

FATIGUE INJURY IN VOLLEYBALL PLAYERS UNDER JUMP RESISTANCE TRAINING



ORIGINAL ARTICLE
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LESÃO POR FADIGA EM JOGADORES DE VOLEIBOL SOB TREINO DE RESISTÊNCIA COM SALTO

LESIÓN POR FATIGA EN JUGADORAS DE VOLEIBOL BAJO ENTRENAMIENTO DE RESISTENCIA CON SALTO

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ABSTRACT

Introduction: The rapid development of competitive sports in the world requires volleyball players not just sufficient physical fitness but also the ability to understand and learn advanced techniques and tactics. In response to the increasing pace of competitive sports, research on fatigue injuries in volleyball players must be deepened and expanded, making coaches and players aware of sports injuries and their means of prevention. **Objective:** Explore the fatigue injury characteristics in volleyball players under jump resistance training. **Methods:** 157 volleyball players from eight sports colleges were selected as the research subject. Composed of 94 male volleyball players and 63 female volleyball players. **Results:** In the investigation of the 157 volleyball players, 153 had some degree of injury, representing a total of 97.1% of the players, and only four non-injured, representing 1.80%; 95 people were injured in special technical training (61.20%); 43 were injured in advanced training (27.62%); 17 people were injured in preparatory activities (10.86%). No one was injured during relaxation activities. **Conclusion:** Preventive measures for fatigue injuries in volleyball players include strengthening with medical supervision and balanced exercise load distribution. With attention to rational preparation of activities including strengthening and knee joint flexibility. **Evidence level II; Therapeutic Studies - Investigating the results.**

Keywords: Muscle Fatigue; Resistance Training; Volleyball.

RESUMO

Introdução: O rápido desenvolvimento dos esportes competitivos no mundo exige que os jogadores de voleibol não tenham apenas aptidão física suficiente, mas também a capacidade de compreender e apreender técnicas e táticas avançadas. Para atender ao ritmo crescente da competição esportiva, deve-se aprofundar e ampliar as pesquisas sobre lesões por fadiga em jogadores de voleibol, fazendo com que treinadores e jogadores se atentem às lesões esportivas e seus meios de prevenção. **Objetivo:** Explorar as características da lesão por fadiga em jogadores de voleibol sob treino de resistência com salto. **Métodos:** 157 jogadores de voleibol de oito faculdades esportivas foram selecionados como objeto de pesquisa. Compostos por 94 jogadores de voleibol masculinos e 63 jogadoras de voleibol feminino. **Resultados:** Na investigação dos 157 jogadores de voleibol, 153 apresentaram algum grau de lesão, representando um total de 97,1% dos jogadores, e apenas 4 não lesionados, representando 1,80%; 95 pessoas ficaram feridas em treinos técnicos especiais (61,20%); 43 feriram-se no treino avançado (27,62%); 17 pessoas feriram-se em atividades preparatórias (10,86%). Ninguém se feriu durante as atividades de relaxamento. **Conclusão:** Medidas preventivas para lesões por fadiga em jogadores de voleibol incluem principalmente o fortalecimento com supervisão médica, a distribuição equilibrada da carga de exercício. Com atenção ao preparo racional das atividades incluindo o fortalecimento e a flexibilidade articular do joelho. **Nível de evidência II; Estudos terapêuticos - Investigação de resultados.**

Descritores: Fadiga Muscular; Treinamento de Força; Voleibol.

RESUMEN

Introducción: El rápido desarrollo de los deportes de competición en el mundo exige a los jugadores de voleibol no sólo una buena forma física, sino también la capacidad de entender y comprender técnicas y tácticas avanzadas. Para hacer frente al creciente ritmo de la competición deportiva, se debe profundizar y ampliar la investigación sobre las lesiones por fatiga en los jugadores de voleibol, concienciando a entrenadores y jugadores sobre las lesiones deportivas y sus medios de prevención. **Objetivo:** Explorar las características de las lesiones por fatiga en jugadores de voleibol sometidos a un entrenamiento de resistencia con saltos. **Métodos:** Se seleccionaron como objeto de investigación 157 jugadoras de voleibol de ocho escuelas deportivas. Compuesto por 94 jugadores de voleibol masculinos y 63 jugadoras de voleibol femeninos. **Resultados:** En la investigación de los 157 jugadores de voleibol, 153 presentaron algún grado de lesión, lo que representa un total del 97,1% de los jugadores, y sólo 4 no lesionados, lo que representa el 1,80%; 95 personas se lesionaron en el entrenamiento técnico especial (61,20%); 43 se lesionaron en el entrenamiento avanzado (27,62%); 17 personas se lesionaron en las actividades preparatorias (10,86%). Nadie resultó herido durante las actividades de relajación. **Conclusión:** Las medidas preventivas de las lesiones por fatiga en los jugadores de voleibol incluyen principalmente el fortalecimiento con supervisión médica, la distribución equilibrada de la carga de ejercicio. Con atención a la preparación racional de las actividades, incluyendo el fortalecimiento y la flexibilidad de la articulación de la rodilla. **Nivel de evidencia II; Estudios terapéuticos - Investigación de resultados.**

