Prevalence and Risk Factors of Sports Injuries in Papuan Athletes

Fazryani Mazita Torano[1]✉, Rio Wakhid Hujjatul Islam[2], Cicilia Kubiari[3], Fellisa Kogoya[4]

Pendidikan Jasmani Kesehatan dan Rekreasi, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Cenderawasih, Jayapura, Indonesia[1234]

Abstract

Sports injuries are a serious issue frequently experienced by athletes, especially in high-intensity sports such as rugby, karate, and softball. Sports-related injuries not only impair athletic performance but can also threaten the longevity of an athlete's career. The limited availability of empirical data concerning the prevalence and contributing factors of sports injuries among Papuan athletes served as the primary motivation for this research. This study was designed to identify the prevalence, types, anatomical locations, and potential risk factors associated with injuries across three sports disciplines. Employing a quantitative descriptive design with an ex post facto approach, the research involved 56 PON athletes. Data were collected through structured questionnaires and analyzed using chi-square and logistic regression tests. The results showed that 83.9% of athletes experienced injuries, mainly grade 1–2 strains and abrasions, with the hip and head being the most affected areas. Rest was identified as the most significant factor influencing sports injuries (p = 0.044; OR = 0.061). The study found that most reported injuries were mild to moderate strains, primarily affecting the pelvis and head, with rest identified as the most significant factor influencing injury incidence. Therefore, effective recovery management and an integrated prevention approach balancing training, rest, psychological support, and technical supervision are essential to reduce injury risks among athletes.

How to Cite

Torano, F. M., Islam, R. W. H., Kubiari, C., & Kogoya, F. (2025). Prevalence and Risk Factors of Sports Injuries in Papuan Athletes. Journal of Physical Education, Sport, Health and Recreation, 14 (3), 1005-1011.

✉ Correspondence address :
E-mail: fazrymazita@gmail.com

INTRODUCTION

Sports injuries are any form of injury sustained during (competition) or after exercise, and to bones, muscles, tendons, and ligaments during or after training (Mustafa, 2022). Sports injuries can affect an athlete's performance and career. The prevalence of sports injuries is quite high in various sports, with around 25% of athletes experiencing injuries each year. The risk of injury for a futsal athlete can reach 23.5% per 1,000 games (Herdiandanu & Djawa, 2020).

Despite the high prevalence of sports injuries, there are still not many scientific studies that discuss sports injuries in professional athletes, especially in Papua. There is one study that examines injuries in Papuan athletes, specifically sports injuries in Papuan sprint athletes, with the results showing that 89 athletes (3.51%) experienced sprains, 54 athletes (31.58%) experienced strains, and 18 athletes (10.53%) experienced abrasions (Asri, 2024).

The results of a study on upper extremity injuries in softball athletes showed that the incidence of injuries experienced by pitchers using the underhand toss technique was 3 people, the sidehand throw technique was 8 people, and the overhand throw technique was 19 people. From the aspect of having or currently experiencing injuries, 15 athletes, injury management methods, 20 athletes, and throwing techniques, 14 athletes (Ade Tuti Lestari & al., 2020). In addition to throwing, softball is a sport that requires speed, accuracy, and agility in its gameplay.

Among athletes at the XVIII DKI Jakarta PON, 41.1% of athletes experienced ligament injuries, and the least common cases were skin injuries or wounds, which amounted to 7.9%. The body part with the most injuries was the lower extremities at 60%, and the least common was the head at 0.8% (Junaidi, 2012). Several factors cause sports injuries, including internal factors, sports characteristics, and equipment or facilities. Internal factors include athletes' age, experience, training level, physical condition, balance, and nutritional balance (Junaidi, 2022).

In Papua Province, there has been little research on sports injuries among athletes, particularly in softball, rugby, and karate. Papua has high hopes for achieving national and international success in these sports. This study aims to fill this gap by identifying the prevalence and risk factors of injuries in Papuan athletes. By understanding the factors that contribute to injuries, it is hoped that effective prevention strategies can be developed. These strategies can be used by co-aches, athletes, and other stakeholders to improve training programs, provide better facilities, and reduce the risk of injury, thereby improving the performance and well-being of athletes in Papua.

