ABSTRACT

This study reveals the characteristics and relationship of sports injury and fatigue of the Winter Olympics athletes, and monitors the athletes’ psychological condition through case analysis of excellent athletes, and provides empirical evidence for athletes’ psychological training and preparation for the physical and mental health services of Winter Olympics. Through questionnaires, literature review and other methods to study the injury situation of Winter Olympics ice and snow athletes, the results show that the proportion of chronic lumbar and knee joint injuries, and repeated muscle strains of Chinese Winter Olympics ice and snow athletes is large, and the cure rate is not high. The preparation activities are neither paid enough attention or sufficient, and the rationality of training plan arrangement is insufficient. The main cause of injury is insufficient understanding of the mechanism of injury and illness among athletes and coaches. Individual elite athletes need to improve their coping skills and pay attention to their psychological fatigue. In view of the sports’ psychological characteristics and the problems faced by winter athletes, personalized psychological intervention programs should be formulated.

Keywords: Athletic Injuries; Snow Sports; Fatigue.

RESUMO

O presente estudo revela as características e a relação de lesões desportivas e fadiga de atletas participantes dos Jogos Olímpicos de Inverno, e monitora as condições psicológicas dos atletas através da análise de casos de atletas de alto desempenho, além de apresentar provas empíricas para o treino e a preparação psicológica dos atletas para os serviços de saúde física e mental dos Jogos de Inverno. Através de questionários, revisão de literatura e outros métodos de estudo das lesões que acometem os atletas dos Jogos Olímpicos de Inverno, em esportes que envolvem gelo e neve, os resultados mostram que a proporção de lesões lombares crônicas, lesões articulares do joelho e recorrência de distensões musculares, e a taxa de cura não é alta. As atividades de preparação não são suficientemente consideradas e a racionalidade do plano de treinos é insuficiente. A principal causa de lesão é a falta de compreensão dos mecanismos que ocasionam lesões e enfermidades entre atletas e treinadores. Atletas individuais de elite precisam melhorar suas habilidades de enfrentamento e prestar atenção à sua fadiga psicológica. Tendo em conta as características psicológicas desportivas e os problemas existentes entre os atletas dos Jogos de Inverno, programas de intervenção psicológica personalizados devem ser formulados.

Descritores: Traumatismos em Atletas; Esportes na Neve; Fadiga.

RESUMEN

A través del análisis de casos de atletas de élite, este trabajo revela las características y la relación entre las lesiones deportivas y la fatiga de los atletas en los Juegos Olímpicos de invierno, monitorea el estado psicológico de los atletas y proporciona evidencia empírica para el entrenamiento psicológico de los atletas y la preparación del Servicio de salud física y mental En los Juegos Olímpicos de invierno. Los resultados mostraron que la proporción de lesiones crónicas de la cintura y la rodilla y la tensión muscular repetida de los atletas de hielo y nieve en los Juegos Olímpicos de invierno en China era mayor. La tasa de curación no es alta. No se presta suficiente atención a las actividades preparatorias y a la racionalidad del plan de capacitación. La razón principal de la lesión es que los atletas y entrenadores no entienden el mecanismo de la lesión y la enfermedad. Los atletas individuales deben mejorar su capacidad de enfrentamiento y prestar atención a la fatiga psicológica. De acuerdo con las características psicológicas de los atletas de invierno y los problemas existentes, se formula un plan de intervención Psicológica individualizado.