Descriptor: Fatiga Muscular; Entrenamiento de Fuerza; Voleibol.



INTRODUCTION

The rapid development of competitive sports in the world requires volleyball players not only to have sufficient physical fitness, but also to have the ability to understand and grasp techniques and tactics, as well as positive and scientific psychological quality. They should develop in an all-round way in terms of physical fitness, intelligence, psychology and so on.¹ In order to meet the growing pace of volleyball competitive sports, we must deepen and expand the research on Volleyball Players' fatigue injury, make coaches and volleyball players pay attention to volleyball players' sports injury, and study and study sports training, sports psychology and other related disciplines in combination with the characteristics of volleyball sports.^{2,3} Through the research on the fatigue injury of elite volleyball players in a university, this paper aims to comprehensively grasp the current situation of fatigue injury of elite volleyball players in Colleges and universities in Beijing, so as to more effectively understand and understand the sports psychological fatigue of volleyball players, draw objective and real research results, find out the factors affecting their sports psychological fatigue, and put forward effective countermeasures and methods, It is applied to the actual sports training of volleyball players to alleviate, reduce and even eliminate the occurrence of volleyball players' fatigue injury, improve the competitive ability level of volleyball players, and provide a certain theoretical basis for the future research on Volleyball Players' fatigue injury and the scientization of volleyball training, It also provides practical reference value for volleyball players in other competitive sports.^{4,5}

METHOD

Research object

157 volleyball players from eight sports colleges were selected as the research object. There are 94 male volleyball players and 63 female volleyball players. This paper attempts to investigate and analyze the knee injury of volleyball players under Sports endurance training such as jumping in sports colleges and universities from the perspectives of sports training, biomechanics, sports physiology and sports psychology, Summarize their commonness and put forward preventive measures.

Literature method

Consult 5 Monographs on sports medicine, track and field courses and sports training, and collect 126 literatures on sports medicine, traumatology, anatomy, sports psychology, sports physiology, sports mechanics, physical training, etc. And the relevant documents of the State Education Commission on the construction of high-level sports teams. Based on the extensive absorption and use of previous research results, through the sorting, induction, analysis, processing and generalization of literature, it provides a reliable theoretical and empirical basis for the analysis of this study.

Expert interview method

In order to understand the current situation of volleyball players' fatigue injury and relevant knowledge of injury under jumping and other sports endurance training, targeted interviews were conducted with experts engaged in jumping training and teaching for a long time, experts in sports medicine and doctors in the school hospital to obtain relevant information and data.⁶

Questionnaire survey method

On the basis of referring to a large number of literature and expert interviews, this paper makes a questionnaire survey on jumping high-level volleyball players, some experts and coaches in sports colleges and

universities, in order to obtain the first-hand data of the research. This study distributed three sets of questionnaires: volleyball player questionnaire, coach questionnaire and expert validity evaluation questionnaire. The expert validity evaluation questionnaire was issued to evaluate the validity of the questionnaire for volleyball players.

Mathematical statistics

Using the knowledge of sports statistics, the effective data collected by consultation, investigation and interview are analyzed and processed by Excel and SPSS software on the computer.

RESULTS

Incidence of fatigue injury of volleyball players under Sports endurance training such as jumping

Through the investigation of 157 volleyball players in eight sports colleges, the results show that there are 153 injured volleyball players, accounting for 97.1% of the total number of volleyball players investigated, and only 4 uninjured volleyball players, accounting for 1.80%. (Table 1). Among the 157 volleyball players investigated, 412 were injured, with an average of 2.5 times per person (Table 2). The data show that the knee injury of volleyball players is common.

