

# EFFECTS OF STRETCHING TRAINING ON LOWER LIMB EXPLOSIVE STRENGTH IN FIGURE SKATING ATHLETES



ORIGINAL ARTICLE  
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EFEITOS DO TREINO DE ALONGAMENTO SOBRE A FORÇA DE EXPLOSÃO NOS MEMBROS INFERIORES DOS ATLETAS DE PATINAÇÃO ARTÍSTICA

EFFECTOS DEL ENTRENAMIENTO DE ESTIRAMIENTO EN LA FUERZA EXPLOSIVA DE LAS EXTREMIDADES INFERIORES DE LOS ATLETAS DE PATINAJE ARTÍSTICO

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## ABSTRACT

**Introduction:** Figure skating is characterized by a high degree of flexibility, balance, and technical precision. It belongs to the sports group that combines high speed and endurance. Therefore, it is very important for athletes to correctly master these techniques and physical strength and execute precise movements in their performances. **Objective:** Explore the effect of stretching training on the lower limb explosive strength of figure skating athletes. **Methods:** 20 outstanding male figure skaters from the Chinese team were selected as volunteers. The experimental method was used using the OPTOJUMP test system, among other instruments, for comparison of pre and post-intervention results. **Results:** Through scientific observation, it was found that skaters have less requirement for upper limb strength training, minimizing its importance because upper limb strength training can assist in motor coordination of athletes' lower limbs and help them stabilize to perform dynamic movements. Therefore upper limb strength training is also emphasized in the proposed training. **Conclusion:** The stretching training on the lower limb strength of figure skating athletes proved to be useful for the improvement of performance and execution of the intrinsic movements of the sport. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Physical Education and Training; Athletes; Muscle Stretching Exercises.

## RESUMO

**Introdução:** A patinação artística é caracterizada por um alto grau de combinação de flexibilidade, equilíbrio e precisão técnica. Ela pertence ao grupo esportivo que combina alta velocidade e resistência. Portanto, é muito importante para os atletas dominar corretamente essas técnicas, a força física e executar movimentos precisos em suas apresentações. **Objetivo:** Explorar o efeito do treino de alongamento sobre a força de explosão nos membros inferiores dos atletas de patinação artística. **Métodos:** 20 patinadores artísticos masculinos de destaque da equipe chinesa foram selecionados como voluntários. Foi utilizado o método experimental utilizando o sistema de teste OPTOJUMP entre outros instrumentos para comparação de resultados pré e pós intervenção. **Resultados:** Através da observação científica, descobriu-se que os patinadores têm menos exigências para o treinamento de força nos membros superiores, minimizando a sua importância pois o treinamento de força nos membros superiores pode auxiliar na coordenação motora dos membros inferiores dos atletas e ajuda-los na estabilização para executar movimentos dinâmicos, portanto o treinamento de força dos membros superiores também é enfatizado no treino proposto. **Conclusão:** O treino de alongamento sobre a força de explosão nos membros inferiores dos atletas de patinação artística mostrou-se útil para o aprimoramento da performance e execução dos movimentos intrínsecos do esporte. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Educação Física e Treinamento; Atletas; Exercícios de Alongamento Muscular.

## RESUMEN

**Introducción:** El patinaje artístico se caracteriza por un alto grado de combinación de flexibilidad, equilibrio y precisión técnica. Pertenece al grupo de los deportivos que combinan alta velocidad y resistencia. Por lo tanto, es muy importante para los atletas dominar correctamente estas técnicas, la fuerza física y ejecutar movimientos precisos en sus presentaciones. **Objetivo:** Explorar el efecto del entrenamiento de estiramiento en la fuerza explosiva de las extremidades inferiores de los atletas de patinaje artístico. **Métodos:** Se seleccionaron como voluntarios 20 destacados patinadores artísticos masculinos del equipo chino. Se utilizó el método experimental con el sistema de pruebas OPTOJUMP, entre otros instrumentos, para comparar los resultados antes y después de la intervención. **Resultados:** A través de la observación científica, se descubrió que los patinadores tienen menos necesidad de entrenar la fuerza de las extremidades superiores, minimizando su importancia porque el entrenamiento de la fuerza de las extremidades superiores puede ayudar a la coordinación motora de las extremidades inferiores de los atletas y ayudarles en la estabilización para realizar movimientos dinámicos, por lo que el entrenamiento de la fuerza de las extremidades superiores también se enfatiza en



**Descriptores:** Educación y Entrenamiento Físico; Atletas; Ejercicios de Estiramiento Muscular.

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## INTRODUCTION

Athlete-specific physical training and technical training are inseparable, physical fitness is the foundation of technology, technology is the carrier of physical fitness, and physical fitness and technology are “one element”. The combination training method is an effective method to realize the integration of various sports qualities and various competitive abilities, and the rational use of the combination training method is an effective way to improve the overall competitive ability of athletes.<sup>1</sup>