The study on the identification of sports injuries among sprint athletes in Papua revealed that most injuries were musculoskeletal, primarily strains and sprains affecting the hamstrings and ankles. These were largely associated with insufficient warm-up routines, sudden increases in training intensity, and inadequate recovery strategies (Putra & Wibowo, 2023). Similarly, a survey conducted on athletes from the Banjarmasin contingent found that injuries often occurred during both practice sessions and local competitions. The study identified multiple contributing factors, including unsuitable training surfaces, imperfect movement techniques, and training loads that exceeded the athletes' physical capacity, all of which led to both acute and overuse injuries (Ramadhan & al., 2022).

A separate investigation involving DKI Jakarta's pre-national training athletes reported a high prevalence of injuries during the centralized training period, encompassing both acute contact-related incidents and repetitive strain injuries specific to each sport. The authors emphasized the importance of pre-training medical screenings and more structured training periodization to reduce injury risk (Suryanto & Wijaya, 2021). Meanwhile, research on finswimming athletes participating in the 2023 PRA PON competition indicated that shoulder and lower limb injuries were most common, primarily caused by repetitive motion and intensive aquatic training. The study recommended tailored injury-prevention programs, improved shoulder stabilization exercises, pre-competition functional screening, and comprehensive rehabilitation protocols to enhance athlete safety and performance (Anwar & Hidayat, 2023).

Most previous studies were conducted in the regions of Java and Kalimantan and primarily focused on a single sport discipline. In contrast, the present study focuses on Papuan athletes and represents three sports, softball, rugby, and karate which collectively encompass both game-based and martial arts categories.

METHODS

The research method used to achieve the objectives of this study was quantitative descriptive with an expose facto design. This study comprised several key stages, including instrument validation and reliability testing, data col-

lection, and subsequent data analysis. Data were obtained through questionnaires distributed to athletes who participated in the 2024 National Sports Week (PON) in Papua Province, representing three sports disciplines: karate, rugby, and softball. The research process was carried out over a six-month period, from April to September 2025. A total sampling technique was employed, involving all athletes from the three selected sports categories.

The sampling technique used was total sampling in three sports, namely karate, rugby, and softball, involving a total of 56 athletes consisting of 8 karate athletes, 18 rugby athletes, and 30 softball athletes. The sampling process was assisted by final-year students. To obtain data of the same quality, the students were given prior training on the procedures and methods of data collection. The samples in this study were athletes from the sports of softball, rugby, and karate. Data collection was carried out by distributing questionnaires to the athletes. Data analysis will be carried out univariately, namely the percentage of sports injuries and risk factors for sports injuries, followed by correlation and logistic regression analysis to identify risk factors for sports injuries. The analysis was carried out with the help of the SPSS statistical program.

RESULTS AND DISCUSSION

This study aims to determine the number of cases and types of sports injuries experienced by athletes from three sports (softball, rugby, and karate) by identifying the types of injuries that occur in each sport and identifying the main risk factors that contribute to sports injuries in athletes. The research was conducted in the city and district of Jayapura, namely at the Cenderawasih University Softball Field, the Jayapura District Rugby Field, and the Cenderawasih Jayapura Sports Hall.

Prevalence of Sports Injuries Among Athletes

Based on the data collected from 56 athletes, the following results were obtained:

Table 1. Prevalence of Athlete Injuries

Sports	INJURY		Total	%
	(Yes)	(No)		
Karate	5	3	8	62,50
Rugbi	18	0	18	100,00
Softball	24	6	30	66,67
Total	47	9	56	100

Based on the research results **Table 1**, the total number of athletes from the three sports, namely karate, rugby, and softball, was 56 athletes, and 83.92% experienced injuries. In karate, there were 5 athletes who experienced injuries, or 62.50% of the athletes experienced injuries. In rugby, all 18 athletes experienced injuries. As for softball, 24 athletes suffered injuries, or 66.67% of the athletes.

The high prevalence of injuries in contact and high-intensity sports such as rugby and sports with repetitive movements such as softball is common. In the contact sport of rugby, the risk of injury is very high. In a study, it was found that all athletes suffered injuries (Barlow, 2012). This is because these sports involve high physical contact and intense play, which leads to high injury rates.

