

# SPORTS KNEE JOINT INJURY IN SKI TRAINING AND ITS PREVENTION



ORIGINAL ARTICLE  
ARTIGO ORIGINAL  
ARTÍCULO ORIGINAL

LESÃO ESPORTIVA DA ARTICULAÇÃO DO JOELHO EM TREINO DE ESQUI E SUA PREVENÇÃO

LESIÓN DE LA ARTICULACIÓN DE LA RODILLA EN EL ENTRENAMIENTO DE ESQUÍ Y SU PREVENCIÓN

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## ABSTRACT

**Introduction:** Ski training presents the high ability of athletes and strong demand on the physical conditioning of the knee joint, which is frequently injured. **Objective:** Study the sports injuries of the knee joint in ski training and explore its preventive measures. **Methods:** The interview method was used with ski instructors, enthusiasts, and athletes by questionnaire with design and distribution of topics related to the occurrence of injuries. Sport injury factors are discussed internally and externally. Preventive measures and protective equipment for knee sports injuries are presented. **Results:** Currently, the proportion of serious sports injuries to the knee joint is relatively high, and problems such as collision are the most common injury factors, and differences exist between male and female athletes. Among the causes of injury, the highest-scoring technical factor for injury was “deviation from technical movements”, and the highest-scoring preventive measures were “strength training for vulnerable parts” and “sufficient preparation for activities”. **Conclusion:** The instructors should provide effective training programs according to the actual situation of the athletes, pay attention to monitoring the skiing environment, and recommend the appropriate protective equipment for the sport. **Level of evidence II; Therapeutic studies - investigation of treatment results.**

**Keywords:** Skiing; Knee Joint; Athletic Injuries.

## RESUMO

**Introdução:** O treino de esqui apresenta alta habilidade dos atletas e forte demanda no condicionamento físico da articulação do joelho, que é frequentemente lesionada. **Objetivo:** Estudar as lesões esportivas da articulação do joelho no treino de esqui e explorar suas medidas preventivas. **Métodos:** O método de entrevista foi usado com instrutores, entusiastas e esportistas de esqui por questionário com projeção e distribuição de tópicos relacionados à ocorrência das lesões. Os fatores de lesão esportiva são discutidos interna e externamente. Medidas preventivas e equipamentos de proteção para lesões esportivas no joelho são apresentados. **Resultados:** Atualmente, a proporção de lesões esportivas graves na articulação do joelho é relativamente alta e problemas como colisão são os fatores de lesão mais comuns, existindo diferenças entre atletas do sexo masculino e feminino. Entre as causas de lesão, o fator técnico de maior pontuação para lesão foi “desvio de movimentos técnicos”, e as medidas preventivas de maior pontuação foram “treinamento de força para partes vulneráveis” e “preparação suficiente para as atividades”. **Conclusão:** Os treinadores devem fornecer programas de treino eficazes de acordo com a situação real dos atletas, atentarem-se ao monitoramento do ambiente de esqui e indicar os equipamentos de proteção adequados ao esporte. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Esqui; Articulação do Joelho; Lesões Esportivas.

## RESUMEN

**Introducción:** El entrenamiento de esquí presenta una alta capacidad de los deportistas y una fuerte exigencia en el acondicionamiento físico de la articulación de la rodilla, que se lesiona con frecuencia. **Objetivo:** Estudiar las lesiones deportivas de la articulación de la rodilla en el entrenamiento de esquí y explorar sus medidas preventivas. **Métodos:** Se utilizó el método de la entrevista con instructores de esquí, aficionados y deportistas mediante un cuestionario con diseño y distribución de temas relacionados con la ocurrencia de las lesiones. Los factores de las lesiones deportivas se discuten interna y externamente. Se presentan las medidas preventivas y los equipos de protección para las lesiones deportivas de rodilla. **Resultados:** En la actualidad, la proporción de lesiones deportivas graves en la articulación de la rodilla es relativamente alta y problemas como la colisión son los factores de lesión más comunes, y existen diferencias entre los deportistas masculinos y femeninos. Entre las causas de las lesiones, el factor técnico con mayor puntuación fue la “desviación de los movimientos técnicos”, y las medidas preventivas con mayor puntuación fueron el “entrenamiento de fuerza de las partes vulnerables” y la “preparación suficiente para las actividades”. **Conclusión:** Los entrenadores deben proporcionar programas de entrenamiento eficaces en función de la situación real de los deportistas, prestar atención al seguimiento del entorno de esquí e indicar el equipo de protección adecuado para el deporte. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptor:** Esquí; Articulación de la Rodilla; Lesiones Deportivas.