Falces, M. Mentions the use of electro-optical motion capture systems in Body Movement During Figure Skating Land Training, quantitatively evaluated seven skaters performing a point ice lap jump on a spinning device (spinner), the displacement of the horizontal projection of the centroid.<sup>2</sup>

Tillaar R Main points in “Several Aspects of Optimizing the Physical Training of Semifinal Student Swimmers”: According to the impact standard on the physical exercise optimization index, the specific operation structure is classified, and classify according to the results of student training.<sup>3</sup> Shen M In “The effect of short-term training and retraining on the physical fitness of elite football players” Main point: The main research objective was to examine the after-season football players, aerobic high-intensity training is effective in reducing body volume and body.<sup>4</sup> Wang Z’s main points in “Snow Skills Project Special Physical Training Content System Research”: Cycle training theory is an important theoretical achievement in sports training, and it is also an important theoretical basis for physical training practice, according to competition goals or tasks, training is divided into different cycles, which is a cycle with certain regularity.<sup>5</sup> In summary, a training plan was developed. The main training methods are special training methods. With such special strength training, the training effect will be more obvious. As shown in Figure 1.

## Experimental subjects and methods

### Comparative analysis method

Through the analysis and comparison of technical data with American athletes, the existing difficulty gap is compared and analyzed, and the reason is found from the perspective of physical fitness.<sup>6</sup>

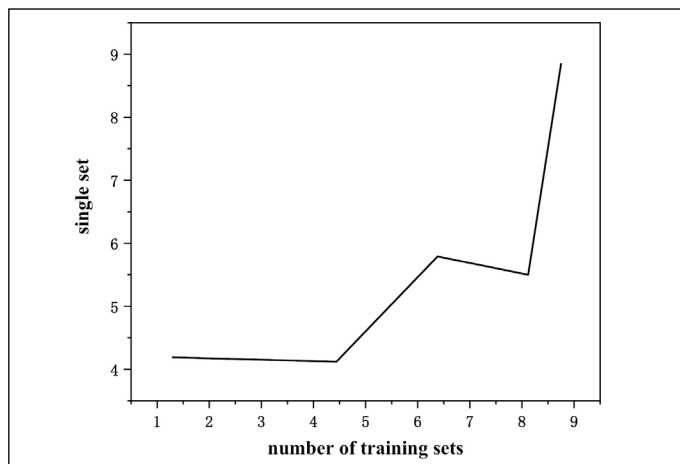


Figure 1. Strength comparison before and after core strength training in 10 weeks.

## Logic Analysis

By comparing the jumping gaps of athletes, logical analysis is carried out to obtain reasonable training techniques.

## Experimental method

Special strength training for figure skaters should strictly follow the training cycle to arrange the training volume, and there is less training on ice for off-season athletes, special strength training is mainly to reserve physical strength for the season, so special strength training is carried out 4-6 times a week, and each training session is about 2 hours; Entering the season is mainly about skilled competition movements, more ice training sessions, and relatively less time and frequency of special strength training for athletes, special strength training is carried out 2-4 times a week, and a course takes about 1.5 hours.<sup>7</sup>

Taking 20 outstanding men’s figure skaters from the Chinese training team as the experimental objects, we provide a training plan for the reference of the coaches, so the first test is in October, and the second test is in November. Through the OPTOJUMP test system and other instruments, the athletes are tested before and after the experiment.

There is no need for a code of ethics for this type of study.

## Experimental results

It is composed of basic physical qualities such as strength, speed, agility, endurance, coordination and flexibility, and basic human activities (walking, running, jumping, throwing, climbing, and climbing, etc.).<sup>8</sup> It is one of the most important structures in the overall structure of athlete’s competitive ability. as shown in Figure 2.

The main purpose of core strength and stability training is to enhance the athlete’s control and improve the quality of the athlete’s ice fall. The following training methods and means are mainly to improve the stability of the core strength of athletes.<sup>9</sup> Generally, circuit training and repetition training are used. The training methods and means of core strength stability are shown in Table 1.