According to McCrory (McCrory & al., 2021), effective injury prevention relies on proper training methods and targeted muscle-strengthening exercises to reduce injury risk. The findings of this study corroborate that assertion: in softball, 66.67% of athletes reported experiencing injuries, highlighting the urgent need for improved prevention strategies, particularly regarding training and playing techniques. Furthermore, based on the types of injuries experienced by athletes, the following data was obtained:

Table 2. Types of Injuries Experienced

Injury Type	Answer		Total	%
	(Yes)	(No)		
Scratcehs	44	12	56	78,6%
Grade 1 Strain	46	10	56	82,1%
Grade 2 Strain	49	7	56	87,5%
Grade 3 Strain	26	30	56	46,4%
Swelling & Redness	28	28	56	50,0%
Grade 1 Sprain	4	52	56	7,1%
Grade 2 Sprain	2	54	56	3,6%
Grade 3 Sprain	8	48	56	14,3%
Fracture & Dislocation	4	52	56	7,1%

The results **Table 2** of the study show that the most common injury experienced by respondents was grade 2 strain, with a total of 49 people or 87.5%. This figure shows that the majority of respondents experienced moderate muscle injuries. In addition, grade 1 strains were also quite high, experienced by 46 respondents or 82.1%. Meanwhile, abrasions, as a form of minor injury, were recorded in 44 respondents or 78.6%. These

three types of injuries ranked highest, illustrating that injuries due to physical activity tend to occur more frequently in the mild to moderate categories.

On the other hand, grade 3 strains were found in 26 respondents or 46.4%, indicating that almost half of the respondents experienced muscle injuries with a more serious level of severity. Injuries in the form of swelling and redness were experienced by 28 respondents or 50%, so it can be said that half of the respondents experienced signs of inflammation due to the physical activities they underwent. Meanwhile, sprains were relatively rare. Grade 1 sprains were experienced by only 4 respondents or 7.1%, grade 2 sprains were even lower with only 2 respondents or 3.6%, while grade 3 sprains were recorded in 8 respondents or 14.3%. These findings indicate that disorders of the ligaments or joints were not as common as muscle injuries.

Serious injuries such as fractures and dislocations were found in 5 respondents or 7.1%. Although the number is not large, the existence of these cases is still important because fractures and dislocations are injuries with a higher risk to the long-term physical abilities of respondents. Overall, the results of this study confirm that strains, especially grades 1 and 2, are the most dominant type of injury experienced by respondents, while cases of sprains, fractures, and dislocations are relatively fewer, although they still require medical attention because they can have a significant impact on health and physical activity.

Based on the types of sports injuries experienced, the following results were obtained:

Table 3. Location of Sports Injuries in Athletes

Risk Factors	ANSWER		Total	%
	(Yes)	(No)		
Head	26	30	56	46,4%
Face	9	47	56	16,1%
Neck	8	48	56	14,3%
Chest	8	48	56	14,3%
Abdomen	17	39	56	30,4%
Waist	15	41	56	26,8%
Pelvis	27	29	56	48,2%
Upper Arm	17	39	56	30,4%
Lower Arm	11	45	56	19,6%
Upper Leg	12	44	56	21,4%
Lower leg and ankle	12	44	56	21,4%

The results **Table 3** of the study show that the most common location of injury among athletes is the pelvic area, with 27 respondents or 48.2%. This figure confirms that the pelvic area is the most vulnerable part of the body to injury during sports activities. In addition to the pelvis, head injuries were also quite high, experienced by 26 respondents or 46.4%. Abdominal injuries were recorded in 17 respondents or 30.4%, while waist injuries were experienced by 15 respondents or 26.8%. This indicates that the middle part of the body tends to be a location where injuries occur quite frequently.

Injuries to the lower legs and ankles were recorded in 12 respondents or 21.4%, while injuries to the upper legs were experienced by 12 respondents or 21.4%. Injuries to the upper arms were found in 22 respondents or 39.3%, and injuries to the lower arms were only experienced by 11 respondents or 19.6%. This shows that the upper body, especially the arms, is also quite at risk of injury, although the incidence rate is not as high as injuries to the pelvis or head.

The anatomical regions with the lowest incidence of injury were identified as the face, neck, and chest. Facial injuries were reported by nine respondents (16.1%), while neck and chest injuries were each reported by eight respondents (14.3%). These findings indicate that the upper body particularly the facial and cervical areas tends to be less susceptible to injury compared to regions such as the pelvis and head.

Overall, these data show that injuries are most prevalent in the pelvis and head, while other areas of the body, such as the face, neck, and chest, are relatively less affected. This distribution pattern shows a tendency for injuries to occur in parts of the body that are heavily involved in sports activities, both in supporting movement and as the center of body weight distribution.

