STRENGTH TRAINING METHODS FOR SKIERS

MÉTODOS DE TREINAMENTO DE FORÇA PARA ESQUIADORES

MÉTODOS DE ENTRENAMIENTO DE FUERZA PARA ESQUIADORES

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ABSTRACT

Introduction: The ski jumping sequence can be divided into four steps: support, take-off, flight, and landing. Each stage has specific tasks and functions and is closely related, with the completion of each stage depending on the previous one. Objective: Explore the effectiveness of special strength training methods for ski sportsmen. Methods: Using the method of scientific literature review, expert interview, experience, and mathematical statistics to perform the special strength training for Chinese ski athletes, comparing the changes in the jump speed and take-off of the big jumps before and after 16 weeks of strength training with a specially developed protocol. Results: There were significant differences in take-off speed and air height before and after the experiment (P<0.05). The athletes in the experimental group significantly differed in takeoff speed before and after participation in the experiment (P=0.01). Conclusion: The experimental results fully evidence that by improving the rapid contraction strength of flexor and extensor muscles of the trunk and hip joints, modern abdominal center strength training methods are more effective than traditional methods. ***Level of evidence II; Therapeutic studies - investigation of treatment outcomes.***

Keywords: Skiing; Athletes; Resistance Training.

RESUMO

Introdução: A sequência de saltos de esqui pode ser dividida em quatro etapas: apoio, decolagem, voo e pouso. Cada etapa tem tarefas e funções específicas e está intimamente relacionada, sendo a conclusão de cada etapa dependente da etapa anterior. Objetivo: Explorar a eficácia dos métodos especiais de treinamento de força para esportistas em esqui. Métodos: Usando o método de análise científica literária, entrevista com especialistas, experiência e estatísticas matemáticas para realizar o treinamento de força especial para atletas chineses de esqui, comparando as mudanças na velocidade de salto e decolagem dos grandes saltos antes e depois de 16 semanas de treinamento de força com um protocolo especialmente desenvolvido. Resultados: Houve diferenças significativas na velocidade de decolagem e na altura aérea antes e depois do experimento (P<0,05). Os atletas do grupo experimental tiveram uma diferença muito significativa na velocidade de decolagem antes e depois da participação no experimento (P=0,01). Conclusão: Os resultados experimentais evidenciaram plenamente que ao melhorar a força de contração rápida dos músculos flexores e extensores das articulações do tronco e quadril, os métodos modernos de treinamento de força do centro abdominal são mais eficazes do que os métodos tradicionais de treinamento. ***Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.***

Descritores: *Esqui; Atletas; Treinamento de Força.*

RESUMEN

Introducción: La secuencia de salto de esquí puede dividirse en cuatro pasos: apoyo, despegue, vuelo y aterrizaje. Cada paso tiene tareas y funciones específicas y está estrechamente relacionado, siendo la conclusión de cada paso dependiente del anterior. Objetivo: Explorar la eficacia de los métodos especiales de entrenamiento de la fuerza para los deportistas de esquí. Métodos: Utilizando el método de revisión de la literatura científica, la entrevista a expertos, la experiencia y la estadística matemática para realizar el entrenamiento de fuerza especial para los atletas de esquí chinos, comparando los cambios en la velocidad de salto y el despegue de los grandes saltos antes y después de 16 semanas de entrenamiento de fuerza con un protocolo especialmente desarrollado. Resultados: Hubo diferencias significativas en la velocidad de despegue y la altura del aire antes y después del experimento (P<0,05). Los atletas del grupo experimental tuvieron una diferencia muy significativa en la velocidad de despegue antes y después de la participación en el experimento (P=0,01). Conclusión: Los resultados experimentales evidencian plenamente que, al mejorar la fuerza de contracción rápida de los músculos flexores y extensores de las articulaciones del tronco y la cadera, los métodos modernos de entrenamiento de la fuerza del núcleo abdominal son más eficaces que los métodos de entrenamiento tradicionales. ***Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.***

