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# Environmental factors and sports injuries in Indian elite university wrestlers

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**Abstract**
This Research investigates the connection between environmental variables and athletic injuries among India's top collegiate wrestlers. It explores how environmental factors including training facilities, equipment quality, weather, and geographic location affect the frequency and severity of injuries in this athletic population through a thorough assessment of the literature and empirical study. The elite wrestlers from the All-India Inter-University Wrestling Competition in November 2022 were the subject of the retrospective study that is being conducted. Using a well-structured injury report form, the researchers gathered daily training and match-play injury data. Common injuries, anatomical body location, injury severity, and risk factors (cause of injury) are all listed on the injury report form. Two dimensions comprise the risk variables: external risk factors and intrinsic risk factors. The degree of the injury determined by how much time was missed from practice and competition as a result of sports-related injuries The India University Wrestling Championship had an incidence rate (IR) of 71.08 per 1012 hours, an epidemiologic incidence proportion (IP) of 0.131, and a clinical incidence of 0.511. The average number of days lost from training and competition due to injury severity was 91.06. The results provide important new information for improving training conditions and ensuring the safety of India's top wrestlers by illuminating the complex interactions between environmental factors and injury risk.

**Keywords:** Environmental, sports injuries, Indian, elite, injury risks, wrestler

## Introduction
Sports-related injuries pose serious problems for athletes' performance as well as their general health and ability to continue playing sports for a long time. These injuries are a major worry in athletic communities around the world. Athletes' training experiences and vulnerability to injury are shaped by environmental factors, which are among the many factors influencing the frequency and severity of sports injuries. The influence of environmental factors on injury rates in the context of Indian elite university wrestlers is still a comparatively unexplored field of study. Comprehending these dynamics is crucial for formulating focused strategies to prevent injuries and refining training environments to improve athlete performance and safety.

India has a long history of wrestling, going back several centuries, and its varied areas continue to produce a number of gifted wrestlers. University-level wrestling programs are essential breeding grounds for developing this potential pool because they provide athletes with demanding training schedules and competitive chances. But in addition to striving for greatness, these athletes deal with a variety of environmental issues that could put them at risk for sports-related injuries. Among Indian best university wrestlers, factors including the caliber of training facilities, equipment standards, climate, and geography can have a big impact on injury risk and recovery results.

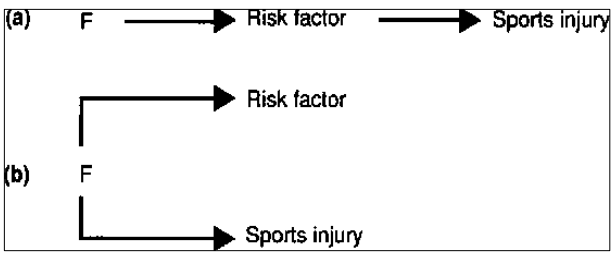


**Fig 1:** Sports Injury Incidence, Severity, Etiology, and Prevention

Studies that concentrate only on Indian wrestling environments are rare, despite the increasing awareness of the significance of environmental elements in sports injury research. The majority of the material now in publication is based on studies done in Western environments, which might not adequately represent the particular difficulties and dynamics faced by Indian athletes. Consequently, to clarify the complex interactions between environmental factors and sports injuries among elite university wrestlers, empirical studies adapted to the Indian setting are desperately needed. By conducting a thorough analysis of environmental factors and sports injuries among Indian elite university wrestlers, this study aims to close this gap in the literature. Through the use of a mixed-methods approach that includes quantitative surveys, qualitative interviews, and injury record analysis, our goal is to obtain a comprehensive understanding of the environmental factors that contribute to sports injuries in this population. We will specifically investigate the effects of variables on injury incidence, severity, and recurrence, including training facility infrastructure, equipment quality, weather, and geographic location.