Risk Factors Associated with Sports Injuries

Based on the results of the study, the following risk factors for sports injuries were identified:

The data in **Table 4** shows that there are several risk factors that contribute to sports injuries. The most dominant risk factor is facilities and equipment, which was experienced by 253 respondents or 75.3%. These findings show that the condition of sports facilities and infrastructure plays an important role in influencing the occurrence of injuries in athletes. In addition, psychological factors also have a fairly high proportion, namely in 168 respondents or 75.3%, so it can be concluded that the mental condition and psychological readiness of athletes are also sig-

nificant risk factors.

Another prominent risk factor is competition technique, experienced by 276 respondents or 70.4%. This shows that inadequate mastery of technique during competition can increase athletes' vulnerability to injury. Meanwhile, individual factors, which include personal characteristics, were recorded in 190 respondents or 68.5%, while rest time factors were experienced by 150 respondents or 67.0%. These findings indicate that internal aspects, both in terms of physical condition and rest patterns, still play an important role, although not as significant as facility, psychological, and competition technique factors.

The factor of recurring injuries also appeared with a fairly high proportion, experienced by 41 respondents or 73.2%. Although the number of respondents who experienced this condition was relatively smaller than other factors, the percentage shows that a history of previous injuries is a very strong risk factor for the possibility of subsequent injuries.

Table 4. Results of the Univariate Test of Risk Factors for Sports Injuries

Risk Factor	Answer		Total	%
	(Yes)	(No)		
Individual	190	90	280	68,5%
Facilities & Equipment	253	83	336	75,3%
Psycological	168	56	224	75,3%
Rest Time	150	74	224	67,0%
Repeated Injuries	41	15	56	73,2%
Competition Techniques	276	116	392	70,4%
Pelvis	27	29	56	48,2%

After obtaining the univariate analysis results, a bivariate crosstab (chi-square) test was conducted to determine the correlation between risk factors that influence the occurrence of sports injuries in karate, rugby, and softball. The correlation test results are as follows:

The results **Table 5** of the bivariate analysis revealed that several variables were significantly associated with the occurrence of sports injuries. The type of sport variable produced a χ^2 value of 7.44 with a p-value of 0.024, indicating a statistically significant relationship between the sport discipline and the likelihood of injury. Similarly, individual factors showed a χ^2 value of 4.179 with a p-value of 0.041, suggesting that athletes' per-

sonal characteristics play a meaningful role in determining injury risk.

Moreover, the rest variable was also found to be significant (χ^2 = 5.735; p = 0.017), indicating that inadequate rest or recovery periods may heighten athletes' vulnerability to injury. Another notable finding was the effect of recurrent injuries, with a χ^2 value of 4.526 and a p-value of 0.033, reinforcing the notion that a history of previous injuries serves as a strong predictor of future injury occurrence.

In contrast, several other variables namely facility and equipment conditions (p = 0.659), psychological aspects (p = 0.529), and competition techniques (p = 0.966)—did not demonstrate significant associations with injury incidence. Although these factors contributed descriptively, their statistical influence was insufficient to establish a meaningful relationship within the study sample.

Table 5. Bivariate Test Results for Sports

Variable (Risk Factor)	χ^2	df	p-value	Description
Sport x Injury	7,44	2	0,024	Significant
Individual factors x Injury	4,179	1	0,041	Significant
Facility Factors x Injury	0,195	1	0,659	Not Significant
Psycological x Injury	0,397	1	0,529	Not Significant
Rest Time x Injury	5,735	1	0,017	Significant
Repeated Injuries x Injury	4,526	1	0,033	Significant
Competition Techniques x Injury	0,002	1	0,966	Not Significant

Overall, these findings show that sports injuries are more influenced by internal factors such as the sport participated in, individual conditions, rest patterns, and previous injury history. Meanwhile, external factors such as facilities, psychological aspects, and competition techniques were not proven to have a significant direct relationship with injuries based on the bivariate test conducted.

