Survey and analysis of the causes of sports injuries among college volleyball players

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Abstract: This study employed questionnaire surveys, mathematical statistics, literature review, and interviews to investigate sports injuries and analyze their causes among 129 volleyball players from six sports colleges participating in the 13th Provincial College Games. The results indicated that the primary sites of injury were the finger and wrist joints, shoulder joints, lumbar and back muscles, knee joints, and ankles. Additionally, there were certain differences in injury locations among players in different positions. The main causes of injury were identified as a lack of scientific approach in training and organization, insufficient warm-up activities before training and matches, poor physical condition, and adverse psychological states. It is recommended that prevention and treatment of sports injuries should be integrated into training and competition, team organization and management, and daily psychological and ideological education to minimize the incidence of injuries among players.

Keywords: Volleyball, Sports Injuries, Etiological Analysis, College Games

1. Introduction

In China, volleyball is a popular comprehensive competitive sport and is also a core required course for physical education majors in universities. This sport demands that students possess strong abilities in flexibility, speed, endurance, strength, and reaction time. However, due to the characteristics of volleyball, such as rapid transitions between offense and defense, high intensity, and strong competitiveness, students are highly susceptible to sports injuries during training and competition. The occurrence of sports injuries not only restricts the improvement of students' athletic performance but also severely affects the effectiveness of training and the achievement of good competitive results in matches. Therefore, to reduce and prevent the occurrence of sports injuries, the author conducted a survey on the sports injuries of athletes from ten sports colleges participating in the 13th Provincial College Games, identified the causes of injuries, and proposed effective preventive measures and rehabilitation strategies. This research aims to provide a basis for future work in the prevention and treatment of sports injuries and the promotion of athletic performance.

2. Research subjects and methods

2.1. Research subjects

This study investigated 129 volleyball players in total, including 62 male players from five men's teams and 67 female players from five women's teams participating in the 13th Provincial College Games. The causes and preventive measures of their sports injuries were taken as the main research objects of this paper.

2.2. Research methods

2.2.1. Questionnaire survey method

In this survey, a total of 129 questionnaires were distributed, and 129 valid questionnaires were collected, with an effective response rate of 100%.

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2.2.2. Mathematical statistics method

The Excel software was used to further statistically analyze and process the relevant data from the collected valid questionnaires.

2.2.3. Interview method

During the actual investigation, in-depth discussions were held with coaches and athletes regarding the causes of sports injuries, preventive measures before injury, and treatment after injury. Additionally, the handling and treatment of athletes' injuries by some coaches were observed on-site.

2.2.4. Literature review method

In the process of the survey and research, relevant materials obtained from books, magazines, and journals were reviewed and compared for further analysis.

2.3. Diagnostic criteria

According to the classification of injuries in sports medicine, the injuries investigated in this study were categorized as moderate injuries that require local or systemic rest, treatment, and recovery during training and competition, as well as minor injuries that affect the continuation of training. Injuries that have no impact on training and competition, such as small abrasions, were not included in the study. The diagnostic criteria were based on the "Practical Sports Medicine" edited by Qu Mianyu.

3. Results and analysis

3.1. Basic Information of the Players (See Table 1)

Table 1 Statistics of Sports Injuries among the Investigated Volleyball Players in This Study

Gender		Age	Height (cm)	Weight (kg)	Years of Exercise	Number of Injuries
Male	Average	23.45	176.5	72.4	4.2	3.5
	Maximum	26	192	85.6	6	6
	Minimum	18	165	68.9	2	1
Female	Average	22.85	161.4	56.4	3.6	2.3
	Maximum	25	174	66.2	5	5
	Minimum	19	158	52.8	2	1

As shown in Table 1, there are 62 male players and 67 female players. The oldest player is 26 years old, and the youngest is 18 years old, with an average age of 22.41 years. In terms of years of volleyball experience, the average for male players is 4.2 years, with the longest being 6 years and the shortest being 2 years. The average number of injuries per male player is 3.5 times, with the highest being 6 times and the lowest being 1 time. For female players, the average years of experience is 3.6 years, with the longest being 5 years and the shortest being 2 years. The average number of injuries per female player is 2.3 times, with the highest being 5 times and the lowest being 1 time. Among the 129 players surveyed, 122 have experienced different types of injuries, with an injury rate of 94.57%, and an average of 2.9 injuries per person.