**Fig 2:** Sports Injuries

### 1.1 Training Facility Infrastructure

Elite athletes' training experiences and safety are greatly influenced by the standard and sufficiency of wrestling facilities at Indian institutions. Evaluating these amenities is a complex process that takes into account a number of important aspects. First off, the quality of training sessions and wrestlers' overall readiness are greatly impacted by the availability and state of basic resources like wrestling mats, rings, and strength training equipment. Properly maintained and adequate equipment not only improves performance but also lowers the possibility of injuries from defective or subpar equipment. In addition, training facility structure and design are important factors to take into account while preventing injuries. A safer training environment can be produced by facilities that are arranged and designed with wrestling activities in mind, hence reducing potential hazards. Considerations like the distance between training zones, the ease of access to emergency exits, and adequate ventilation are crucial elements that demand close consideration. Stakeholders can implement measures to optimize the training environment for elite wrestlers and promote athlete safety and performance excellence by thoroughly examining the quality, availability, and design of wrestling training facilities in Indian universities.

### 1.2 Equipment Quality and Maintenance

In order to guarantee athlete safety and peak performance, wrestling equipment quality and maintenance procedures must be assessed. This evaluation covers a number of topics, such as the maintenance and standards for safety equipment, footwear, and training clothes. Wrestlers' capacity to train and compete efficiently might be negatively impacted by the danger of injury posed by subpar or poorly suited equipment. Establishing regular inspection and maintenance processes, prioritizing high-quality equipment, and putting in place strong procurement procedures are all necessary to meet this issue. Investing in high-quality equipment and implementing strict maintenance guidelines can help stakeholders reduce the risk of injuries and give athletes the tools they need to perform well in training and competition.

## 2. Review of Literature

Al, S. A. Z. H. M., Bahadli, P., & Al-Tamimi, A. F. A. (2022) [1] This study examines the effects on young and

experienced wrestlers competing in both Free and Roman wrestling styles using a particular rehabilitation program that targets the rhomboid muscles and fibrous strains. This study investigates how well the rehabilitation program works for shoulder injuries that are frequently sustained by wrestlers, especially for athletes who practice and compete at high intensities. The study offers important insights into potential tactics for injury prevention and rehabilitation catered to the particular demands of wrestling by concentrating on a focused muscle group that is prone to damage.

Arbo, G. D., Brems, C., & Tasker, T. E. (2020) [2]. This study explores how yoga can help reduce the risk factors for sports-related injuries, providing a comprehensive strategy for injury avoidance and athlete health. By means of a methodical examination of existing literature and empirical investigation, the research delves into the physiological and psychological advantages of integrating yoga techniques into athletes' training plans. Yoga shows promise as an addition to traditional training methods by addressing aspects including flexibility, strength, balance, and mental toughness. It can potentially lower the risk of injury and improve physical performance in a variety of sports, including wrestling.

Bell, J., Duke, M., Travis, E., & Jones, A. (2023) [3]. This retrospective study sheds light on the epidemiology of sports injuries in this demographic by examining injury incidence and prevalence among a sample of British wrestlers. With the use of statistical modeling and in-depth data analysis, the study offers insightful information about the kinds, origins, and prevalence of injuries wrestlers suffer during practice and competition. The study helps shape focused injury prevention methods and emphasizes the significance of thorough injury surveillance and management protocols in preserving wrestlers' optimal performance and health by identifying prevalent injury patterns and risk variables.

Besnier, N., Guinness, D., Hann, M., & Kovač, U. (2018) [4] This qualitative study, which focuses on Senegalese wrestlers, Fijian rugby players, and Cameroonian football players, critically investigates how masculinity is constructed among athletes in the setting of neoliberalism. The authors investigate how neoliberal ideals interact with cultural norms and athletic practices to influence athletes' identities, behaviors, and experiences through ethnographic research and in-depth interviews. Through a comparative analysis of the football, rugby, and wrestling athletic cultures in various cultural and socioeconomic situations, this study provides valuable insights into the intricate relationships between gender, power, and globalization within the sports industry. It calls into question accepted notions of masculinity and emphasizes the need for more sophisticated methods of gender analysis in the field of sports studies.