Descriptores: *Esquí; Atletas; Entrenamiento de Fuerza.*

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INTRODUCTION

The ski jumping sequence can be divided into four stages: assist, take off, flight, and landing. Each stage has specific tasks and functions and is closely related, and the completion of each stage depends on the previous stage.[1] Ski jumpers must establish initial conditions for the flight in a very short period of time during the take-off stage, that is, they generally need to complete the complete take-off action within 300ms, it is also very challenging for elite athletes to complete high-quality take-off movements at such a high speed (about 25m/s); In addition, the action quality of the take-off stage also determines all the initial conditions of the athlete's subsequent flight stage, including the launch speed, take--off height, angular momentum, the athlete's posture and the position of the snowboard, etc., and the mistakes in the take-off stage cannot be made up in the subsequent flight process. Takeoff and subsequent flight phase techniques are also affected by ambient winds. The study found that environmental wind is closely related to the fairness of ski jumping competitions.[2,3]

METHOD

Research object

Taking the athletes who have reached the level of athlete in the national snowboard platform jumping team as the research object, a total of 50 athletes participated in the experiment, including 25 men and 25 men, by random selection, each group of athletes was divided into two groups according to their sports performance.[4] The basic conditions of the two groups of athletes are introduced as follows: The age range of athletes is 17.11-19.51 years old, the height range is 164.48-169.08cm, the weight range is 50.08-65.28kg, and the sports years range is 5.5-11.9 years (see Table 1).

Research methods

Documentation Law

The author uses CNKI, Google Scholar and other academic websites, checked the relevant materials needed for the research, and looked up related books in the library, obtained documents and materials related to skiing, snowboarding, snowboard big jumping competition rules and core strength training.[5]

Expert interview method

In order to make the research process more scientific and reasonable and the research data results more real and effective, the author makes some observations about some colleges and universities that carry out better skiing projects, for example, ski experts such as sports academies, as well as provincial team coaches conducted interviews, find out what they think about the use of core strength training in snowboard big jump training and how it is currently used; At the same time, they were consulted and interviewed on whether the core strength training used in this study was feasible, and whether the training content and intensity were scientific.[6,7]

Experimental method

During the experiment, the author applied different training methods to the training of the experimental group and the control group, respectively, the general strength training method was used in the control group, and the core strength training method was used in the experimental group. According to the needs of the research task, the experimental research period of 50 athletes was 20 weeks, and the experimental group and the control group were divided into groups for training. Use core strength training, the training time is arranged as 8 classes per week, each time is 1~1.5h, the training intensity of the two groups is basically the same, both are large-medium-small. In the experiment, the training content of the control group used traditional strength training accounting for 70%, and core strength training content accounting for 30%. On the contrary, the experimental group mainly focused on core strength training, accounting for 70%, and traditional strength training accounted for 30%. Before and after the experiment, the average flying height and take-off speed of the two groups of athletes were tested, in order to examine important movement technique changes in two groups of athletes. 50 athletes were tested for core muscle strength before and after the experiment. Athletes in the experimental group and the control group will perform a 60°/s isokinetic maximum core muscle strength test before the experiment, and the test selects the Australian Kinitech isokinetic muscle strength test system, it can scientifically reflect the changes of core muscle strength, the main indicators are set as the maximum strength of trunk and hip extensors and flexors and the maximum power of extensors and flexors, maximum peak moment of extensor muscle and maximum peak moment of flexor muscle, extensor muscle power, flexor muscle power.[8]

Table 1. Basic conditions of athletes in the experimental group and the control group (n= 24).

Age	height (cm)	weight (kg)	Sports years (years)
17.46±2.5	171.23±2.4	58.61±4.6	9.3±4.5

Mathematical statistics

In this study, the experimental data were collected, and Excel was used for statistical analysis, at the same time, SPSS19.0 statistical analysis tool was used to conduct in-depth analysis of the experimental results and data, the results were compared horizontally and vertically, and the t-test was used to analyze the data within and between groups, $P \geq 0.05$ means no significant difference; $P \leq 0.05$ means significant difference; $P \leq 0.01$ means very significant difference.

Ethical Compliance

Research experiments conducted in this article with animals or humans were approved by the Ethical Committee and responsible authorities of Hebei Sport University following all guidelines, regulations, legal, and ethical standards as required for humans or animals.