Descriptores: prevención de lesiones deportivas; atletas de hielo y nieve; lesiones deportivas y fatiga.
INTRODUCTION

Ice and snow sports are widely carried out in the world. It is a fashionable sport loved by people all over the world. At the same time, it is dangerous. Skiing is a sport in which people put snowboards on their boots to speed, jump and ski on the snow. It is a highly dynamic and exciting sport. With the development of ice and snow sports (especially modern competitive skiing), there are more and more sports and more fields. Speed skating is a traditional competitive winter sport in China. A group of elite speed skaters have achieved excellent results in various world speed skating competitions. Some of our well-known speed skating fans will not be able to play their own functional ability and technical level on the road to the Olympic gold medal zero breakthrough, and they will lose the golden opportunity. Helpless to say goodbye to the speed skating sports arena, prematurely put an end to his sports career, whether it is a major loss for his individual or the country. It can be said that the high damage rate of athletes in winter projects seriously affects and restricts the development of winter projects in China. In particular, many excellent athletes are at a peak when their age, physical fitness, skills and psychological quality are at their peak, just because of sports injuries, they lose the opportunity to obtain their best scores.

A random questionnaire survey was conducted among 29 Elite Speed Skaters in China. According to the investigation and literature study of the injuries and illnesses, it is found that the main causes of athletes' injuries and illnesses in speed skating events are inadequate preparatory activities, inappropriate exercise schedule, excessive local load and backward strength training methods. In order to achieve excellent sports results, we must attach great importance to the prevention and treatment of injury. Winter project managers, coaches, scientific researchers and medical workers must be aware of the harmful and destructive effects of sports injuries on athletes and the development of winter events. Take proactive measures to prevent, avoid or reduce the occurrence of sports injuries. The athletes who are responsible for the task are older and have more injuries and injuries, ensuring the normal training and participation of athletes. The treatment and recovery of injuries is particularly important. In view of the previous two empirical studies on biathlon, the current situation of mental fatigue, coping skills and self-confidence with exercise status is rarely discussed. The purpose of this study is to reveal the characteristics of sportman's self-confidence, mental fatigue, coping skills and their relationship in the winter Olympics, and to monitor the psychological status of athletes through case analysis of elite athletes. The psychological services of the Olympic Games provide an empirical basis.

RELATED WORK

China’s modern competitive skiing began in 1991, and mass tourism and leisure skiing began gradually in the late 20th century. Because alpine skiing is thrilling, beautiful, free, dynamic, attractive, and can be widely used. Therefore, alpine skiing is regarded as the essence and symbol of skiing. It is the first choice and main project of tourist skiing, attracting skiing fans will not be able to play their own functional ability and technical level on the road to the Olympic gold medal zero breakthrough, and they will lose the golden opportunity. Helpless to say goodbye to the speed skating sports arena, prematurely put an end to his sports career, whether it is a major loss for his individual or the country.

Therefore, a computational model of the musculoskeletal system is needed to provide the relationship between external measurements and internal forces and moments, as shown in Figure 1. Musculoskeletal model technology has been developed and widely used in clinical and biomechanical gait analysis, especially in the study of lower limb dynamics.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Interpretation rate(%)</th>
<th>Variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychological fatigue</td>
<td>32.45</td>
<td>0.98</td>
</tr>
<tr>
<td>Self confidence</td>
<td>35.67</td>
<td>0.73</td>
</tr>
</tbody>
</table>

Table 1. Regression Analysis of Psychological Fatigue and Coping Skills of Winter Olympics Ice and Snow Athletes on Self-Confidence in Sports Status.
There is an information system D, where R is a conditional attribute set, m is a decision attribute set and A is a universe, then the resolution formula is:

$$D(p_i) = A \cdot m(1-r)$$  \hspace{1cm} (1)

Information system Q, where I is a set of conditional attributes and D is a set of decision attributes. And for any attribute m > 0, its attribute importance is defined as follows:

$$AI_i = (I_i + D_i + (I_i + D_i - I_i \cdot D_i)) = I_i + D_i - \frac{D_i}{2}$$  \hspace{1cm} (2)

Where D is the dependence of decision attribute I on attribute Q, expressed as a positive domain formula:

$$A_i = (I_i + Q_i + I_i + Q_i - D_i) = I_i + Q_i - \frac{D_i}{2}$$  \hspace{1cm} (3)