Pagdilao, C., Makovicka, J. L., & Chhabra, A. (2021) [5] The prevalence and features of spine injuries among male collegiate wrestlers competing in National Collegiate Athletic Association (NCAA) competitions are examined in this epidemiological study. In order to determine patterns, risk factors, and mechanisms underlying spine injuries in wrestling, researchers retrospectively analyze injury data gathered over a predetermined period of time. The results offer important new information about the incidence rates, anatomical locations, and severity ranges of spine injuries associated with wrestling. Through the clarification of the epidemiological profile of spine injuries in collegiate wrestling, this study contributes to the development of focused injury prevention plans, clinical management plans, and policy initiatives that protect athletes' health and welfare in this high-risk sport.

## 3. Research Methodology

The goal of the current study was to identify the risk variables and examine the injury profile of elite Indian wrestlers competing in the All Indian Inter University Championship at Maharishi Dayanand University in Rohtak.

### 3.1 Research Design

This study examined the elite wrestlers from the All-India Inter-University Wrestling Competition that took place at Maharishi Dayanand University in Rohtak in November 2022. During tournaments, injury data was gathered within a specific time frame.

### 3.2 Selection of the Sample

The focus of the current study was restricted to Indian university wrestlers. Thus, a sample of the individuals who competed in the All India Inter University Wrestling Championship was chosen. The same amount of people participated in each sample. The sample that was chosen included ages ranging from 18 to 25.

### 3.3 Selection of the Variables

The choice of variables is a crucial factor in the field of sports injuries. The researcher used an organized injury report form to gather daily training and match-play injury data. Common injuries, anatomical body location, injury severity, and risk factors (cause of injury) are all listed on the injury report form. There are two types of risk factors: external risk factors and intrinsic risk factors. The degree of the injury determined by how much time was missed from practice and competition as a result of sports-related injuries. In addition, the clinical incidence rate, epidemiologic incidence proportion (IP), and injury incidence rate were evaluated. In sports injury epidemiology, measures of incidence must always be accompanied by confidence intervals (CIs). The 95% confidence interval is typically interpreted as follows: The true incidence in the population would be contained in 95 of the 100 CIs if a particular study were hypothetically repeated 100 times and 100 CIs were calculated from those studies. Study size and confidence intervals are connected. Larger studies have narrower CIs (greater precision), while smaller studies typically have wide CIs (less precision). Naturally, the CI is also impacted by the rate's inherent fluctuation.

P values and confidence intervals are strongly correlated. Let's say a researcher wanted to see if there were any differences in injury rates between two sports. Alternatively, the 95% CIs for the rates might be compared, or a P value could be used. In general, the P value for determining whether the rates are different will be statistically significant at the 5% level if the 95% confidence intervals do not overlap.

Because confidence intervals provide more information than P values alone, they are more valuable than P values alone. A CI is a range, but a P value is only one number. Stated differently, P values combine the study size and study effect into a single overall measure, whereas CIs distinguish

between the study size (width of the interval) and the study effect size (rate).

**3.3.1 Injury Definitions:** "An injury prohibiting a player from participating fully in training or match play for a period of greater than 24 hours from midnight at the end of the day the injury was sustained" was the definition of an injury. "The number of days that had elapsed between the day the injury was sustained until the player returns to full training and availability for match-play selection" was the reported definition of injury severity. "An injury of the same type and at the same site as an index injury and which occurs after a player's return to full participation from the index injury" was the definition given for a recurrent injury.
Training exposure was described as "individual and team-based physical activities that are intended to maintain or improve a player's physical conditioning or wrestling skills under the supervision of the team's coaching and fitness staff."

**3.4 Statistical Technique:** The term "incidence" describes the quantity of new injury cases that occur during a given time frame. Although rates and risks are two different approaches to measure the incidence of sports injuries, many individuals mistakenly believe that rates and risks are the same thing. Three metrics of incidence were utilized in this study: the clinical incidence, the incidence rate (IR), and the epidemiologic incidence proportion (IP). While the clinical incidence is a better indicator of resource usage, the epidemiologic IP is defined as the average risk of injury per athlete and the IR as the incidence of injury per unit of athlete time. The injury severity is expressed as the mean number of days lost with a 95% confidence interval, and the incidence rate is expressed as the rate per 1000 players exposed with a 95% confidence range.