## INTRODUCTION

At present, with the continuous development of China's comprehensive national strength and the continuous growth of competitive sports investment, China's skiing is constantly approaching the world's skiing power. In this environment, there are higher requirements for athletes' special technical level and physical fitness, and it is more likely to lead to sports injuries, which will affect athletes' normal competition and training state.<sup>1</sup> Skiing is a very challenging special sport, which is different from the sport on flat ground. This kind of sport has fast speed, and has technical events such as rotation and large rotation and super large rotation of speed. Therefore, it puts forward high requirements for athletes' skills and physical fitness, in which the flexion, extension and swing of knee joint are the main actions.<sup>2</sup> For most athletes, knee injury is very easy to occur in their sports career. A skier with excellent skills must have good physique and special ability. In order to obtain these qualities and skills, it needs several or even more years of high-intensity training. In the process of training, knee joint injury often occurs, which affects athletes' training and normal competition.<sup>3</sup> If athletes continue training or competition in the case of injury, the inconvenience caused by injury may shorten or even end the athletes' sports life, affect the athletes' career development, and may lead to a lot of waste of human, material and financial resources. Therefore, it is necessary to improve the scientificity of skiing training, reduce the risk of sports injury, improve the sports life of athletes, further improve the development of such activities and ensure the continuous improvement of competition level.<sup>4</sup> And it is necessary to conduct in-depth research on sports injury to find out the common causes of related injury, so as to provide basis for other related research.<sup>5</sup> This paper summarizes the situation of knee joint sports injury of skiers, analyzes the severity of current sports injury and injury factors, discusses the problems of knee joint sports injury in the process of current skiing, and scores and evaluates the existing preventive measures, so as to explore the effectiveness of current preventive measures and provide better sports guidance for athletes.<sup>6</sup>

## METHODS

The research content of this paper is to explore the injury and prevention of knee joint in current skiing. Due to the certain physical fitness and state deviation between male and female athletes, in the overall research process, the sub data analysis of male and female skiers is carried out. After obtaining the current training status and injury status of current athletes, the technical factors, physiological factors, prevention methods Unified analysis of preventive equipment. Firstly, this paper uses the literature research method to systematically collect the data on the physiology and pathology of skiing and knee injury, so as to lay a certain theoretical foundation for this paper. Finally, the questionnaire method is used to investigate the occurrence of knee injury with ski enthusiasts, and then the questionnaire method is used to make an interview with ski enthusiasts, so as to understand the basic situation of knee injury in the process of ski training.

In terms of data collection, this paper adopts the way of questionnaire survey. In addition to the basic situation of the current research object, the questionnaire also includes the degree of knee joint sports injury, injury factors, injury types and other issues, so as to have a full understanding of the characteristics of current skiers' knee joint sports injury. The study and all the participants were reviewed and approved by Ethics Committee of Beijing Sport University (NO. 2017BSU0210). In the discussion of the factors of sports injury of knee joint, it is divided into two aspects: technical factors and physiological factors. The injury factors of sports injury are discussed from the current external environment and internal environment at the same time. Finally, the current preventive measures and protective equipment for knee sports injury

are investigated, so as to have a deeper understanding of the current prevention situation and facilitate subsequent research and analysis. After a period of data collection, 141 questionnaires were obtained, including 72 male skiers and 69 female skiers.

## RESULTS

### Sports injury of knee joint of male skiers

As shown in Table 1, the factors of male skiers' sports injury are shown. From the table, it can be seen that the highest injury factor is the factor of "collision with field equipment". In 72 sports injury accidents, 27 mild injuries and 15 severe injuries were caused, followed by the factor of "teammate collision", which led to 7 mild injuries and 6 severe injuries. It can be seen that in terms of the types of injuries suffered by skiers, problems such as collision and fall are the most common. Therefore, we should pay attention to the adjustment and avoidance of these two aspects in the process of sports training.

From the overall situation of male athletes' knee sports injury, the current proportion of severe knee sports injury is high, and problems such as collision are the most common injury factors. Therefore, in the process of skiing, we should consciously avoid relevant risk factors and ensure our own safety as much as possible.

### Sports injury of knee joint of female skiers

(Table 2) shows the analysis of injury factors of knee sports injury of female skiers. Among the 34 mild patients, the highest injury factor was the collision with field equipment, the second was the collision with team members, and the third was non-contact injury; Among the 35 severe patients, it can be seen that the injury factor with the highest proportion is also the collision with field equipment, followed by the collision with team members, and the third is non-contact injury. Comparing the injury factors between male athletes and female athletes, it can be seen that collision with field equipment, collision with team members and non-contact injury are the most common cases, while the range of injury factors of male athletes is slightly higher than that of women.

