), and trunk and spine (18%).[1] Other studies by Rechel et al. and Ebrahimi Attari et al. also reported high frequencies of sports injuries in futsal competitions and in the lower limbs.[10,11]

Most domestic experts agree that the biggest rate of injuries among sports injuries is related to muscle and tendon injuries, whereas bone injuries have the lowest rate.[1,10,12] In his investigation of sports injury rates, Schmidt discovered that strain was the most common injury.[13] Rezvani identified the lack of equipment and facilities as the cause of injuries.[14] Eliassy attributed it to the failure to use protective equipment,[15] and Zakani stated that improper body warming and fatigue serve as injury-causing factors.[16]

Different statistics on sports injuries in various sports fields among students worldwide have been reported in studies. Although the advancement of science, technology, and sports medicine has gradually lessened the incidence of injuries, differences in culture, player education, research methods, researchers' attitudes, and data collection methods necessitate conducting regional epidemiological studies. This is especially relevant since differences in facilities and standards in various countries give rise to varying frequencies of sports injuries among athletes and the factors affecting them.

As sports activities serve as a foundation for national teams, mostly derived from student and university sports, knowledge of injury prevalence and types during student participation in sports activities is crucial. Awareness of injury frequency and type in each sports field can help identify weaknesses and predict appropriate ways to eliminate or reduce them. In addition, planners can limit or control injury-causing factors by taking the necessary action to reduce student vulnerability.

Objectives

The purpose of this study is to investigate the frequency, causes, and types of sports injuries in male student athletes, particularly in individual fields, as no previous research has been conducted in Iran on this topic.

Methods

This study is a descriptive-sectional study conducted on adolescent boys with a sports history of 3.03±0.18 years in four different sports: track and field, skipping rope, swimming, and gymnastics. The study population was 1927 male student athletes who participated in the 30th Sports Festival of Male Students across the country in Yazd in September 2022. A purposive sample of 425 student athletes from four different sports who completed the informed consent form was selected. The participants ranged in age from 7 to 15 years, with a mean age of 12.7±1.8 years. The inclusion criteria for this study required participants to be male students aged 7 to 15 years who actively participated in skipping rope, wrestling, swimming, or gymnastics activities and had completed the informed consent form. The exclusion criteria consisted of participants outside the specified age range of 7 to 15 years and those who did not complete the informed consent form.

Injury Report Form

The Fuller Injury Report Form from the British Journal of Sports Medicine (2006), which includes information such as injured body parts, type of injury, cause of injury,

and injury severity, was used to collect information on sports injuries.[17] For this study, all relevant information regarding the history of each athlete and sports injuries in male athletes in different sports fields was collected separately to investigate the relationship between the prevalence and type of sport, level of participation, and sports history. The present physician recorded all the information on the injury report form, including the cause and severity of the injury, at the competition site with the assistance of the research team.

Statistical analysis

The continuous variables were expressed as the mean±SD, and the categorical variables were presented as a percentage and frequency. All statistical analyses were performed with SPSS (version 16.0, SPSS Inc, Chicago, IL, USA). A "P-value" less than 0.05 was considered significant.

Ethical considerations

The parents, guardians, or teachers of male students aged 7 to 15 years were provided with comprehensive information on the purpose and procedures of the study, as well as potential risks and benefits, and informed consent was obtained before conducting the research. The study was conducted in accordance with the Declaration of Helsinki. Institutional Review Board approval was obtained.

Results

The study analyzed a total of 1927 male student athletes who took part in the 30th National Student Sports Festival held in Yazd, Iran, in September 2022. The athletes participated in four different sports disciplines, including skipping rope, wrestling, swimming, and gymnastics. Table 1 presents their demographic characteristics, such as age, weight, height, and BMI, for the four sports fields analyzed, i.e., track and field, skipping rope, gymnastics, and swimming.

Results indicate that injuries are prevalent in these four sports, with 54% of track and field athletes, 23.30% of gymnastics athletes, 13.5% of skipping rope athletes, and 9.2% of swimmers having a history of sports injuries. Table 2 provides more information on the prevalence of injuries across different sports fields.