## 4. Data Analysis and Result

The subject features of the chosen examples are displayed in table 1.

**Table 1:** Descriptive Statistics

| Variable | N | Mean | Std. Deviation | SE | Minimum | Maximum |
|---|---|---|---|---|---|---|
| Age | 50 | 21.7141 | 2.91251 | 0.528 | 20 | 30 |
| Height | 50 | 181.9121 | 13.48251 | 3.85 | 151.49 | 201.81 |
| Weight | 50 | 83.5142 | 19.25184 | 4.59 | 60 | 150 |
| Experience | 50 | 6.658 | 3.58921 | 0.612 | 3 | 20 |

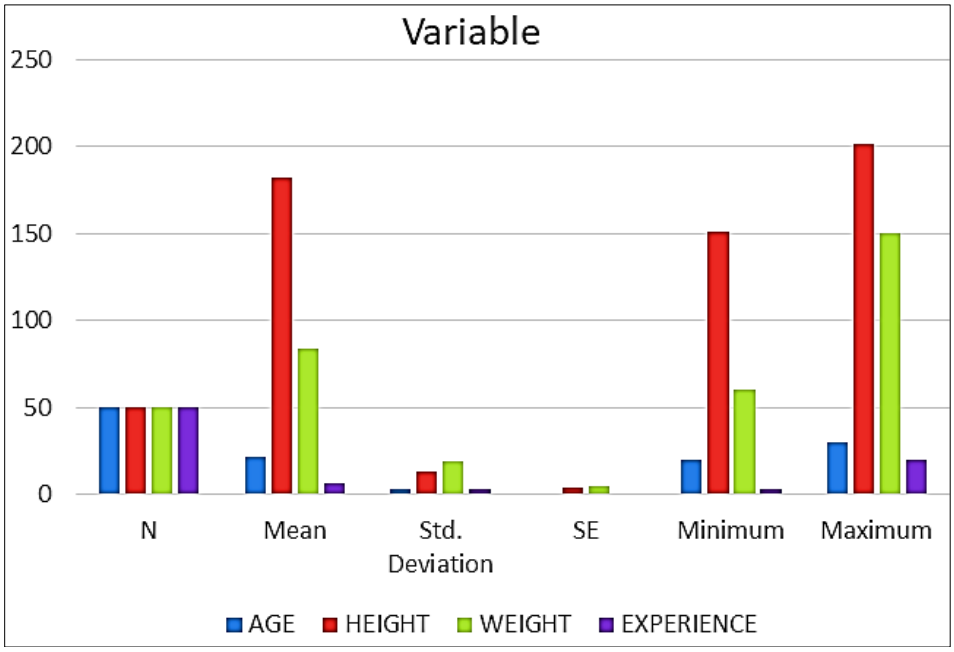


**Fig 3:** Graphical Representation on Descriptive Statistics

The information presented sheds light on four important variables: age, height, weight, and experience, and provides information about the characteristics of a sample population. With a standard deviation of 2.91 and an average age of roughly 21.71 years, this sample of 50 people shows a somewhat narrow distribution around the mean. The ages in the sample vary from 20 to 30 years old, indicating a varied but mostly youthful population.
With a standard deviation of 13.48 and an average height of roughly 181.91 centimeters, the sample appears to have considerable diversity in height. The respondents' heights ranged widely, with the lowest recorded height being 151.49 centimeters and the highest being 201.81 cm. This heterogeneity may be the result of various factors, including variations in nutrition and environmental impacts, or genetic diversity. The sample population's average weight is roughly 83.51 kg, with a standard deviation of 19.25 kg, indicating a significant amount of weight distribution diversity. The weight ranges from 60 to 150 kg, which may indicate that respondents had varying degrees of physical fitness and training regimes in addition to different body compositions. The data also provides information on the experience levels of the participants, with an average of roughly 6.66 years in the relevant field. The sample's wide range of experience levels is indicated by the standard deviation of 3.59. A relatively rookie subgroup is indicated by the minimum

experience level of 3 years, while a more seasoned group with substantial knowledge in the topic under examination is suggested by the maximum experience level of 20 years.

