Investigation and analysis of ankle injuries among students in basketball sports

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Abstract: This study employs literature review, questionnaire surveys, and statistical analysis to investigate and analyze ankle injuries among students who take basketball as an elective course, exploring the locations, types, causes, and preventive measures of these injuries. The main reasons for ankle injuries in basketball are identified as improper warm-up activities, lack of awareness, poor physical fitness, poor quality of the venue, low technical level, high sports load, and emotional venting under pressure, among others. Therefore, it is necessary to enhance students' awareness of sports, master self-protection methods, reasonably arrange warm-up activities, standardize technical movements, adjust students' psychological emotions, and standardize the use of venue equipment to reduce the occurrence of sports injuries.

Keywords: Basketball, Ankle Joint, Injury, Prevention

1. Introduction

Sports injuries are a common occurrence in physical activities, especially with the increased competitiveness in basketball, which has become widely popular. For instance, the NBA internationally, the CBA domestically, and the introduction of basketball courses in primary and secondary schools are all contributing factors. The severity of sports injuries in teaching and competition is escalating day by day. If preventive measures and treatment methods are not adopted, it can have a negative impact on students' physical development. Moreover, prevention is always more important than treatment. This article investigates the injuries sustained by students playing basketball at Ziwei High School. By analyzing and evaluating the results, the study summarizes experiences, grasps the patterns and characteristics of injuries, and aims to minimize sports injuries among students in basketball as much as possible. It also proposes corresponding preventive treatment methods and measures for physical education basketball teaching and basketball competitions in middle schools, ensuring the normal conduct of teaching, training, and competitions.

2. Research subjects and methods

2.1. Research subjects

Basketball elective students in the first and second years of a certain high school.

2.2. Research methods

2.2.1. Literature review method

The literature review involved consulting relevant documents and using various methods, including the internet, to read a vast array of books related to injury and prevention, as well as knowledge in sports medicine, traumatology, human anatomy, and statistics. This information was organized, analyzed, and researched, providing a theoretical foundation and a thought process for solving problems in this study. Additionally, it provided ample theoretical basis and reference material for the design of the questionnaire.

2.2.2. Questionnaire survey method

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A questionnaire survey was conducted among the male basketball elective students in the first and second years of a certain high school. A total of 100 questionnaires were distributed, with 82 returned, resulting in a recovery rate of 82%. There were 82 valid questionnaires.

2.2.3. Mathematical statistics method

Data statistical analysis was utilized, with valid data being statistically processed on Excel, followed by corresponding induction and summary.

3. Research results

3.1. Body injury sites of students in basketball elective course

Table 1 Injury Sites and Occurrence Percentages

Body Part	Ankle Joint	Knee Joint	Hip Joint	Waist	Elbow Joint	Wrist Joint	Finger Joint	Other	Total
Number of People	62	16	3	32	9	10	48	9	188
Percentage	75.61	19.51	3.66	39.02	10.98	12.2	58.54	10.98	

From Table 1, it can be seen that ankle joint and surrounding tissue injuries account for 75.61% of the total number of people, making it the most frequently injured joint. Injuries to the finger joints and waist account for 58.54% and 39.02% of the total number of people, respectively. The knee joint, wrist joint, and hip joint account for 19.51%, 12.20%, and 3.66% of the total number of people, respectively, and elbow joint injuries and other injuries account for 10.98% each. It can be seen from Table 1 that the ankle joint ranks first in basketball sports, while finger joints rank second. This is significantly related to the technical methods, body confrontation and other factors in basketball sports, as well as the characteristics of human body structure.