Comparing the injury causing factors between male athletes and female athletes, it can be seen that female athletes have a high proportion of fractures and a large number of severe cases. In addition, the proportion of strains, abrasions, sprains and so on is high, which is different from the injury types with a high proportion of contusion of male athletes. Therefore, when coaches conduct sports guidance, they should fully according to the different sports characteristics and personal needs of boys and girls, Select the appropriate guidance scheme.

**Table 1.** Analysis of injury factors of knee joint sports injury in male skiers (person times).

Injury factor	Mild	Heavy	Total
Team members collided	7	6	13
Non-contact injury	5	5	10
Collision with venue equipment	20	15	35
Overworked	4	3	7
Disease / infection	1	0	1
Other	1	5	6
Total	38	34	72

**Table 2.** Analysis of injury factors of knee joint sports injury of female skiers (person times).

Injury mechanism	Mild	Heavy	Total
Team members collided	7	6	13
Non-contact injury	4	6	10
Collision with venue equipment	21	16	37
Overworked	1	3	4
Disease / infection	1	0	1
Other	0	4	4
Total	34	35	69

## Factors of knee joint sports injury in skiing training

(Figure 1) shows the analysis of technical factors of athletes' knee injury. For those with more than 3 points, that is, among the options considered "more important" and above, the technical factor causing injury with the highest score is "deviation in technical action operation", with a score of 3.902; The second is "technical action is not in place", with a score of 3.843; Once again, "the movement is too difficult and there is a certain risk", with a score of 3.468. It can be seen that the lack of mastery of skiing operation and problems are the most likely factors to cause knee sports injury. Therefore, in the process of training, coaches must fully observe the situation of each athlete and put forward adjustments in time. Athletes should also study carefully. They must not be eager for success before they are mature, so as to avoid serious injury.

(Figure 2) shows the analysis of physiological factors of athletes' knee injury. For those with more than 3 points, that is, among the options considered "more important" and above, the physiological factor with the highest score is "there is a certain deviation in body strength", with a score of 3.805; Followed by "excessive fatigue", with a score of 3.448; Once again, it is "there are unrecovered injuries in the body", with a score of 3.114; The final score is "not flexible enough", with a score of 3.003. The lower ranking is "no response in time" with a score of 2.923. It can be seen that before starting skiing, athletes must evaluate their actual situation. If they are unable or tired, they should stop the exercise in time to prevent physical discomfort caused by excessive fatigue, so as to avoid injury in the exercise.

## Prevention methods of knee joint sports injury in skiing training

As shown in Figure 3, the preventive measures for athletes' knee injury are shown, among which those with more than 4 points, that is, among the options considered "important" and above, the preventive measure with the highest score is "strength training for vulnerable parts", with a score of 4.287; The second is "making full preparations", with a score of 4.257; Once again, "enhance the mastery of technical actions", with a score of 4.099; It is also listed as "pay attention to relaxation after competition", with a score of 4.099; Finally, "fully improve self-protection awareness", with a score of 4.095. For those with a score of more than 3, that is, among the "more important" and above options, the preventive measure with the highest score is "flexibility training for vulnerable parts", with a

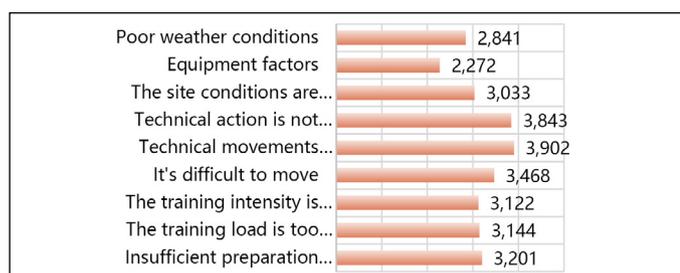


Figure 1. Analysis on technical factors of athletes' knee injury.

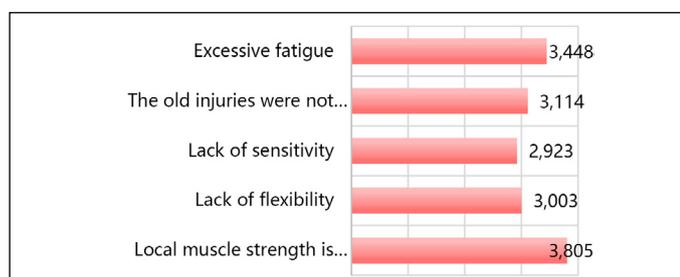


Figure 2. Analysis of physiological factors of knee joint injury in athletes.

score of 3.990; The second is "strengthening relevant physical training", with a score of 3.937; Once again, it is "timely evaluate your own state", and the score is 3.839; The fourth is "scientific design of exercise load", with a score of 3.802; The fifth is "sensitivity training for vulnerable parts", with a score of 3.674; The sixth is "prevention of site climate and other problems in advance", with a score of 3.660; The final score is "not eager for success, fully learning technical movements", with a score of 3.596. Therefore, athletes should fully analyze their own situation, determine their ability and physical strength to participate in sports, and prevent problems caused by blind self-confidence. Coaches should scientifically conduct sports guidance according to the actual situation of athletes, so as to prevent knee sports injury in the process of sports.