Time characteristics of knee injury

Through the investigation, it is found that 95 of the 155 volleyball players with knee injury were injured in special technical training, accounting for 61.20% of the total number of injuries; 43 people were injured in quality training, accounting for 27.62% of the total number of injuries; 17 people were injured in preparatory activities, accounting for 10.86% of the total number of injuries; No one was injured during relaxation activities (Figure 1).

Among 155 jumping volleyball players with knee joint injury, 63 volleyball players' injury occurred during winter training, accounting for 40.65% of the total number of injuries; The injuries of 44 volleyball players occurred in the period of intensive training before the game, accounting for 28.39% of the total number of injuries; The injuries of 12 volleyball players occurred in the competition, accounting for 7.74% of the total number of injuries; The injuries of 31 volleyball players occurred at the

Table 1. incidence of knee injury of Volleyball Players.

	Injured	Not injured	Total
Number	153	4	157
%	97.10	1.80	100.00

Table 2. Injury person times.

Total number of injuries	Number of people	Number of injuries per capita
412	157	2.5

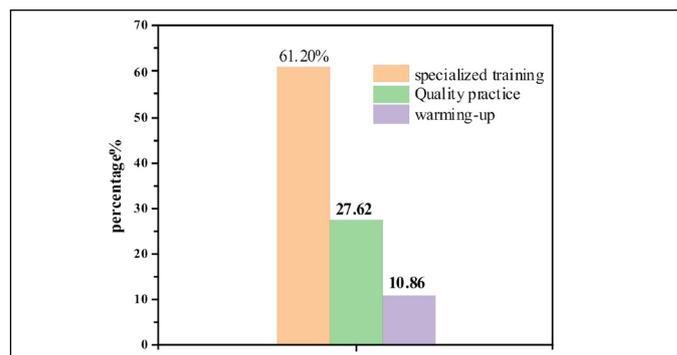


Figure 1. Proportion of injuries in each period of training course.

beginning of the holiday, accounting for 20.00% of the total number of injuries; Five volleyball players' injuries occurred in the recovery period after the game, accounting for 3.22% of the total number of injuries; It can be seen that volleyball players' injuries mainly occur in winter training, pre competition intensive training period and the beginning of holidays. There were less injuries during the game and during the recovery period after the game. The main reason is that the amount and intensity of training in these periods are relatively large, and the exercise load exceeds the endurance of volleyball players.

Relationship between knee injury and endurance training years and sports grade

The training years of 155 volleyball players investigated were divided into three groups (Table 3) and divided into three groups according to sports grade. The single factor analysis of variance between the number of injuries, training years and sports grade was carried out respectively. The results are as follows:

It can be seen from table 3 that there is a significant difference between the 1-5 year group and the 6-10 year group ($P < 0.05$), and there is a very significant difference between the 1-5 year group and the group over 11 years ($P < 0.01$). There was no significant difference between 6-10 years group and more than 11 years group ($P > 0.05$); There is significant difference between level 2 and level 1, level 2 and master level, and there is no significant difference between level 1 and master level. There are many reasons for this situation. From the perspective of training, it is mainly due to the poor physical quality of volleyball players in the initial stage of training and can not bear large sports load, resulting in injury. However, with the continuous deepening of training, the physical quality of volleyball players has been greatly improved. Volleyball players adapt to the sports load at this time and the continuous improvement of technology, The rate of damage is decreasing.

DISCUSSION

Knee joint injuries are mostly due to long-term local overload or imbalance in training or competition, resulting in changes in the normal function of knee joint.⁷ Although the load threshold of the basic structure and auxiliary structure of the knee joint can not be determined, it is recognized that excessive load is easy to cause fatigue and then lead to strain. Sports practice shows that moderate load can enhance the stress and function of the anatomical structure of the knee joint, but overload will reduce the bearing capacity of the knee joint.

Table 3. multiple comparison of knee injury in different training years groups.

Years of training group	Training years group	Mean difference	Standard error	sig
Group under 5 years	6-10 year group	.8326*	.4251	.035
	Group with more than 11 years	1.2514**	.4653	.004
6-10 years	Group with more than 11 years	.6038*	.3803	.047

Note: * is $p < 0.05$, ** is $p < 0.01$

Scientific and reasonable arrangement of exercise load

Sports practice shows that unreasonable sports load arrangement can not only improve athletes' competitive ability and performance, but also cause injury and affect the exertion of competitive level. Scientific control of training load is an important condition to ensure the success of training. It is of great significance to improve competitive ability and prevent sports injury. In the training plan, coaches should strictly follow the principle of step-by-step, design the basic trend of load measurement change, scientifically plan and effectively adjust the change of load and intensity. And make the arrangement of load measurement adapt to the periodic changes of athletes' body state. Control the load change within an appropriate range to promote the improvement of athletes' physical function and competitive ability.⁸ Coaches and athletes should also pay attention to the recovery after load, and take various recovery means such as training, medical biology, nutrition and psychology to eliminate the fatigue brought by training load in time and prevent the occurrence of injury. Such as changing the training content and environment, adjusting the time and mode of training interval; Use sauna, massage and other means; Pay attention to the reasonable combination of various nutrients and supplement vitamins and trace elements; Using psychological recovery methods such as self suggestion and biofeedback.