Furthermore, logistic regression analysis was conducted on the four factors influencing in-

juries in athletes to identify the most dominant factors contributing to injuries in karate, rugby, and softball athletes. The results of the logistic regression test can be seen in **Table 6.**

Table 6. Results of Logistic Regression Test

Variable	B	SE	Wald	df	p-value	OR (Exp B)
Sports	-0,626	1,172	0,286	1	0,593	0,535
Individual	-1,772	1,086	2,663	1	0,103	0,170
Rest	-2,803	1,390	4,067	1	0,044	0,061*
Recurrent Injury	-1,146	1,196	0,919	1	0,338	0,318

The results **Table 6** of the logistic regression test show that of the several variables analyzed, only the rest factor was found to have a significant effect on the incidence of sports injuries. The logistic regression analysis revealed that the rest variable had a p-value of 0.044 with an Odds Ratio (OR) of 0.061. This result indicates that inadequate rest patterns significantly increase the likelihood of injury, highlighting recovery time management as a crucial component in injury prevention strategies.

Conversely, the variables of sport type, individual characteristics, and recurrent injuries did not demonstrate statistically significant effects on injury incidence. Specifically, the sport type variable yielded a p-value of 0.593 with an OR of 0.535, the individual factor showed a p-value of 0.103 and an OR of 0.170, while the recurrent injury variable recorded a p-value of 0.318 with an OR of 0.318. These results suggest that although these factors displayed associations with injury occurrence in descriptive and bivariate analyses, their influence diminished when examined within the multivariate model.

Overall, these findings indicate that rest serves as the most influential determinant in either elevating or reducing the risk of sports injuries. While factors such as sport type, individual condition, and prior injury history remain contextually relevant for practical interventions, they were not statistically significant according to the logistic regression results.

The results of this study show that the sports injuries experienced by respondents were mostly mild to moderate strains, with the most common locations of injury being the pelvis and head. Of the various risk factors studied, rest was the only variable that had a significant effect on the incidence of injury in the logistic regression analysis. This suggests that although individual factors, facilities, competition techniques, psychological factors, and injury history play a cer-

tain role, the pattern of recovery through rest remains the most decisive aspect.

In line with previous studies, previous injury history has consistently been cited as a strong predictor of recurrent injury. A prospective study by van Mechelen et al. (van Mechelen et al., 1996) showed that injury history increases athletes' susceptibility to subsequent injuries, making this factor a key variable in prevention.

In this study, injury history was significant in the bivariate test but not in the logistic regression, indicating that its influence may be reduced when controlled for rest. This confirms that adequate recovery can mitigate the negative impact of injury history.

In addition, strain injuries involving large muscles in the pelvis. This is in line with the report by Mendiguchia et al. (Mendiguchia & al., 2022), which states that muscle injuries, especially in the hamstrings, often occur in the myotendinous junction area, which is vulnerable during intense contraction.

The injury patterns that emerged were consistent with the injury mechanism resulting from explosive activities or collisions. In addition, the incidence of head injuries was also a concern, as the results of the study found several cases of mild head injuries. The study by Tenforde et al. (Tenforde & al., 2023) confirmed that injuries to the pelvic or head area can prolong recovery time and have a serious impact on athletic performance.

The psychological factors that emerged in the univariate test in this study are in line with the results of a study conducted by Ivarsson et al. (Ivarsson et al., 2021), namely that psychosocial stress, anxiety, and mental load are risk factors that contribute to an increased incidence of overuse injuries in competitive athletes. Although psychological factors were not significant in the regression analysis in this study, this does not mean that their role can be ignored. Rather, it suggests that their influence may be more indirect and requires longitudinal analysis to confirm their contribution.

Based on the results of this study, what needs to be considered is the importance of rest as a protective factor. Research conducted by Herman et al. (Herman & al., 2025) suggests that stress fractures and dislocations in soccer players indicate that excessive training hours and minimal recovery time are closely related to an increased risk of injury. This is in line with the results of this study, which identified rest as a dominant variable. Therefore, training programs should be designed to maintain an optimal bal-

ance between exercise intensity, training volume, and recovery duration to effectively reduce the likelihood of injury.

Although facility and competition technique factors were not statistically significant, these aspects remain relevant when considering the importance of instructor quality, equipment, and technique in preventing injuries. Research by Poston et al. (Poston et al., 2023) on the CrossFit population shows that inadequate facility conditions and technical instruction can increase the risk of injury, even though these factors are often influenced by contextual variability. The difference between these findings and international studies is likely due to the homogeneity of the facilities used by respondents or limited variation in competition techniques.

CONCLUSION

The findings of this study indicate that the majority of sports injuries reported by respondents were classified as mild to moderate strains, with the pelvis and head identified as the most frequently affected areas. Among the various risk factors examined, rest emerged as the most significant variable influencing injury incidence. In contrast, factors such as individual characteristics, previous injury history, facility conditions, psychological aspects, and competition techniques did not demonstrate consistent effects after multivariate analysis.