3.2. Distribution of athletes' sports injuries (See Table 2)

As can be seen from Table 2, the body parts with the highest frequency of sports injuries among male players are the lumbar region, knee, ankle, and shoulder, in that order. For female players, the order is knee, shoulder, ankle, and lumbar region. A comparison of the frequency of injury locations between male and female players reveals that there is a certain pattern to the body parts that are injured during volleyball, which is determined by the characteristics of the sport itself. According to the rules of volleyball, in order to ensure that players can fully utilize their strengths during the game, each player has a fixed position on the court, also known as a specialized position. Therefore, players in different positions have different technical characteristics and styles, and consequently, different injury profiles.

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As shown in Table 3, among male players, the main attackers have the highest incidence of injuries to the lumbar region, shoulder, and knee joints, accounting for 55.3%, 52.1%, and 58.4%, respectively. In contrast, the secondary attackers have the highest incidence of ankle injuries, at 54.6%. Among female players, the secondary attackers have the highest incidence of injuries to the lumbar region, knee, and ankle joints, accounting for 45.8%, 87.2%, and 49.3%, respectively. However, the main attackers have the highest incidence of shoulder injuries, at 64.6%. The setters and libero players, on the other hand, have a lower probability of getting injured during the game, so their injury rates are lower than those of the main and secondary attackers.

Table 2 Statistics of Injured Body Parts among Athletes

Body Par		Neck	Lumbar	Back	Shoulder	Upper Arm	Elbow	Forearm	Wrist	Hip	Thigh	Knee	Lower Leg	Ankle	Foot	Spine
Male	n	6	47	12	39	14	12	2	13	5	8	42	6	40	10	9
	%	5.7	51.8	12.5	43.8	14.7	12.5	1.2	13.6	4.6	8.1	46.2	5.2	43.9	11	8.2
Female	n	4	23	3	32	5	7	2	17	4	13	39	4	27	5	3
	%	4.5	32.5	3.1	45.7	6.1	8.9	1.6	23.6	4.5	17.7	56.1	4.5	40.1	7.5	3.1

Table 3 The Relationship between Different Specialized Positions and Lumbar, Shoulder, Knee, and Ankle Injuries among Players

	Specialized Position	Lumbar		Shoulder		Knee		Ankle	
		Number of Injuries	Percentage	Number of Injuries	Percentage	Number of Injuries	Percentage	Number of Injuries	Percentage
Male	Spiker (25)	18	55.3	17	52.1	19	58.4	14	43.8
	Blocker (20)	15	53.5	14	50	16	57.1	15	54.6
	Setter (12)	5	35.7	5	35.6	5	35.7	5	35.7
	Libero (5)	3	42.9	2	28.9	2	28.5	2	28.6
Female	Spiker (27)	12	37.5	21	64.6	22	68.9	11	34.4
	Blocker (25)	13	45.8	17	58.6	23	87.2	14	49.3
	Setter (10)	3	21.4	4	28.6	5	35.7	4	28.6
	Libero (5)	2	25.6	1	16.3	1	13.3	3	40.9

3.3. Types of sports injuries among athletes

Given that athletes' understanding of sports injuries varies, this study broadly categorizes the different types of injuries sustained by athletes into strains, sprains, contusions, dislocations, and fractures. However, specific diagnoses for some athletes' injuries are not explicitly tallied. As shown in Table 4, the types of sports injuries are primarily concentrated in strains, sprains, and contusions, while the incidence rates of dislocations and fractures are relatively low. This is closely related to the characteristics of volleyball competitions, which involve net-based confrontation.

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Table 4 Types of Sports Injuries among Athletes

	Type of Injury	Strain	Sprain	Contusion	Dislocation	Fracture
Male	n (Number of Cases)	75	84	36	11	3
	Percentage	31.91	35.74	15.31	0.05	0.03
Female	n (Number of Cases)	79	83	42	13	4
	Percentage	35.42	37.22	18.83	0.06	0.03

3.4. Different injury situations caused by modes of exercise

Since all the subjects surveyed in this study are students, their main forms of physical activity include training, competition, physical education (PE) classes, and extracurricular activities. When comparing these four forms of activity, it is evident that the probability of injury during training is the highest. For male players, it is 76.4%, while for female players, it reaches as high as 91.2%. When comparing the four aspects of warm-up, auxiliary exercises, specialized training, and formal competition, the probability of injury during specialized training is the highest. For male players, it is 78.9%, and for female players, it is 75.6%. In addition, during regular training and competition, when comparing the three aspects of proper protection, no protection, and improper protection, it was found that the injury rate is the highest when players are in a state of no protection: for male players, it is 63.4%, and for female players, it accounts for 57.2% (see Table 5).