**Table 2:** Incidence measures estimated with 95% Confidence Intervals.

| Incidence Measure | Estimated Value | SE | 95% Confidence Interval |
|---|---|---|---|
| Incidence Rate (IR) | 71.08 | 0.010 | (51,40, 81.76) |
| Epidemiology Incidence Proportion (IP) | 0.135 | 0.825 | (2.41, 2.51) |
| Clinical Incidence | 0.511 | 0.314 | (0.09, 0.91) |

The calculated incidence measures, standard errors (SE), and 95% confidence ranges are shown in the table. First off, the computed Incidence Rate (IR) is roughly 71.08, meaning that for every 1000 athlete exposures, there are roughly 71.08 injuries. For this estimate, the standard error is 0.010. We may be 95% confident that the genuine incidence rate lies within the range of the 95% confidence interval for the incidence rate, which spans from 51.40 to 81.76.

Second, an estimated 0.135 Epidemiology Incidence Proportion (IP) with a 0.825 standard error is reported. This implies that the population's athletes have suffered an injury at a rate of about 13.5%. The high standard error, however, suggests that there is a great deal of ambiguity surrounding this estimate. The Epidemiology Incidence Proportion's 95% confidence interval, which spans from 2.41 to 2.51, is not practically significant and could point to problems with the estimating procedure. Finally, a calculation yields a Clinical Incidence of 0.511 with a standard error of 0.314. This suggests that 51.1% or thereabouts of athletes have sustained a serious injury. The clinical incidence's 95% confidence interval, which spans from 0.09 to 0.91, shows significant uncertainty in the estimate because to the large interval.

**Table 3:** Ranking of injuries based on time lost in days and distribution of injuries' severity and incidence

| Injury Type | N | % | Incidence Rate (IR) | Severity Rank* |
|---|---|---|---|---|
| Abrasion | 5 | 7.2 | 5.071 | 15 |
| Contusion | 8 | 15.71 | 8.15 | 12 |
| Incision | 8 | 12.75 | 8.18 | 10 |
| Dislocation | 7 | 10.08 | 7.10 | 5 |
| Fracture | 10 | 14.71 | 10.18 | 2 |
| Jerk | 6 | 8.61 | 9.12 | 8 |
| Ligament rupture | 5 | 7.5 | 5.18 | 3 |
| Inflammation | 3 | 2.7 | 5.12 | 6 |
| Muscle cramp | 3 | 4.05 | 6.08 | 15 |
| Muscle pull | 5 | 7.3 | 5.071 | 9 |
| Pain | 6 | 8.68 | 6.10 | 12 |
| Sprain | 8 | 11.75 | 8.18 | 5 |
| Strain | 3 | 4.05 | 6.05 | 15 |
| Wound | 4 | 5.62 | 4.08 | 7 |