Strengthen the strength and flexibility exercise of the knee joint and treat the injury in time

The knee joint is under great pressure when jumping. Biomechanics and tests show that the braking force of long jump and triple jump can reach about 1000kg and the height of jump can also reach about 600kg. Excessive braking support reaction force will inevitably increase the burden of support and knee joint. If the muscle strength around the knee joint is insufficient, it is bound to be difficult to bear great pressure. The special sports skills of jumping also require high flexibility of knee joint.⁹⁻¹⁰

CONCLUSION

This paper studies the fatigue injury of volleyball players under Sports endurance training such as jumping. Coaches should scientifically arrange the amount and intensity of sports load according to the technical characteristics of jumping events. Timely and reasonably control the load and load intensity in sports training to prevent all kinds of damage caused by excessive load. And strengthen the study of sports medicine and sports training. While improving their own knowledge and ability, we should also pay attention to the teaching and education of volleyball players' knowledge of preventing sports injuries, so as to cultivate volleyball players' ability and consciousness of self-protection and preventing injuries.

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REFERENCES

- Geisler M, Eichelkraut L, Miltner W, Weiss T. An fMRI study on runner's high and exercise-induced hypoalgesia after a 2-h-run in trained non-elite male athletes. *Sport Sciences for Health*. 2020;16(1):159-67.
- Hammoudi L, Brun JF, Noirez P, Bui G, Chevalier C, Gimet F et al. Effects of 2 years endurance training targeted at the level of maximal lipid oxidation on body composition. *Science & Sports*. 2020;35(6):350-7.
- Bagheri MH, Azamian-Jazi A, Banitalebi E, Kazeminasab F, Nasr-Esdahani MH. Both high-intensity interval training and low-intensity endurance training decrease intrahepatic lipid deposits via alterations of the expression of HIF-1 α , HIG2 in a murine model of non alcoholic fatty liver disease (NAFLD). *Science & Sports*. 2021;36(2):120-8.

4. Aminizadeh S, Habibi A, Masoumi-Ardakani Y, Shahouzehi B, Marefati H, Shakerian S. The role of estrogen-related receptor α (ERR α) in metabolic adaptations by endurance training in skeletal muscle of streptozotocin-induced diabetic rats. *Sport Sciences for Health*. 2021;17(6):1-12.
5. Müller DC, Izquierdo M, Boeno FP, Aagaard P, Teodoro JL, Grazioli R et al. Adaptations in mechanical muscle function, muscle morphology, and aerobic power to high-intensity endurance training combined with either traditional or power strength training in older adults: a randomized clinical trial. *European Journal of Applied Physiology*. 2020;120(5):1165-77.
6. Petré H, Hemmingsson E, Rosdahl H, Psilander N. Development of Maximal Dynamic Strength During Concurrent Resistance and Endurance Training in Untrained, Moderately Trained, and Trained Individuals: A Systematic Review and Meta-analysis. *Sports Medicine*. 2021;51(5):991-1010.
7. Senefeld JW, Joyner MJ. Strength-Endurance Training Classes. *Mayo Clinic Proceedings*. 2020;95(3):437-9.
8. Mrówczyński W. Health Benefits of Endurance Training: Implications of the Brain-Derived Neurotrophic Factor—A Systematic Review. *Neural Plasticity*. 2019;2019(7):1-15.
9. Ihalainen JK, Hackney AC, Taipale RS. Changes in inflammation markers after a 10-week high-intensity combined strength and endurance training block in women: The effect of hormonal contraceptive use. *Journal of Science and Medicine in Sport*. 2019;22(9):1044-8.
10. Tonkonogi M, Krook A, Walsh B, Sahlin K. Endurance training increases stimulation of uncoupling of skeletal muscle mitochondria in humans by non-esterified fatty acids: an uncoupling-protein-mediated effect?. *Biochemical Journal*. 2019;351(3):805-10.