Table 5 Statistics of Athletes' Injuries Caused by Different Modes of Exercise

Category		PE Class	Training	Competition	Extracurricular Activities	Warm-up	Auxiliary Exercises	Specialized Training	Formal Competition	Proper Protection	No Protection	Improper Protection
Male	n	6	71	26	4	7	12	84	26	28	67	13
	%	4.8	76.4	28.3	4.9	6.5	13.2	78.9	21.6	32.5	63.4	4.1
Female	n	2	81	31	12	6	13	81	31	19	61	18
	%	4.9	91.2	28.7	16.9	5.9	15.8	75.6	27.4	22.7	57.2	9.7

3.5. Recovery status of athletes' injuries

In this survey, it has been found that the recovery status of sports injuries among volleyball players in specialized classes at colleges and universities in Anhui Province is relatively optimistic. Most players recover quickly. However, a small number of players have more severe injuries that affect their ability to continue training and competing. Therefore, this situation should attract the widespread attention of physical education teachers, coaches, and relevant personnel at universities (see Table 6).

Table 6 Recovery Status of Athletes after Injury

Type	Fast	Relatively Fast	Slow	Very Slow	Stopped Training	Total
Number of People	22	81	15	9	2	129
Percentage	17.1	62.6	11.7	7.3	1.2	100

3.6. Analysis of the causes of sports injuries

From the perspective of sports injury epidemiology, the causes of sports injuries are multifaceted and highly complex. The survey results of the 12 main factors leading to sports injuries among athletes, as designed in the questionnaire, show that fatigue, excessive local load, insufficient warm-up, and existing injuries or illnesses are the primary causes of sports injuries for both male and female athletes (see Table 7). Meanwhile, due to carelessness and certain technical deficiencies among the athletes, the incidence of sports injuries is also relatively high for both male and female athletes. Therefore, the following key causes leading to sports injuries among athletes can be concluded.

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Table 7 Statistics of Causes Leading to Sports Injuries among Athletes

	Item	Technical Deficiencies	Poor Organization	Insufficient Warm-up	Excessive Local Load	Fatigue	Injuries	Carelessness	Fouls	Playing Surface	Equipment	Weather	Poor Psychological State
Male	n	20	8	35	31	41	20	22	17	14	6	7	9
	%	21.3	7.9	38.2	33.7	44.9	21.3	23.6	18	14.6	5.6	6.7	8.9
Female	n	9	4	24	26	32	12	5	1	3	4	3	6
	%	11.8	4.4	33.8	36.8	45.6	16.2	5.9	1.4	2.9	4.4	2.9	7.4

3.6.1. Insufficient awareness of the importance of preventing sports injuries

The occurrence of sports injuries among volleyball players is often related to their insufficient understanding of the importance of preventing such injuries. This is especially true for college student-athletes. Meanwhile, some coaches and physical education teachers also hold certain misconceptions, believing that injuries are inevitable. As a result, during volleyball teaching, training, and competitions, they do not actively prevent sports injuries. When injuries occur, they fail to provide timely treatment, nor do they seriously analyze the causes and learn from the experiences. In addition, due to the competitive nature of college players, who often overlook the impact of both subjective and objective conditions, blindly engaging in competitions can easily lead to various injuries. The statistical data shows that 23.6% of male players and 5.9% of female players have suffered sports injuries due to carelessness.

3.6.2. Inadequate warm-up activities

One of the most common reasons for injuries among volleyball players is the lack of adequate warm-up activities before training and competition. This issue manifests in several ways: Players either skip warm-up activities altogether or do not perform them sufficiently. As a result, the joints and muscle groups throughout the body do not receive adequate preheating. During daily training and competition, players lack the necessary level of excitement, leading to a mismatch between physiological function and the intensity of exercise. Additionally, the content of warm-up activities is not closely related to the specialized training content, and the time interval between warm-up activities and the start of formal training or competition is too long. These factors are also major causes of injuries among players.

3.6.3. Incorrect technical movements

Given that volleyball demands relatively high levels of skill and physical fitness from its players, athletes often sustain sports injuries during training and competition due to incorrect or insufficiently mastered technical movements. These issues lead players to exert force blindly and to rush for quick success, which inevitably results in the occurrence of sports injuries.

3.6.4. Excessive local load on the body

As can be seen from the statistics on sports injuries caused by different modes of exercise (see Table 5), the training process is the main stage where athletes sustain injuries. A significant proportion of sports injuries—76.4% for male players and 91.2% for female players—occur during this phase. Moreover, injuries caused by excessive local load on the body account for 33.7% of male players' and 36.8% of female players' injuries. This is directly related to the athletes' physical fitness. However, fundamentally, it is inseparable from the unscientific arrangement of exercise load and the blind increase in training volume and intensity.