RESULTS

Changes in the athlete's aerial height and take-off speed before and after the experiment

There were significant differences in take-off speed and flying height between the athletes in the experimental group before and after participating in the experiment ($P<0.05$). The female athletes in the experimental group had a significant difference in take-off speed before and after participating in the experiment ($P=0.0001$), which was more obvious than that of the male athletes; Analyzing the data of the control group, it can be found that there is no significant difference in the average take-off speed and height of the male and female athletes in the control group ($P>0.05$). (Figure 1)

Changes in the strength of the athlete's trunk and hip joints before and after the experiment

An independent sample t-test was performed on the data of the athletes in the experimental group and the control group before the experiment. From the results of the trunk strength test, before the experiment, the peak moment of extensor muscles ($P=0.0979$), extensor muscle power ($P=0.1905$), there was no significant difference in peak flexor moment ($P=0.1030$) and flexor power ($P=0.4087$). (Figure 2)

From the hip joint strength test results, before the experiment, there was no significant difference between the experimental group and the control group in extensor peak moment ($P=0.4703$), extensor power ($P=0.4588$), flexor peak moment ($P=0.6244$), and flexor power

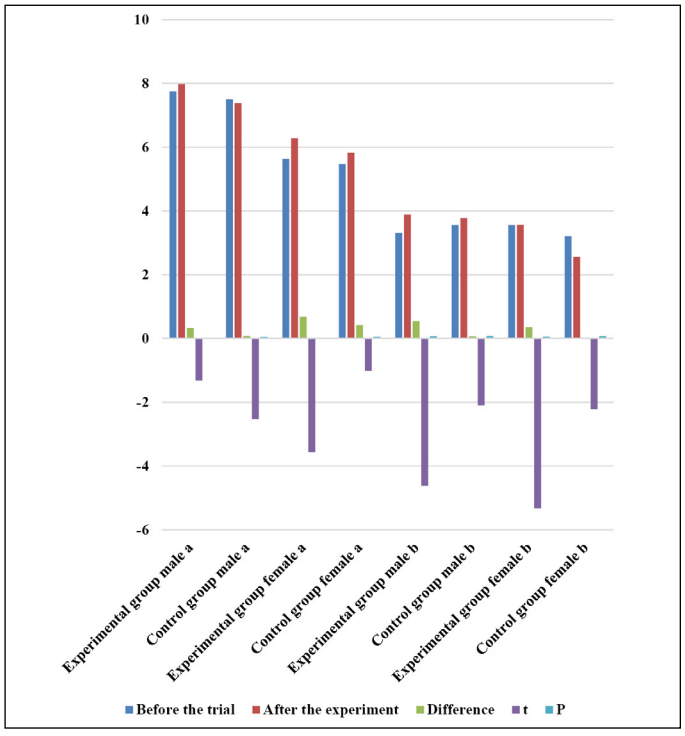

Figure 1. Comparison of differences between male and female snowboarders before and after the experiment.

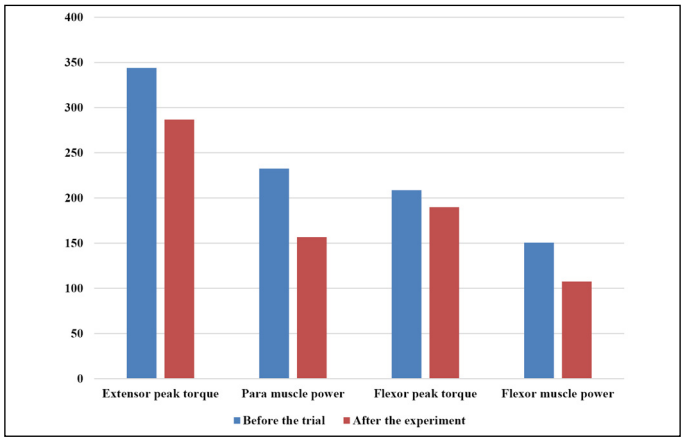

Figure 2. Comparison of the differences in the trunk strength test indicators between the experimental group and the control group before the experiment.

(P=0.0686) (Figure 3).[9] The trunk strength data measured before and after the experimental group and the control group participated in the experiment were calculated, and the results were obtained, the experimental groups had significant differences in peak extensor moment (P=0.0012), extensor power (P=0.0201), flexor peak moment (P=0.0001), and flexor power (P=0.0048). The control group had no significant difference in peak extensor moment (P=0.6854), extensor power (P=0.5521), and flexor power (P=0.8940), however, there was a significant difference in peak flexor moment (P=0.0001). (Figure 4)

DISCUSSION

Aerial attitude and air time are important conditions for high scores in snowboard big jumps