A plank training: The action requires that the athlete’s legs are clamped, the toes are on the ground, the forearm is flat with the ground and

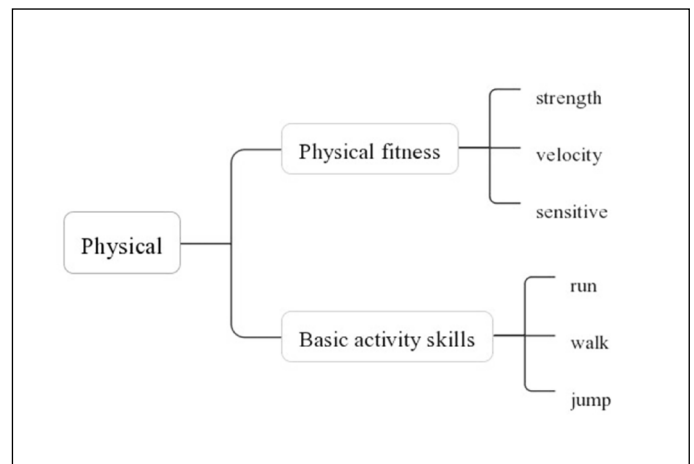


Figure 2. Classification and composition of physical fitness.

**Table 1.** Training methods and means of core strength stability.

Action name	Training volume (set x reps)	group rest time
plank	According to the individual ability of the athlete	30 seconds - 1 minute
Sit-ups	According to the individual ability of the athlete	30 seconds - 1 minute
box jumping	According to the individual ability of the athlete	30 seconds - 1 minute
jumping steps	According to the individual ability of the athlete	30 seconds - 1 minute

the upper arm is perpendicular, the five fingers are separated, the head is straight, and the toes, buttocks and head are in a line.

A plank training: Action requirements, the athlete's legs are clamped, the toes are on the ground, the forearm is flat with the ground and the upper arm is perpendicular, the five fingers are separated, the head is straight, and the toes, buttocks and head are in a line.

According to the individual ability of the athlete, the intensity and load of the athlete are arranged.<sup>10</sup> The athlete keeps other positions unchanged, and can straighten the elbow joint to train the core stability of the athlete in a more targeted manner. However, the specific load intensity and quantity should be arranged according to the individual differences of athletes.<sup>11</sup>

B sit-up training: In order to more effectively stimulate the core muscle group, the upper body rise and fall angle is between 0-45°, when the upper body forms an angle of about 45° with the ground, keep still for 5 seconds. Then go to the next time, each time you complete the movement, rise and fall slowly, with a consistent rhythm, and avoid other wrong movements during the completion process.

The movements of the back muscle training are the same as the maximum core strength, and the training requirements are different due to the different training goals.

A back training: The partner holds the trainer's ankle joint with both hands, the trainer crosses the back with both hands, and the upper body rises and falls at about 45°. After the upper body reaches 45° to the ground, keep still for 3 seconds, and then proceed to the next training.

B training from both sides of the abdomen and back: This action is mainly reflected in the control of the legs and trunk. The ups and downs are slow, and after reaching the maximum angle of bulging, keep still for 2 seconds.

A box jumping practice training: Choose the height of the box according to the height of the athlete, the height of the box is between 60-70cm, arranged in two rows, 6-8 in each row.

After the warm-up, athletes perform box jumping exercises with their hands behind their backs, completing each set of exercises rhythmically.

Then proceed to the next set of exercises, the next set of exercises needs to add arms, and rely on the swing of the arms to drive the body to jump. Doing so can enhance the athlete's coordination, and the cooperation of the upper and lower limbs can improve the efficiency of take-off. Effectively improve the core control of athletes. The specific load intensity and quantity should be arranged according to the individual differences of athletes.

The throwing, twisting and lifting in the double skating action have great requirements on the upper body strength of athletes, especially for male athletes. However, single skaters have little upper body strength. The training of upper body strength is on the one hand to assist athletes in taking off, and on the other hand, to enhance the performance of athletes in short programs and free skating. The training methods and means of upper body strength are shown in Table 2.

Figure skating single skaters have very little upper body strength requirements, while pair skaters, especially male athletes, require extremely high upper body strength, because pair skating requires the completion of difficult movements such as twists, lifts and throws. The purpose of single-person upper body strength training is to enhance artistic expression and assist athletes to complete more difficult movements. Through arm stretching exercises and push-up exercises, the circuit training method and continuous training method are used for training, which can effectively improve the upper body strength of athletes.

**Table 2.** Exercise methods and means of upper body strength.

Action name	Training volume (set x reps)	group rest time
arm stretching exercises	According to the individual ability of the athlete	30 seconds - 1 minute
push ups	According to the individual ability of the athlete	30 seconds - 1 minute

## CONCLUSION

Experiments have shown that by lying on the prone bird, the left foot jumps inward, the right foot jumps inward, the left foot jumps out, and the right foot outwards. Interval training, repetitive training and circuit training are used for training to enhance the athlete's explosive power and effectively improve the athlete's take-off ability, help athletes improve idle time and forward speed, so that athletes can complete more difficult jumps, the comparison of the data before and after the experiment can prove that the upper body special strength training program is effective.

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

**AUTHORS' CONTRIBUTIONS:** Each author made significant individual contributions to this manuscript. MM: writing; BJ and YZ: data analysis and article review and intellectual concept of the article.

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