Analyzing through the anatomical structure of the ankle joint: the ankle joint is composed of the lower ends of the tibia and fibula and the saddle surface of the talus. The medial and lateral articular surfaces of the tibia and fibula and the lower articular surface of the tibia form the ankle mortise (narrow in front and wide behind) on the talus. The medial and lateral articular surfaces together form the joint that is placed in the ankle mortise, with the lateral malleolus being narrower and longer than the medial malleolus, and slightly backward, and the saddle joint surface of the talus is narrow in front and wide behind. When the foot is dorsiflexed, the wider part of the talus enters the ankle mortise, making the joint more stable at this time. When the foot is plantarflexed, because the talus is narrower, part of it is placed in the ankle mortise, making the ankle joint loose at this time. In the movements of basketball sports, when jumping, the foot is plantarflexed, and at this time the body loses its center of gravity and falls, stepping on someone else's foot, or the foot does not step firmly when landing, or being tripped by someone when landing, etc., all kinds of situations may cause the foot to invert inward, causing sprains of the ankle joint and injuries to other joints, thus causing foot injury and preventing normal joint activity, ultimately affecting sports.

3.2. Types of sports injuries among students in basketball elective course

Table 2 Types of Injuries

Type	Ligament Sprain	Abrasion	Muscle Strain	Laceration	Fracture	Contusion	Total
Number of People	62	36	10	5	3	22	138
Percentage	75.61	43.9	12.2	6.1	3.66	26.83	

From Table 2, it is observed that ligament sprains in the ankle joint occupy the first position in basketball sports, with 62 individuals having sustained such injuries, accounting for 75.61% of the

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surveyed population of 82 people. This is primarily due to middle school students' inadequate physical fitness, lower sports technical skill levels, and lack of personal awareness, leading to injuries from stepping on others' feet upon landing, falling, scrambling for loose balls, rapid starts, and stops on a surface that is too slippery, or possibly uneven, resulting in ankle sprains and similar injuries. Abrasions rank second in Table 2, with 36 instances of abrasions among the surveyed 82 people, representing 43.90%. Muscle strains occurred in 10 cases, 12.20%; lacerations in 5 cases, 6.10%; fractures in 3 cases, 3.66%; and contusions in 22 cases, 26.83%.

3.3. Causes of ankle joint injuries among students in basketball elective course

Table 3 Causes and Percentage of People for Ankle Joint Injuries

Reason	Inadequate Preparation Activities	Lack of Awareness	Low Technical Skill Level	Poor Physical Fitness	Poor Facility Conditions	High Exercise Load	Emotional Venting Under High Pressure
Number of People	32	20	15	18	25	10	15
Percentage	39	24.3	18.3	22	30.5	12.2	18.3

From Table 3, it is observed that inadequate preparation activities led to 32 occurrences, accounting for 39%; poor facility conditions caused 25 occurrences, accounting for 30.5%; lack of awareness resulted in 20 occurrences, accounting for 24.3%; low technical skill level led to 15 occurrences, accounting for 18.3%; poor physical fitness caused 18 occurrences, accounting for 22.0%; high exercise load resulted in 10 occurrences, accounting for 12.2%. Emotional venting under high pressure led to 15 occurrences, accounting for 18.3%.

3.3.1. Unreasonable preparation activities

In the general process of sports teaching, it is divided into three parts: preparation activities, main part, and ending part. Both insufficient and excessive preparation activities can lead to various sports injuries [3]. Among them, insufficient preparation activities are one of the causes of ankle joint injuries. There are four poor situations in the preparation activities:

First, not preparing or insufficient preparation activities pose a serious hazard to students whose neural organs and various joints and muscles have not yet been activated. In intense exercise, the body's functions are inert, the temperature needed by muscles and tissues is not enough, and the body's agility is not high enough, which can cause varying degrees of damage to muscles, ligaments, and joints during high-difficulty technical movements and strong confrontational sports.

Second, some warm-up exercises in the preparation activities do not match the content of the classroom teaching, resulting in the ligaments that need to be stretched in the classroom teaching not being stretched, and the joints not being opened, which will also cause strains and injuries to muscles and ligaments.

Third, the amount of preparation activities is too large, causing the students' bodies to be in a state of fatigue or declining function during the classroom content process, thereby increasing the chance of injury.