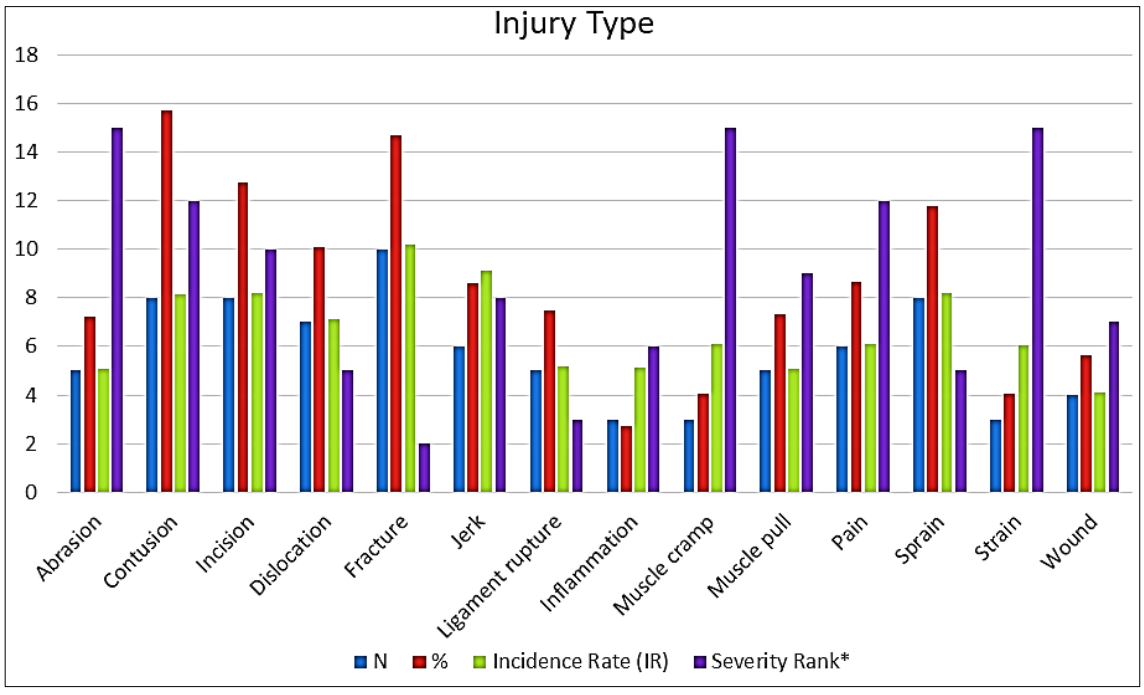


**Fig 4:** Graphical Representation on Ranking of injuries based on time lost in days and distribution of injuries' severity and incidence

The table gives a thorough summary of all the different kinds of injuries that have been seen, including information on their frequency, percentage of occurrence, incidence rate (per 1000 athlete exposures), and severity ranking. At 10 cases, or 14.71% of all reported injuries, fractures were the most common type of injury among those that were recorded. Additionally, fractures had a relatively high severity score of 2, indicating that they had a major effect on the athletes who were impacted.

With 8 cases each, contusions and sprains came in second and third, accounting for 15.71% and 11.75% of all injuries, respectively. Although sprains were less common than contusions, both types of injuries received moderate severity ratings (12 and 5, respectively). Moreover, dislocations and ligament tears were noteworthy, each with seven cases. These injuries had greater severity rankings of 5 and 3, despite their comparatively lower frequency, highlighting their potential influence on the health of athletes. There were five to six documented cases of intermediate frequency abrasions, incisions, and jerks, with differing severity ratings. At three to five instances each, inflammation, aches, strains, muscular pulls, cramps, and wounds were less frequent. Even though these injuries are less common, they could still be important to pay attention to because they can impair sports performance and require medical attention.

**Table 4:** Assignment of Causes, Extrinsic and Intrinsic

| S. No | Intrinsic Cause | N | N* | Fr. (%) | IR | Extrinsic Cause | N | N* | Fr. (%) | IR |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Diet | 20 | 25 | - | - | Bare foot | 20 | 50 | - | - |
| 2 | Fatigue | 20 | 25 | - | - | Carelessness | 20 | 50 | - | - |
| 3 | Fitness | 20 | 25 | 5 (20.06) | 5.07 | Climatic condition | 20 | 50 | 2(6) | 2.04 |
| 4 | Improper training | 20 | 25 | - | - | Collision | 20 | 50 | 12(51) | 12.18 |
| 5 | Improper warming up | 20 | 25 | 2 (5.81) | 2.03 | Competition | 20 | 50 | 3(10) | 3.05 |
| 6 | Jerk | 20 | 25 | 3(10.66) | 3.05 | Drugs | 20 | 50 | - | - |
| 7 | Mentally disturb | 20 | 25 | - | - | Fall or slip | 20 | 50 | 5(18) | 5.08 |
| 8 | Over loading | 20 | 25 | 3(10.65) | 3.05 | Faulty equipment | 20 | 50 | - | - |
| 9 | Over stretching | 20 | 25 | 4(15.32) | 3.04 | Field/playground | 20 | 50 | 3(9) | 3.05 |
| 10 | Over training | 20 | 25 | - | - | Grip | 20 | 50 | 2(5) | 2.02 |
| 11 | Twist | 20 | 25 | 9(41.10) | 9.18 | Poor technique | 20 | 50 | - | - |
| 12 | Unknown | 20 | 25 | 2(5.81) | 2.03 | Unknown | 20 | 50 | 5(18) | 5.08 |