Regarding injury severity, 80% of injuries were considered mild, 10.5% were moderate, and 6.3% were severe [Figure 1]. According to previous research, "mild" injuries kept the athlete away from sports for less than a week, "moderate" injuries kept them away from sports for 8 to 21 days, and "severe" injuries prevented the athlete from practicing sports for more than 22 days.

Data indicate that 54% of the injuries were muscular-tendon injuries (strain, sprain, contusion, muscular hematoma, etc.), 32.30% were bone-joint injuries (fractures and dislocations), and 13.7% were skin injuries (abrasions, lacerations, etc.). Figure 2 presents this information in detail.

Figure 3 shows that 44.5% of the injuries were related to lower limbs, 36.3% were related to upper limbs, and 19.2% were related to the trunk and spine.

Finally, Figure 4 presents the causes of sports injuries, revealing that 36% of injuries were due to incorrect sports movements, 30% were due to a lack of warming up, 20% were due to insufficient physical preparation, and 14% were due to inappropriate environmental conditions.

Overall, the study findings demonstrate the need for preventive measures while participating in sports, especially in individual fields, and provide insights that could help reduce the occurrence and severity of injuries among male student athletes in Iran.

Table 1. The demographic characteristics of students

Sports field	**Age** (year)	**Weight** (Kg)	**Height** (cm)	**BMI** (kg/m^2)
Track and field	12.3±2.3	45.3±5.6	158.2±7.5	18.3±3.2
Skipping rope	11.9±2.6	46.2±3.4	160.2±8.1	17.9±2.5
Gymnastics	12.5±2.1	45.9±4.8	156.2±6.5	18.9±1.8
Swimming	13.1±1.8	50.3±6.2	159.7±4.5	19.7±3.4