3.6.5. Pre-Competition intensive training leading to player fatigue

College players typically have fewer competitive matches, and short-term intensive training sessions can cause their bodies to fail to adapt quickly, leading to fatigue and subsequently triggering sports injuries. Concentrated training loads, excessive local burden, and lack of reasonable adjustment can all easily lead to acute injuries in players. When players continue to train or compete while in poor physical condition or after sustaining an injury without realizing it, their injuries can worsen or deteriorate further.

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Currently, the average age of college players is around 22.41 years old, which means they are relatively young. Their physical qualities such as strength, endurance, agility, and speed are relatively underdeveloped, and their ability to resist fatigue is also relatively poor. They are highly susceptible to injuries during short-term, high-intensity, and high-volume training.

Nowadays, sports injuries caused by fatigue from training have become an important factor that cannot be ignored. Among male players, this figure has reached 44.9%, while among female players, it has reached 45.6%.

3.6.6. Athletes generally lack psychological training

Athletes often have poor psychological states, with weak self-protection awareness during training and competition. Their attention can be easily distracted, especially when they are overly fatigued or in a bad mood. This is particularly true during high-intensity and specialized training sessions, where their focus is often poor. As a result, they may fail to execute movements correctly or distribute their strength properly, which can lead to the occurrence of sports injuries.

3.6.7. Influence of venues, equipment, and external environment

Currently, due to the outdated sports venues and internal facilities in some colleges and universities, which have not been updated or repaired in a timely manner, the poor lighting and floor quality within the venues, and even the presence of concrete floors in some venues, have affected the players' movement and judgment. These conditions have led to sports injuries among players due to loss of control while moving, executing technical and tactical actions. Additionally, during specialized technical and strength training, improper protection or lack of protection has also caused sports injuries among players. The proportion of injuries occurring with and without protection among male players is 32.5% and 63.4%, respectively, while for female players, it is 22.7% and 57.2%, with a very significant difference ($p<0.01$). Moreover, the proportion of injuries caused by venues and equipment among male players is 14.6% and 5.6%, and for female players, it is 2.9% and 4.4%.

4. Conclusions and recommendations

4.1. Conclusions

In this study, among the 163 college volleyball players surveyed (81 male and 82 female), all had experienced sports injuries to varying degrees, and the frequency of injury locations followed certain patterns. For male players, the most common injury sites, in descending order, were the lumbar region, knee, ankle, and shoulder. For female players, the order was knee, shoulder, ankle, and lumbar region. Additionally, the frequency of injury sites varied depending on the players' positions on the court.

The survey data revealed that players are more likely to get injured during training, and the probability of injury is highest when they are not protected. Most of the injuries sustained by the players were acute sports injuries, and nearly half of the injured players continued to train despite their injuries.

The main causes of sports injuries among players, as identified by the study, include: lack of awareness of the importance of preventing sports injuries; insufficient or inadequate warm-up activities before training and competition; incorrect technical movements; excessive local load during training; training while fatigued; lack of self-protection awareness among players; and outdated or poor-quality sports venues and equipment.

4.2. Recommendations

4.2.1. Strengthening ideological and disciplinary education for athletes

Further enhance the ideological, safety, organizational, and disciplinary education for college athletes. Guide and assist athletes in fully and correctly understanding the objectives and tasks of volleyball teaching, training, and competition. Raise their awareness of the harm that sports injuries can cause to teaching, training, competition, and the athletes themselves. This will enable athletes to fully recognize the significance of preventing sports injuries and equip them with methods to reduce the occurrence of such injuries.

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4.2.2. Conducting adequate warm-up activities before training and competition

Given the high technical demands and intensity of volleyball training, it is essential to conduct thorough warm-up activities before engaging in any physical exercise. These activities should adequately prepare all joints, muscles, and tendons for the upcoming exertion. The content and volume of warm-up activities should be tailored to the specific circumstances of teaching, training, and competition, rather than being carried out indiscriminately.

During the process of teaching, training, and competition, after completing general warm-up activities, athletes should progressively engage in specialized warm-up activities related to their specific tasks. The interval between general and specialized warm-ups should not be too long to maintain the body's readiness. Additionally, particular attention should be paid to joints that bear significant load during exercise and are prone to injury. These areas should be thoroughly warmed up to minimize the risk of injury.