Fourth, the time between the preparation activities and the classroom content is too long. The preparation activities are done early, but the classroom content is delayed, so that when the classroom content is done, the warm-up of the preparation activities has passed, just like not having prepared at all, which is also a major factor. Basketball is a fierce sport with high flexibility. If the preparation activities do not reach the stress state of exercise, the elasticity and extensibility of the muscles, ligaments, and surrounding soft tissues of the joints will be greatly reduced. The viscosity of the joints is relatively large, and the flexibility will be very low. At this time, if there are sudden events on the court during teaching, competition, and exercise (such as emergency actions and technical movements), the coordination between the muscle groups and tissues is uncoordinated, or the occurrence of exercise causes muscles,

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tissues, and joints to be one beat slower and unable to keep up with the rhythm, which will increase the chance of sports injuries. Therefore, sufficient preparation activities must be done in the early stages of these basketball activities. During the competition, teaching, and training process, athletes, students, and teachers must maintain a high concentration of attention to minimize and avoid the occurrence of sports injuries.

3.3.2. Lack of mental attention

Ankle injuries in basketball are often caused by a lack of mental attention from students. During sports training and classroom teaching, some students or teachers may think that sports injuries are a matter for medical staff and are not related to themselves. This leads to a lack of awareness and carelessness towards injuries, neglecting scientific exercise methods, not following the laws of motion, and not progressing step by step but seeking quick results, which greatly increases the likelihood of sports injuries. Some students may feel fear and apprehension towards difficult movements, hesitating and being overly cautious when performing them, while others may be careless and nonchalant with simple techniques, not taking them seriously. This mental disregard significantly increases the chances of ankle joint injuries.

3.3.3. Poor physical fitness

Basketball is an intense, competitive, and highly confrontational sport. Some students have poor qualities such as sensitivity, strength, endurance, and speed. The elasticity and strength of their muscles are lacking, and their joints do not have enough agility and stability. When performing technical movements, if the strength is not in place, the speed is insufficient, and the sensitivity is inadequate, all these factors can lead to ankle joint injuries.

3.3.4. Poor court conditions

In school basketball courts, some schools, due to funding issues, have courts that are made of coal slag, which can cause students to slip and fall during the process of jumping and landing while playing basketball. Additionally, some courts are slippery when wet, leading to ankle injuries as students slide when making sudden stops or starts. Furthermore, courts that are uneven and pockmarked can also lead to injuries. During basketball activities, when students make sudden stops or starts, jump and land, or change direction and accelerate, the unevenness of the court can cause them to fall, resulting in damage to joints, ligaments, and soft tissues, and increasing the likelihood of ankle injuries.

3.3.5. Poor technical skill level

Technical movement errors refer to the injuries caused by athletes' technical shortcomings and mistakes, which violate the characteristics of human body structure and the activity patterns of various organ systems, as well as the mechanical reasons during movement. Poor technical execution is one of the significant causes of sports injuries. Many students have unreasonable and insufficient technical applications, leading to unstable center of gravity, unstable landing, ankle inversion, and ankle sprains, resulting in ankle joint injuries. The correct and reasonable use of movement techniques is one of the essential factors in ensuring the suppression of injury mechanisms. Standardized, reasonable, and correct application of movement techniques helps to better utilize the athletic level of athletes and students, improving their sports competition performance and technical and physical abilities. Moreover, it conforms to the order of force application in the skeletal, muscular, joint, ligamentous, and soft tissue structures in human anatomy, which can greatly reduce or avoid unexpected, unnecessary, unneeded, and meaningless sports injuries and damages. There should also be an emphasis on strengthening the teaching and training of basic sports techniques and abilities, more prevention, and more practice, which will reduce the chances and frequency of injuries.