As shown in the Figure 4, the most popular protective equipment for knee joint is 313.6%; The second was bandage, accounting for 57.384%; The third is protective equipment, accounting for 48.553%. However, the number of times that the cloth is used is not much, accounting for only 8.199%. A small number of other minority protective equipment are not counted, but only accounting for 5.399%.

## DISCUSSION

The survey found that some Chinese athletes are in a state of fatigue, but coaches do not know enough about Athletes' fatigue. They often put athletes back into training or competition when they have not fully recovered. In the state of fatigue, athletes will have a series of physiological and biochemical reactions, mainly manifested in the decline of running ability, the deformation of technical movements, the significant increase of errors and so on. And the body reacts slowly, and the attention and alertness will be reduced accordingly. If coaches organize high load training at this time, it is easy to cause sports injury.

In the training plan, we should strictly abide by the training principles, reasonably adjust the amount of exercise, pay attention to the athletes' fatigue and recovery state, and avoid heavy local burden on the knee joint. Exercise should adhere to the principle of step by step and pay attention to rest. If you train under fatigue, you will react slowly at this time, which is easy to cause uncoordinated movement and injury. Coaches must strictly follow the principle of step-by-step, design the basic



Figure 3. Preventive measures for sports injury of athletes' knee joint.

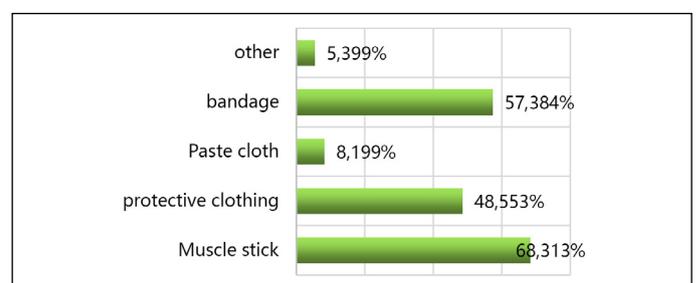


Figure 4. Protective equipment for athletes' knee injury.

trend of load measurement change, scientifically plan and effectively adjust the load and intensity change, and make the load measurement adapt to the periodic change of athletes' physical condition, so as to control the load change in an appropriate cycle, so as to promote the improvement of athletes' physical function and technical ability. Coaches and athletes should also pay attention to the recovery after load, and adopt a variety of recovery skills such as training, medical biology, nutrition and psychology to eliminate physical fatigue in time, so as to prevent sports injury.

In daily training, we should pay attention to strengthening the strength and flexibility of knee joint to avoid injury as much as possible. Once the knee joint is injured, it must be treated in time. If athletes continue training or competition without treatment, it will not only aggravate injuries, but also lead to other injuries. Therefore, in daily training, coaches and medical personnel should encourage athletes to actively carry out treatment. Due to the lack of scientific research and capital investment in cross-country skiing in China, athletes cannot get timely rescue when injured, and the injury turns into chronic injury, which affects training, competition and even their career. In training or competition, the injured parts such as knee joint should be bandaged as soon as possible to enhance their supporting strength and prevent

sports injury from changing into permanent injury, especially ligament and muscle injury. For sports injuries, such as sprain and mild strain, the use of pressure bandage immediately after injury can fix the injured part to limit its activity, compress the patient to reduce inflammation, reduce the exudation of subcutaneous blood and body fluids, and alleviate injury and pain.

## CONCLUSION

From the research of this paper, we can see that the knee injury is a very serious problem in skiing, which also brings troubles to many skiers. Through the research, it is found that athletes should strengthen the improvement of their own consciousness, evaluate their own situation in time, and master their ability and skills; Coaches should also provide effective and scientific training programs according to the actual situation of athletes. At the same time, they should pay attention to the monitoring of the ski resort environment, so as to reduce the interference of external factors on Athletes' skiing as much as possible, so as to reduce knee sports injury.

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All authors declare no potential conflict of interest related to this article

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**AUTHORS' CONTRIBUTIONS:** Each author made significant individual contributions to this manuscript: YZ, WZ: writing, revision and performing the experiments, analysis of the data; XY and XM: intellectual concept; statistical analysis; SQ: writing and revision, statistical analysis.

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