The information provided provides a thorough analysis of the differences between extrinsic and intrinsic factors that contribute to injuries, most often in the setting of sports or physical exercise. Whereas extrinsic causes result from external variables like the surroundings, the caliber of the equipment, or social interactions, intrinsic causes are characteristics that are unique to the individual, such as fitness level, training, and mental state. The analysis makes it easier to comprehend the different aspects that contribute to injuries by grouping the reasons into these two main categories.

The frequency (N), normalized frequency (N*), frequency percentage (Fr. (%)), and injury rate (IR) of each cause are included. While normalized frequency offers a way to compare several causes, frequency shows the exact number of occurrences for each cause. While injury rate most likely represents the rate at which injuries occur owing to each cause, maybe measured per unit of time or exposure, frequency percentage provides insight into the proportion of injuries ascribed to each cause relative to the overall number of injuries. Upon closer inspection, a few particular causes become apparent. For example, fitness levels are found to be a major risk factor for injuries, highlighting the significance of appropriate physical training in attempts to prevent injuries. Furthermore, the high proportion of injuries and high frequency of injuries linked to twisting motions demonstrate the severity and frequency of injuries brought on by these actions. On the other hand, although less common, factors like inadequate warm-up and defective equipment still need to be taken into consideration because they can result in injuries, but not as severely.

Unknown causes in both the intrinsic and extrinsic categories point to areas that may require more research or better data gathering techniques due to gaps in knowledge or documentation. Researchers and practitioners can improve injury prevention techniques to more effectively target the underlying causes of injuries and lower their incidence by identifying and filling in these gaps. This comparison analysis provides insightful information about how sports injuries are multifactorial. It assists in the creation of customized preventative strategies that take into account various elements by determining the relative contributions of intrinsic and extrinsic causes. These tactics could involve enhancing technique and physical conditioning to lessen intrinsic risks as well as putting policies in place to deal with environmental dangers and guarantee equipment safety to lessen extrinsic risks. In the end, a thorough approach to injury prevention that is guided by the knowledge gained from this research has the power to dramatically reduce injury rates and encourage safer engagement in physical activity and sports.

## 5. Conclusion

An in-depth grasp of the complex dynamics of injury incidence is provided by the study of environmental factors and sports injuries among top Indian university wrestlers participating in the Maharishi Dayanand University in Rohtak's All Indian Inter University Championship. The study outlines the various features of the sample population by carefully examining factors, injury definitions, and statistical methods; it particularly emphasizes fractures as the most frequent and serious injuries. Fitness levels and twisting motions are the main risk variables when causes are divided into intrinsic and extrinsic components. This highlights the importance of physical conditioning and technique training in preventing injuries. Even if they are less common, elements like improper warm-up and defective equipment nevertheless significantly increase the risk of injury and call for focused treatments. The discovery of unidentified causes indicates knowledge gaps, which motivates requests for more investigation and enhanced techniques for gathering data. The study promotes a

comprehensive strategy for lowering injury incidence and encouraging safer sports participation among elite athletes by filling in these gaps and improving injury prevention techniques to take into account both internal and extrinsic factors.