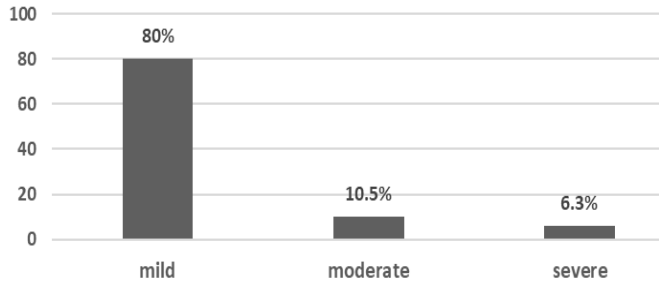

Figure 1. The severity of sports injuries among 4 sports fields

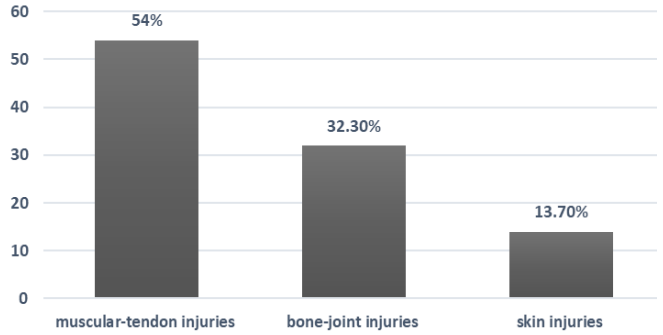

Figure 2. The types of injury in different sports fields

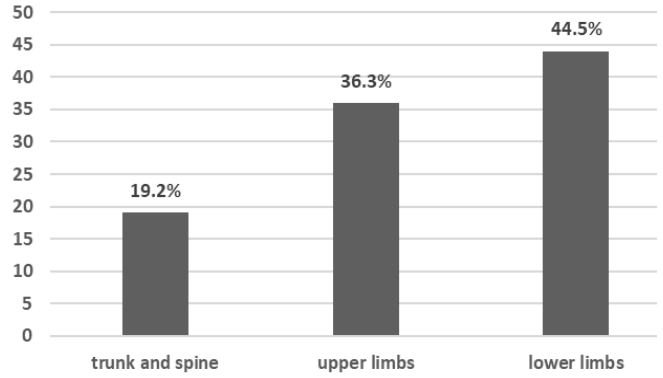

Figure 3. The injured limbs in different sports fields

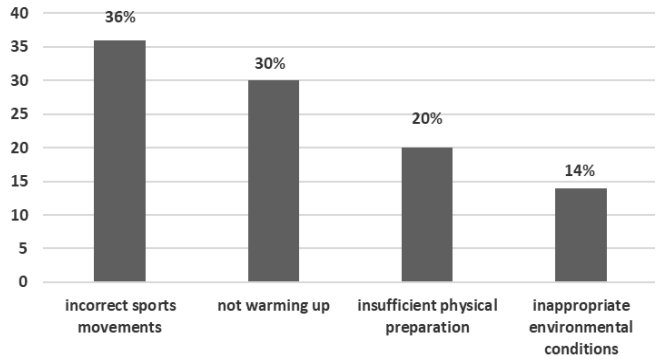

Figure 4. Causes of sports injuries

Table 2. Distribution of the frequency of participating and injured students in 4 sports fields

Sports field	Participant in any field, n (%)	Injured in any field, n (%)
Track and field	115 (27.06)	62 (54)
Gymnastics	98 (23.05)	14 (23.3)
Skipping rope	112 (26.35)	21 (13.5)
Swimming	100 (23.52)	9 (9.2)
Total	425 (100)	106 (100)

Discussion

The aim of this research is to investigate the frequency of sports injuries and their related causes in male student athletes participating in the 30th National Sports Festival for male students (Yazd, Iran, September 2022). The information obtained from this research can help the team staff, especially the medical staff of sports teams, determine the prevention program for injuries.

The research results showed that the highest percentage of injuries are related to track and field. The research findings indicate that track and field have the highest percentage of injuries among the studied sports. This sport is generally associated with a moderate to high prevalence of injuries, particularly among youth athletes. Common injuries in track and field include muscle strains, sprains, stress fractures, and tendinopathies. Factors contributing to the injury risk include repetitive movements, high-intensity training, overuse, inadequate recovery, and technical errors.[18]

Gymnastics, while providing opportunities for strength, flexibility, and coordination development, also carries a higher risk of injury. The sport involves various activities, such as vault, bars, balance beam, and floor exercises, and the prevalence of injuries can be influenced by factors like training level, routine complexity, repetitive stress, and physical demands.[19]

Skipping rope is a lower-impact activity with a lower prevalence of injuries compared to track and field. However, injuries like ankle sprains, shin splints, and knee pains can still occur, especially with improper form, excessive jumping, or pre-existing conditions.

Swimming is considered a low-risk activity for musculoskeletal injuries due to the buoyancy of the water, which reduces joint impact. However, swimming-related

injuries can still happen, including shoulder impingement, swimmer's knee, and overuse injuries due to training volume or technique issues. The prevalence of swimming-related injuries in 7–15-year-old male students may vary based on training intensity, stroke technique, and individual characteristics.[20]

It's important to note that the prevalence of injuries in sports can vary depending on factors such as the specific age group, skill level, training techniques, and environmental conditions. It seems that physical education coaches and teachers should work more systematically, pay attention to the age of the student in teaching movements, and adjust training programs for different ages. Additionally, conditions should be provided for coaches to use more teaching aids during training. Modifying training methods and balancing pressures allows students to continue their sports activities continuously and creates conditions for achieving sports successes.