The dependence of conditional attributes on decision attributes is transformed into mutual information, and the change of mutual information caused by adding an attribute is taken as a measure of the importance of attributes. The probability distribution is:

$$f(x) = sign(x^T x + b)$$  \hspace{1cm} (4)

The information entropy of the condition attribute x in the decision table is:

$$w(t) = w_1 + (w_1 - w_2) \frac{T - t}{T}$$  \hspace{1cm} (5)

Entropy of relative condition attribute P of decision attribute w in decision table is defined as:

$$p = \begin{cases} k & \sigma^2 < \sigma^2_f(P_i) > f_i \\ 0 & \text{otherwise} \end{cases}$$  \hspace{1cm} (6)

Assuming that an attribute n is added to the conditional attribute P of the above-mentioned information system k, the increment of mutual information after adding n is calculated.

$$e_j = -k \sum_{i=1}^{n+1} f_i \ln f_j$$  \hspace{1cm} (7)

After repeated experiments and comparing the results of many experiments, it is concluded that when the training error is 0.03 and the learning efficiency is set to 0.04, the prediction effect of reduction results based on mutual information is the best. When the error drops to 0.001, the curve gradually tends to be flat, indicating that the structure achieves stability and good results. The training process is shown in Figure 2 below.

![Training process](image-url)
With m rules, the function of the node in this layer is:

$$w_j = w_j + a\left(\frac{X_i}{m} - w_j \right)$$  \hspace{0.5cm} (11)

The number of nodes in this layer is 1, and the initial value of the weight d is set in advance to the rule rough membership value, and the output of the layer node:

$$sim(x, y) = \frac{1}{1 + d(x, y)}$$  \hspace{0.5cm} (12)

The results of the survey indicate that the injured part of the speed skater is mainly the habitual strain of the lower limb muscle, lumbar muscle strain and soft tissue injury of the knee joint. It shows that the speed skater's injury is mainly caused by special training, as shown in Figure 3.

The response skills of biathlon athletes are at a high level, and the concentration of male athletes is significantly better than that of female athletes, indicating that male athletes may be more able to control their thinking under the conditions of external interference or situational pressure. Women's personality is more delicate, and everything is much more thought-provoking. It is more susceptible to the suggestion and influence of the situation, so it may lead to the distraction of attention and the inability to better control their own thoughts. Pay attention to mobilizing the enthusiasm of athletes. Bring into play the comprehensive advantages of coaches, and enable athletes to establish correct training modes of technical movement stereotypes and physical, technical, psychological and political education “five in one”, improve the scientific training level of training, scientific research, management, security and ideological education.

**CONCLUSIONS**

The injuries of ice and snow athletes in the Winter Olympic Games are mainly the habitual strain of lower limb muscles, strain of lumbar muscles and soft tissue injury of knee joint. 96.34% of the athletes can be treated in time after injury, but the cure rate is only 18.64%, 86.71% turn to long-term chronic injury. The high incidence of sports injuries seriously affects the training and competition of athletes. The main reasons for the injury of ice and snow athletes in the Winter Olympic Games are inadequate preparatory activities, lack of attention, inadequate mastery of technical movements, weak sense of safety, inadequate training of psychological quality, factors of skating fatigue or injury, factors of skiing field management, and equipment factors such as skating clothes and equipment. We should pay enough attention to mental fatigue. In terms of psychological training and intervention, we must continue to consolidate and strengthen athletes' self-confidence training and strengthen stress to cope with psychological counseling. In order to track and monitor the athlete's self-confidence, psychologically fatigue, coping skills, etc., the comprehensive effect of mental fatigue and coping skills on self-confidence in sports should be considered. It provides a valuable opportunity for China to develop ice and snow sports. At the same time, it will face more challenges. We should seize the opportunity to find out the problems and gaps in the current development of China's ice and snow sports, and take active and effective measures and means. Let more people know about snow sports and participate in ice sports.

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