## References


1. Al SAZH M, Bahadli P, Al-Tamimi AFA. Effect of a rehabilitation program for rhomboid muscles and fibrous strain on young and senior wrestlers (freestyle and Greco-Roman). [Journal details not provided]. 2022.
2. Arbo GD, Brems C, Tasker TE. Mitigating the antecedents of sports-related injury through yoga. Int J Yoga. 2020;13(2):120-129.
3. Bell J, Duke M, Travis E, Jones A. Injury incidence and prevalence in a sample of wrestlers based in Britain: a retrospective study. J Elite Sport Perform. 2023;3(1):1-13.
4. Besnier N, Guinness D, Hann M, Kovač U. Rethinking masculinity in the neoliberal order: Cameroonian footballers, Fijian rugby players, and Senegalese wrestlers. Comp Stud Soc Hist. 2018;60(4):839-872.
5. Brinkman JC, Tummala SV, McQuivey KS, Hassebrock JD, Pagdilao C, Makovicka JL, Chhabra A. Epidemiology of spine injuries in National Collegiate Athletic Association men's wrestling athletes. Orthop J Sports Med. 2021;9(9):23259671211032007.
6. Eskandari E, Zolaktaf V. Prevalence and likely causes of injuries in amateur Greco-Roman wrestlers. J Res Rehabil Sci. 2018;14(3):160-167.
7. Hassebrock JD, Patel KA, Makovicka JL, Chung AS, Tummala SV, Hydrick TC, et al. Elbow injuries in National Collegiate Athletic Association athletes: a five-season epidemiological study. Orthop J Sports Med. 2019;7(8):2325967119861959.
8. Hope JMV, Sane JC, Diao S, Sy MH. Spinal cord injury due to cervical disc herniation without bony involvement caused by wrestling: a case report. J Orthop Case Rep. 2019;9(1):19-22.
9. Karaman ME, Arslan C, Kinaci AE. Effect of a single bout of competitive training on muscle damage and liver enzymes in university student wrestling and taekwondo athletes. J Pharm Res Int. 2021;33(17):26-30.
10. Molnár S, Hunya Z, Pavlik A, Bozsik A, Shadgan B, Maffulli N. SLAP lesion and injury of the proximal portion of the long head of the biceps tendon in elite amateur wrestlers. Indian J Orthop. 2020;54:310-316.
11. Molnár S, Mensch K, Bacskai K, Körösi É, Sántha Á, Gáspár K. Wrestling. In: Epidemiology of Injuries in Sports. Berlin: Springer; 2022. p. 155-162.
12. Nakagawa Y, Mukai S, Miyata M, Minami K, Hattori Y, Yamagishi H. Radiological findings of the lumbar spine in high school and collegiate sumo wrestlers. Orthop J Sports Med. 2023;11(11):23259671231206712.
13. Riccio I, Tarulli FR, Maffulli N. Wrestling. In: Specific Sports-Related Injuries. Cham: Springer; 2022. p. 471-485.
14. Singh RK, Kumar A, Apte VV, Kolekar A. Wingate anaerobic test reference value for lower limb of elite Indian men wrestlers. Natl J Physiol Pharm Pharmacol. 2020;10(12):1122-1122.
15. Somaiah PE. Socio-economic environment of sports. [Publisher details not provided]. 2019.
16. Tamara RH, Nugroho BS. Popularizing American professional wrestling as popular culture outside the United States. Crossover. 2021;1(2):1-27.
17. Thomas RE, Zamanpour K. Luxuries in wrestling: a systematic review. Phys Sportsmed. 2018;46(2):168-196.
18. Umesh DSSA, Tamboli AN. Comparative study of aggression and anxiety level among wrestlers and judoka. [Journal details not provided]. 2021.
19. Vaishya R, Kambhampati SB, Vaish A. Meniscal injuries in Olympic and elite athletes. Indian J Orthop. 2020;54:281-293.
20. Yadav MH. Sport psychology: an analysis of athletes and wrestling behavior. Int J. 2020;5(12):230-233.


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