The results of this study indicate that adolescent sports injuries are mostly minor and are consistent with the results of Nejati's research.[1] It should be noted that such injuries can easily be treated at the time of onset, but if the coach is negligent, these injuries can become chronic, jeopardizing the student's athletic life or even causing the student to withdraw from sports and lose their athletic abilities. The results are consistent with Abernethy et al.'s research, which evaluated the severity of sports injuries among Irish students and showed that most injuries are of mild severity, which is consistent with the present study. Injury severity is defined in three ways: injuries that heal after one week or players return to the game with limitations; moderate injuries that take up to three weeks to heal; and severe injuries that take more than three weeks to heal.[22]

The results showed that the highest rate of injuries were musculoskeletal injuries, and the lowest rate of injuries were skin injuries, which is consistent with the results of many domestic and foreign studies, including Pakravan et al.,[23] ShojaAldin et al.,[24] Ebrahimi Attari et al.[10] The reason for the increased prevalence of this type of injury is related to the superficial placement of muscles in the body, which makes them easily susceptible to collisions with objects and opposing team players, and muscles cover a significant volume of the body. The results do not agree with Nejati's research, which showed a similar percentage of tendon and joint injuries. This discrepancy may be due to a change in the type of sample. In Nejati's study, the sample consisted of girls, and genetic issues may be the reason for the higher percentage of bone injuries in this group.[1]

The research findings have shown that the lower and upper limbs are more prone to injury, which is not unexpected considering the nature of the sports under investigation. The results are consistent with the findings of several researchers, including Rechel et al., Abernethy et al., ShojaAldin et al., and Ebrahimi Atari et al.[10,11,22,24] who introduced the lower limbs as the most vulnerable part of the students' bodies. The research results are also consistent with the findings of Junge et al. and Deitch et al.[25,26] One of the main reasons for this issue, based on scientific principles and direct observation of teachers, is the effect of inappropriate shoes, non-standard ground surfaces, repeated falls, jumping, collisions, tackles, and the failure to use knee and ankle pads, all of which contribute to lower limb injuries, especially in the knee, ankle, shin, and toes.[7] Among the other reasons, the involvement of muscles and joints in the lower body and the nature of the sports under investigation, particularly wrestling and skipping rope, can be mentioned. The research findings are not consistent with those of Knobloch et al. and Nejati.[1,27] They referred to upper limb injuries more than the present study, which may be due to the different nature of the sports under investigation in the two studies. They studied volleyball, basketball, and handball, which require the use of the upper limbs, while the present study was conducted on individual sports. The nature of the sports under investigation is such that the involvement of the upper limbs, physical collisions, sudden jumps, and the like are less prevalent in them.[1,27]

The results of this study indicate that improper exercise movements and inadequate warm-up are the most important causes of injury, which shows that physical education coaches and teachers should pay more attention to these factors. The results are consistent with the findings of Knobloch et al., Nejati, and ShojaAldin et al., who also identified improper exercise movements as the main cause

of injury.[1,24,27] The results contradict the findings of Wong et al.[28] They stated that the most important factor in injury is a lack of sufficient physical readiness. They stated that players who are physically unprepared and unable to respond quickly to collisions with opposing players, as well as those who are not flexible enough to withstand collisions, are at risk of severe injuries. In this study, most of the injured individuals had more than three years of sports experience, and their coaches were among the best coaches at the provincial and national levels, so it cannot be said that insufficient physical readiness and skills are the main cause of injury.[28] In addition, the results do not match the findings of Bennett et al. and Junge et al. They identified collisions and hits from opposing players, which they declared non-traumatic mechanisms, as the most important cause of injuries.[29,30] Considering that the nature of the sports under investigation is individual and collisions occur very rarely, collisions cannot be the main cause of injury. The second cause of injury is inadequate warm-up before the start of the competition, which can result from coaches' lack of precise control during warm-up or players' own shortcomings.

In this study, the focus is limited to male students aged 7 to 15 years, which may restrict the generalizability of the findings to other populations. Additionally, the reliance on self-reported data from participants introduces the possibility of bias. The study's small sample size may limit the statistical power and accuracy of the findings. Furthermore, the study does not include a follow-up period to assess the long-term effects of sports injuries and related causes.