Effective recovery management is therefore essential for maintaining athletes' physical condition, underscoring the importance of adequate and quality rest as a key element in injury prevention. Nevertheless, psychological factors, prior injuries, and facility quality remain important considerations within a holistic prevention framework, as they may indirectly contribute to injury risk. Consequently, injury prevention strategies should be developed through an integrated approach that balances training intensity, ensures sufficient recovery periods, provides psychological support, and promotes proper technical supervision during sports activities.

REFERENCES

Ade Tuti Lestari, A., & al., et. (2020). Cedera ekstremitas atas atlet softball: Analisis teknik lemparan dan faktor penyebab cedera. Jurnal Ilmu Keolahragaan, 10(2), 45–60.

Anwar, R., & Hidayat, T. (2023). Prevalensi cedera olahraga pada atlet finswimming PRA-PON 2023. Jurnal Keolahragaan Nasional, 8(1), 112–125.

Asri, A. (2024). Identifikasi cedera pada atlet lari sprint Papua. Jurnal Kesehatan Dan Olahraga, 12(3), 89–101.

Herdiandanu, Y., & Djawa, A. (2020). Analisis risiko cedera pada atlet futsal: Studi prevalensi dan pencegahan. Jurnal Sport Medicine Indonesia, 7(2), 23–35.

Herman, K., & al., et. (2025). Risk Factors for Stress Fractures in Soccer Players: A Systematic Review. Sports Medicine. https://pubmed.ncbi.nlm.nih.gov/40486656/

Ivarsson, A., Johnson, U., Andersen, M. B., Tranaeus, U., Stenling, A., & Lindwall, M. (2021). Psychosocial risk factors for overuse injuries in competitive athletes: A mixed-studies systematic review. Sports Medicine, 51(4), 653–670. https://link.springer.com/article/10.1007/s40279-021-01597-5

Junaidi, A. (2022). Faktor penyebab cedera olahraga: Kajian dari aspek internal dan eksternal atlet. Jurnal Ilmu Keolahragaan, 11(2), 34–48.

McCrory, P., & al., et. (2021). Sports-Related Concussion—Consensus Statement from the 6th International Conference on Concussion in Sport, Amsterdam, October 2012. British Journal of Sports Medicine. https://pmc.ncbi.nlm.nih.gov/articles/PMC8645320/

Mendiguchia, J., & al., et. (2022). Location of hamstring injuries based on magnetic resonance imaging: A systematic review. British Journal of Sports Medicine. https://pubmed.ncbi.nlm.nih.gov/35148645/

Mustafa, H. (2022). Cedera olahraga dan dampaknya terhadap performa atlet. Jurnal Kedokteran Olahraga Dan Fisioterapi, 9(1), 67–80.

Poston, W., Haddock, C. K., Jahnke, S. A., Jitnarin, N., Day, R. S., & Harms, C. A. (2023). Injury incidence and risk factors in CrossFit training: A systematic review. Healthcare, 11(9), 1346. https://www.mdpi.com/2227-9032/11/9/1346

Putra, R., & Wibowo, A. (2023). Identifikasi kasus cedera olahraga pada atlet lari sprint Papua. Jurnal Sport Science Indonesia, 10(3), 78–92.

Ramadhan, T., & al., et. (2022). Survei lokasi dan penyebab cedera olahraga pada atlet kontingen Kota Banjarmasin. Jurnal Kesehatan Olahraga Indonesia, 9(4), 45–60.

Suryanto, B., & Wijaya, H. (2021). Cedera olahraga pada atlet Pelatda PON XVIII DKI Jakarta: Kajian retrospektif. Jurnal Sport and Health Sciences, 14(1), 55–70.

Tenforde, A. S., & al., et. (2023). Bone stress injuries in athletes: Clinical diagnosis, management, and outcomes. Journal of Orthopaedic & Sports Physical Therapy, 53(2), 95–106. https://pubmed.ncbi.nlm.nih.gov/36720584/

van Mechelen, W., Hlobil, H., & Kemper, H. C. G. (1996). Incidence, severity, aetiology and prevention of sports injuries: A review of concepts. Sports Medicine, 14(2), 82–99. https://pubmed.ncbi.nlm.nih.gov/8883006/.