3.3.6. High exercise load

Due to an excessive amount of exercise and a heavy load, students experience sports fatigue, leading to exhaustion, poor sleep, unnecessary movements, low mood, and a decrease in confidence. This lack of coordination and correctness in movement affects the physical health of students. Therefore, conducting training and teaching exercises while students are in a state of fatigue increases the likelihood of sports injuries, causing physical and mental harm to students. The exercise load should be appropriate, not

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excessive or insufficient. Teachers or coaches should systematically arrange the type and amount of exercise for students and athletes, trying to avoid increasing training volume drastically in pursuit of sports or competition achievements. This could lead to students and athletes entering a state of fatigue, creating a vicious cycle where the more tired they are, the worse their performance becomes, and the worse their performance, the more they are taught and trained.

3.3.7. Emotional venting under pressure

High school is a unique phase, where students face the college entrance examination (Gaokao) and are under significant value and pressure from schools, society, and parents, leading to a highly tense psychological and emotional state. They spend most days studying and reviewing academic knowledge, leaving little time for sports and training. Consequently, long-term accumulation of negative emotions, such as dissatisfaction with exam results, unpleasant moods, excessive stress, and overly complicated matters, can be released through the physical outlet of sports during the two weekly basketball elective classes. However, playing basketball under these emotional conditions can easily lead to emotional excitement, incomplete technical movements, excessive movements, and forceful actions, which significantly increase the likelihood of sports injuries, especially the already high-risk ankle injuries. This can ultimately affect the study and review of academic courses, have adverse psychological effects on students, and fail to provide a healthy physical condition for the Gaokao.

4. Prevention of ankle joint injuries

For such matters as injuries, prevention is always more important than treatment!

4.1. Cultivating sports self-protection awareness

Strengthen students' awareness of the importance of sports and their ability to master self-protection methods proficiently. Sports are not just for teachers or coaches, and self-protection is not solely their responsibility. The mistaken notion that it's none of one's business should be eradicated. Sports are for oneself, and the consequences of injuries belong to the individual. Therefore, during sports, competitions, and training, athletes and students must pay high attention to themselves, increase their focus and awareness, and be adept at mastering methods and capabilities for self-protection.

Teachers also need to enhance their emphasis on sports and teaching. They should organize and arrange time each week for students to practice self-protection methods and techniques, with a special focus on exercising the flexibility, coordination, and stability of the ankle joints to prevent injuries. Only by practicing often and becoming proficient in self-protection methods can the likelihood of injury be reduced. By strengthening the flexibility, coordination, and stability of the ankle joints through exercise, their endurance and resistance can be enhanced. With such consistent training, the ankle joints will not be as fragile and prone to injury.

4.2. Scientific sports teaching methodology

Teachers need to reasonably arrange preparatory activities, avoiding both the absence of warm-up and insufficient or excessive warm-up activities. They should properly connect classroom content with preparatory activities, grasp the key and difficult points of learning movement techniques, strengthen comprehensive quality training and improvement for students, and enhance strength and coordination training for susceptible injury areas. Teachers should promptly correct students' incorrect movements and methods, using scientific teaching methods that cater to individual differences, proceed step by step, provide individualized guidance, and follow principles from simple to complex. Doing a good job with the preparatory activities of a class is a good start to any task, which can lead to a better completion of an excellent class and greatly reduce the likelihood of losses during the class, ensuring both quality and safety.

4.3. Classroom safety and observation

Teachers should be observant, paying close attention to students' facial expressions and physical conditions during class, training, or competitions. If students show signs of pain, discomfort, pale faces, or

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are rolling on the ground, they should be given timely help and treatment, such as cold or heat applications. Teachers should also be equipped with some routine treatment methods and handling techniques. On the other hand, teachers should frequently observe the conditions of the venue for potential safety hazards and suitability for basketball activities. If the venue is found unsuitable, does not meet the necessary conditions for class, or poses significant safety risks, decisive action should be taken to stop basketball teaching on that site, opting instead for a safer venue to reduce the chances of losses.