Conclusions

Improper warm-ups and incorrect exercise movements were found to be the major causes of sports injuries in student athletes. This highlights the need for improved sports education and coaching in schools. This study has identified the susceptible body parts to injuries in various sports fields and emphasized the importance of teaching relevant stretching, coordination, and strengthening exercises to athletes in their respective fields. Teachers and coaches should take the following precautions to keep pupils safe: a) educating students about the consequences of incorrect sports movements, b) ensuring a serious and appropriate warm-up program is followed by both physical education teachers and students, c) mandating the use of safety equipment to protect body parts, d) optimizing the physical and environmental conditions of sports activities, such as taking into account weather, geography, facilities and equipment used, e) implementing physical fitness and readiness programs suited for the specific sports field, which will help students be resilient against difficult training conditions or inevitable collisions, f) increasing the knowledge of physical education teachers about sports injuries as well as the physical and biological characteristics of students.

Acknowledgment

The researchers express their gratitude to the athletes, coaches, and sports medicine staff who provided invaluable assistance during the course of this study.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

Fuller Injury Report Form: FIRF

Authors' contributions

All authors read and approved the final manuscript. All authors take responsibility for the integrity of the data and the accuracy of the data analysis.

Funding

None.

Role of the funding source

None.

Availability of data and materials

The data used in this study are available from the corresponding author on request.

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki. Institutional Review Board approval was obtained.

Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

References

1. Nejati V. Prevalence of sports injuries and related causes in female students. Harkat. 2008(35):117-28.
2. Zakani A, Shoja Aldin S. The study of the relationship between prevalence of sport injuries and some injury causing factors among college student free-style top wrestlers of Iran. Res Sports Sci. 2006;3(9):87-104.
3. Zolfaghari R. Prevalence and causes of freestyle wrestling injuries among elite high school athletes in Mashhad: University of Tehran; 1997.
4. Gratz RR. School injuries: what we know, what we need. J Pediatr Health Care. 1992;6(5):256-62. doi:10.1016/0891-5245(92)90024-X PMid:1403570
5. Gharakhanlou R, Daneshmandi H, Alizadeh MH. Prevention and Treatmentof Sports Injuries. Tehran: Sports Sciences Research Institute of Iran; 2021. 656 p.
6. Taylor BL, Attia MW. Sports-related injuries in children. Acad Emerg Med. 2000;7(12):1376-82. doi:10.1111/j.1553-2712.2000.tb00495.x PMid:11099428
7. Murphy D, Connolly D, Beynnon B. Risk factors for lower extremity injury: a review of the literature. Br J Sports Med. 2003; 37(1):13-29. doi:10.1136/bjsm.37.1.13 PMid:12547739 PMCid:PMC1724594
8. Nielsen RO, Rønnow L, Rasmussen S, M Lind. A prospective study on time to recovery in 254 injured novice runners. PLoS one. 2014;9(6): e99877. doi:10.1371/journal.pone.0099877
9. Jenkins WL, Raedeke SG. Lower-extremity overuse injury and use of foot orthotic devices in women's basketball. J Am Podiatr Med Assoc. 2006;96(5):408-12. doi:10.7547/0960408 PMid:16988170
10. Ebrahimi Atri A, Hashemi Javaheri SAA, Kushki H, Ahmadi M, Mahmudi A. Frequency of sports injuries and related factors in male students participating in the athletic sports olympiad 2010 of Khorasan Razavi province, Iran. J Sabzevar Univ Med Sci. 2012;19 (2):198-205.
11. Rechel JA, Yard EE, Comstock RD. An epidemiologic comparison of high school sports injuries sustained in practice and competition. J Athl Train. 2008;43(2):197-204. doi:10.4085/1062-6050-43.2.197 PMid:18345346 PMCid:PMC2267335
12. Seyedahmadi M, Samadi H. The prevalence of sports injuries and associated factors among male students. Int J Basic Sci Appl Res. 2014; 3(1):7-11.
13. Schmidt K. Sport injuries in adolescents. J Med Sci. 1990;18:312-21.
14. Rezvani MH. Investigating the prevalence and causes of various sports injuries in high schools in Shahroud Student: University of Tehran; 1996.
15. Eliassy Q. Determining and describing sports injuries in football: University of Isfahan; 1998.
16. Zakani A. Frequency of sports injuries among Iranian elite track and field wrestlers: Islamic Azad University, Central Tehran Branch; 1996.
17. Fuller CW, Ekstrand J, Junge A, Andersen TE, Bahr R, Dvorak J, et al. Consensus statement on injury definitions and data collection procedures in studies of football (soccer) injuries. Scand J Med Sci Sports. 2006;16 (2): 83-92. doi:10.1111/j.1600-0838.2006.00528.x PMid:16533346
18. Tyflidis A, Kipreos G, Tripolitsioti A, Stergioulas A. Epidemiology of track & field injuries: a one year experience in athletic schools. Biol Sport. 2012;29(4):291-5. doi:10.5604/20831862.1019885
19. Campbell RA, Bradshaw EJ, Ball NB, Pease DL, Spratford W. Injury epidemiology and risk factors in competitive artistic gymnasts: a systematic review. Br J Sports Med. 2019;53(17): 1056-69. doi:10.1136/bjsports-2018-099547 PMid:30670379
20. Mountjoy M, Junge A, Alonso JM, Engebretsen L, Dragan I, Gerrard D, et al. Sports injuries and illnesses in the 2009 FINA World Championships (Aquatics). Br J Sports Med. 2010; 44(7): 522-7. doi:10.1136/bjsm.2010.071720 PMid:20460256
21. Gessel LM, Fields SK, Collins CL, Dick RW, Comstock RD. Concussions among United States high school and collegiate athletes. J Athl Train. 2007;42(4):495.
22. Abernethy L, MacAuley D, McNally O, McCann S. Immediate care of school sport injury. Inj Prev. 2003;9(3):270-3. doi:10.1136/ip.9.3.270 PMid:12966020 PMCid:PMC1730995
23. Pakravan M, Saheb Al-Zamani M, Ghahreman Tabrizi K. Investigating the prevalence and causes of sports injuries in physical education students. Stud Sports Med. 2009;3:81-94.
24. ShojaAldin SSAD, Alizadeh Mohammad H, Moradi M. The investigation of relationship between prevalence of sport injuries and some injury causing among athlete male students in Payame Noor University. Res Sports Sci. 2008; 6(19):71-83.
25. Deitch JR, Starkey C, Walters SL, Moseley JB. Injury risk in professional basketball players: a comparison of Women's National Basketball Association and National Basketball Association athletes. Am J Sports Med. 2006;34(7):1077-83. doi:10.1177/0363546505285383 PMid:16493173
26. Junge A, Langevoort G, Pipe A, Peytavin A, Wong F, Mountjoy M, et al. Injuries in team sport tournaments during the 2004 Olympic Games. Am J Sports Med. 2006;34(4):565-76. doi:10.1177/0363546505281807 PMid:16303876
27. Knobloch K, Rossner D, Gössling T, Richter M, Krettek C. Volleyball sport school injuries. Sportverletzung Sportschaden: Organ der Gesellschaft fur Orthopadisch-Traumatologische Sportmedizin. 2004;18(4):185-9. doi:10.1055/s-2004-813481 PMid:15592981
28. Wong P, Hong Y. Soccer injury in the lower extremities. Br J Sports Med. 2005;39(8):473-82. doi:10.1136/bjsm.2004.015511 PMid:16046325 PMCid:PMC1725275
29. Bennett P, Fawcett L. Trauma injuries sustained by female footballers. Trauma. 2006;8(2):69-76. doi:10.1177/1460408606072682
30. Junge A, Dvorak J. Injuries in female football players in top-level international tournaments. Br J Sports Med. 2007; 41 (suppl 1):i3-i7. doi:10.1136/bjsm.2007.036020 PMid:17646248 PMCid:PMC2465250

Cite this article as:
Mohammad Seyedahmadi M, Razi MJ, Akbari H. Prevalence of sports injuries and related causes among male students aged 7–15 years in Yazd, Iran, 2022. Novel Clin Med. 2023;2 (4):180-186. doi: 10.22034/NCM.2023.406892.1105