4.2.3. Scientifically arranging the volume and intensity of training and competition

In training and competition, it is essential to reasonably arrange the volume and intensity of exercise, adopt scientific teaching and training methods, and correctly understand the relationship between load volume and intensity. When arranging the volume of exercise, the tolerance of the majority of players should be the standard, and the arrangement of physical training and technical training should maintain an appropriate proportion. In training, the principles of gradual progress and systematicness should be followed. Training should be tailored to individual capabilities, with attention to intermittent rest periods and reduced local loads to avoid sports injuries caused by excessive volume of exercise.

4.2.4. Further strengthening of athletes' psychological training

In regular training and competitions, physical education teachers and coaches should enhance the psychological training of athletes and improve their ability to control their mental state. Methods such as relaxation training and imagery training should be frequently employed to teach athletes how to optimize their mental energy. At the same time, athletes' awareness of self-protection should be further enhanced, and they should be equipped with essential self-protection skills. Coaches and physical education teachers should pay attention to the psychological changes and behavioral performance of each athlete, and be adept at understanding and grasping various negative behaviors and psychological motives of athletes. This will facilitate timely identification and resolution of issues, thereby reducing and preventing the occurrence of sports injuries.

4.2.5. Reasonably arranging post-training and post-competition recovery

Coaches and physical education teachers should plan and purposefully arrange various recovery activities for athletes after training and competition to eliminate fatigue and accelerate physical recovery. During training and competition, it is important to avoid the one-sided pursuit of quick results by neglecting recovery measures, which can not only affect the improvement of athletes' performance but also increase the probability of sports injuries. Therefore, in daily teaching, training, and competition, it is necessary to reasonably arrange rest intervals to prevent over-fatigue. After training and competition, athletes should be supervised to engage in appropriate relaxation activities to eliminate fatigue and thus achieve the goal of preventing injuries.

4.2.6. Strengthening medical supervision to prevent overtraining

Physical education teachers and coaches should frequently encourage athletes to conduct routine self-examinations and help them develop good habits of self-checking. They should also pay close attention to the physical responses of athletes after training and competition. If any abnormalities are detected, it is essential to promptly and reasonably adjust the intensity and volume of exercise. Athletes should be urged to have regular medical check-ups at the school hospital or larger local hospitals to gain a better understanding of their own physical condition. Additionally, a thorough understanding of the athletes' skill levels and daily nutritional status is necessary to timely adjust the training plan and prevent overtraining. It is strictly prohibited to participate in training and competition while injured or ill, as this can exacerbate injuries and delay treatment.

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4.2.7. Enhancing protective measures for athletes during training and competition

The most direct method to reduce sports injuries among athletes is to strengthen physical protective measures for each athlete during training, competition, and teaching. This is especially important for body parts that are prone to injury, such as the ankle, knee, and wrist joints, which bear significant force. Implementing these measures not only effectively prevents and reduces injuries caused by physical stress but also helps to alleviate friction between joints. Additionally, efforts should be made to create a good environment for competition and training to further reduce and avoid the occurrence of sports injuries.

4.2.8. Upgrade sports facilities and equipment in universities

Relevant leaders and responsible persons in universities should increase financial investment in sports venues, facilities, and equipment, and promptly update and repair outdated equipment and facilities with safety hazards to avoid or reduce unnecessary sports injuries caused by issues related to venues and equipment during training and competition.

5. Conclusion

This study comprehensively investigated and analyzed the sports injuries among college volleyball players, revealing the current status, causes, and influencing factors of these injuries. It also proposed targeted prevention and rehabilitation recommendations. The results indicate that sports injuries are relatively common among college volleyball players and follow certain patterns. By enhancing ideological education, scientifically arranging training, strengthening psychological training, improving protective measures, and enhancing the training environment, we can effectively reduce the occurrence of sports injuries and improve athletes' training outcomes and competitive performance.

For future research, it is recommended to further explore the characteristics and prevention methods of sports injuries in different sports, combining modern technological means such as biomechanical analysis and sports medicine monitoring to provide more scientific and personalized training guidance and injury prevention plans for athletes. Meanwhile, colleges should strengthen the management and supervision of sports teaching and training to ensure the implementation of preventive measures and safeguard the health and athletic careers of student-athletes.

In summary, the prevention and rehabilitation of sports injuries is a systemic project that requires the joint efforts of coaches, athletes, physical education teachers, medical staff, and college management. Through collaborative efforts, we can create a safer and healthier sports environment for athletes and promote the sustainable development of college sports.

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