Snowboard big jumpers must have good aerial posture and time in the air if they want to get high scores, according to expert interviews, it is known that the take-off speed and the flying height determine the athlete's flying time. The measurement of flying technology is mostly based on the flying height, the flying height creates more room for the

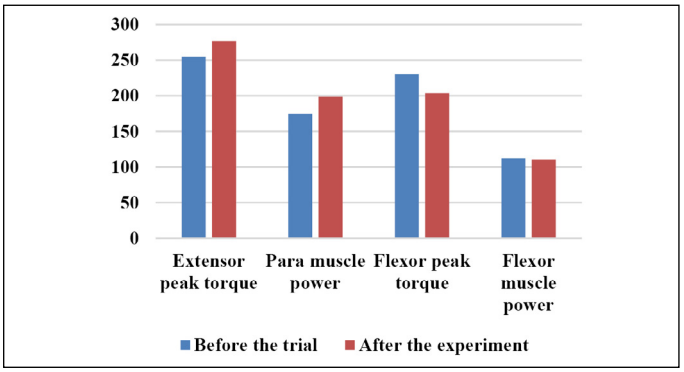

Figure 3. Comparison of the differences in hip joint test indexes between the experimental group and the control group before the experiment.

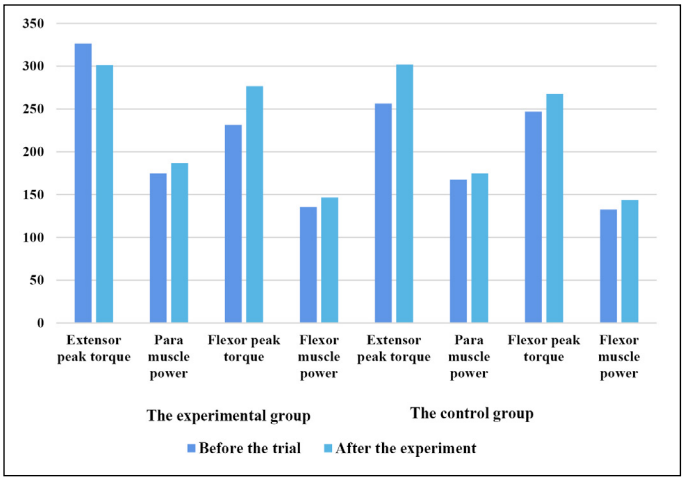

Figure 4. Comparison of the differences between the experimental group and the control group before and after the trunk strength test.

quality of technical movements, and the height is sufficient, athletes get more time to complete the movements of higher difficulty, get a higher difficulty score, thereby winning the game. The improvement of take-off speed and air height is beneficial to athletes to obtain higher difficulty scores, thus helping to improve sports performance.

Core strength training has a significant effect on athlete's take-off speed and altitude

Research shows, there were significant differences in the take-off speed and altitude of the athletes in the experimental group before and after participating in the experiment, and the difference in the take-off speed of the female athletes in the experimental group before and after participating in the experiment was more obvious than that of the male athletes. Compared with the experimental group, under the general strength training method, the control group did not significantly improve the take-off speed and air height. This indicates that core strength training has a certain role in improving the take-off speed and altitude of the athlete's snowboarding technique.[10]

Core strength training is beneficial to improve the hip muscles of athletes

Strength after 16 weeks of core strength training, the athlete's hip muscle strength was generally enhanced. The landing technique is a very important scoring technique in the big platform competition, and the stability of the hip joint is an important factor to ensure the stability of the athlete's landing, the strength of the leg muscles and the efficiency of the muscles around the hip joint are determined by the development of the hip joint strength. The experimental results fully proved that in improving the rapid contraction strength of the flexor

and extensor muscles of the trunk and hip joints, modern core strength training methods are more effective than traditional training methods, and it can effectively improve the flexors and extensors of the trunk and hip joints in terms of maximum muscle strength indicators.

CONCLUSION

The aerial height and take-off speed of the snowboard big jump are the basic guarantees for athletes to complete difficult aerial skills and land smoothly. Scientific, step-by-step core strength training for athletes, it has positive significance for the improvement of athletes' athletic quality and movement technical quality, for example, in terms of take-off speed and air height, core strength training can be continuously improved, so as to provide motivation and foundation for athletes to complete high-quality technical movements in the air, the improvement of these two technologies can help athletes improve their sports skills, it plays a vital role in the improvement of sports performance.

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