4.4. High school emotional care strategy

Address the psychological and emotional needs of students during the special period of high school. Efforts should be made to alleviate the pressures students face from schools, society, and parents. For students with significant emotional fluctuations, more communication and understanding are necessary. During basketball classes, teachers should observe students' facial expressions and physical conditions to identify those who may be feeling down or overly excited. These students require additional attention and care to prevent them from engaging in overly aggressive movements or actions. Adhere to the principle of gradual progression and appropriate exercise; for senior students, high-intensity exercises should be avoided. Instead, activities that help relieve stress and release emotions should be conducted.

5. Suggestions

Teachers should enhance the strength and coordination training of susceptible injury areas (ankle joints). During the training process, appropriate weight and load should be added to the ankle joints, and the load should be gradually increased to strengthen their bearing capacity. Strengthen students' self-protection skills and methods to timely treat and recuperate from ankle joint injuries. Learn to prevent before the injury occurs and to recuperate after the injury to minimize the adverse factors and situations brought about by the injury.

Teachers should have certain medical knowledge for treatment and prevention, and prohibit students from wearing unsuitable clothing for physical education classes, such as boys not wearing jeans and girls not wearing skirts, etc. Be good at observing the venue and equipment, be good at observing students' class conditions, be good at discovering problems, and supervise students medically.

For special high school students, pay more attention, care, and understanding to their physical and psychological conditions, organize teaching reasonably, arrange training intensity appropriately, adhere to the principle of moderation, and help students under too much pressure through more communication and understanding to alleviate their stress. Comfort and understand students with great emotional fluctuations.

Standardize the use of venues and equipment, frequently inspect and repair equipment that is often used, and promptly deal with potential safety hazards, both visible and hidden, to ensure orderly and safe teaching, training, and competitions. Schools should build venues and equipment with strong standards and high safety factors and regularly maintain them to increase safety.

Each sports item has its own technical characteristics, and therefore the load on each part of the body is different, and there are also different susceptible injury areas, so the training amount for each joint should be reasonably arranged.

In basketball training, sports injuries are the most common. Especially in recent years, with the rapid development of the sport of basketball, the level of physical confrontation has been continuously increasing, which puts higher demands on athletes' skills, physical strength, and psychological qualities. Improper arrangement of training volume, especially the repetitive practice of some high-difficulty movements, leads to excessive local load and is the main cause of fatigue-related injuries. Due to improper arrangement of exercise volume, athletes often persist in training under extreme physical fatigue, and the intense practice makes it difficult for coaches and athletes to perceive the warning signals from their bodies. On the other hand, under strict requirements, athletes dare not report their physical conditions to the coach, and long-term persistence leads to injuries. Therefore, it is necessary for coaches and athletes to pay more attention to the conditions of their teammates and themselves. Once such problems are discovered, training should be stopped immediately, and proper rest and recuperation should be given, so as to reduce the chances of injury and minimize the degree of physical damage.

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6. Conclusion

Ankle joint injuries account for the highest proportion in middle school basketball, with an incidence rate as high as 75.61% among the surveyed individuals.

The causes of ankle joint injuries include inadequate warm-up activities, lack of awareness, poor physical fitness, substandard facilities, low technical skill level, excessive exercise load, and emotional venting during stressful periods, covering seven main aspects.

As a sport with high intensity and strong confrontation, basketball places high demands on students' physical fitness, technical ability, and psychological quality. Ankle joint injuries, being one of the common sports injuries in basketball, are significant for ensuring students' sports safety and improving sports performance in terms of prevention and treatment. Through this study, we have gained a deeper understanding of the causes and characteristics of ankle injuries in basketball and have proposed a series of feasible prevention and response measures. It is hoped that the findings of this study can provide a reference for middle school basketball teaching and training, and contribute to the healthy growth of students and the scientific development of basketball. At the same time, we also look forward to more future research focusing on the prevention and rehabilitation of sports injuries, offering more scientific guidance and assistance to athletes and sports enthusiasts.

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