

# SUPERISOMETRIC AQUATIC TRAINING IN THE PHYSICAL PREPARATION OF SOCCER PLAYERS



ORIGINAL ARTICLE  
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TREINAMENTO AQUÁTICO SUPERISOMÉTRICO NO PREPARO FÍSICO DE FUTEBOLISTAS

ENTRENAMIENTO ACUÁTICO SUPERISOMÉTRICO EN LA PREPARACIÓN FÍSICA DE FUTBOLISTAS

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## ABSTRACT

**Introduction:** With the growing importance of physical training over sport training for competition, more research has been conducted. One of the least explored techniques is superisometric aquatic training. **Objective:** Study the application of super-isometric aquatic training to the physical training of soccer athletes. **Methods:** A literature review was performed to elaborate an experimental protocol. The experimental method was conducted on 24 university volunteers randomly divided into control and experimental groups. Classical training was conducted for two weeks between the groups, superisometric aquatic training was added only in the experimental group. Through the mathematical-statistical method, a comparative analysis of the research results was elaborated, and the effects of the intervention were discussed. **Results:** The movement time of the athletes in the experimental training group was reduced by 1.89s. The performance of running, tapping, standing jump, and weightlifting tests is not significantly different from those of the traditional strength training group. **Conclusion:** The application of superisometric aquatic training in the physical preparation of soccer players increased the overall strength of athletes, and also beneficially influenced specific activities of the sport. It is recommended to analyze the characteristics of the athlete and integrate superisometric training to general strength training specifically to the need of each athlete. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Physical Education and Training; Soccer; Isometric Exercise.

## RESUMO

**Introdução:** Com a crescente importância do treinamento físico sobre o treinamento esportivo para competição, um número cada vez maior de pesquisas vem sendo realizado. Uma das técnicas pouco exploradas é o treinamento aquático superisométrico. **Objetivo:** Estudar a aplicação do treinamento aquático superisométrico ao treinamento físico de preparo dos atletas de futebol. **Métodos:** Uma análise da literatura foi efetuada para elaborar um protocolo experimental. O método experimental foi conduzido sobre 24 universitários voluntários divididos aleatoriamente em grupo controle e experimental. O treinamento clássico foi conduzido por duas semanas entre os grupos, o treinamento aquático superisométrico foi adicionado apenas no grupo experimental. Através do método estatístico matemático uma análise comparativa dos resultados da pesquisa foi elaborada e os efeitos da intervenção foram discutidos. **Resultados:** O tempo de movimento dos atletas no grupo de treinamento experimental foi reduzido em 1,89s. O desempenho de corrida, toque, salto em pé e os resultados dos testes de levantamento de peso não foram significativamente diferentes daqueles do grupo de treinamento de força tradicional. **Conclusão:** A aplicação do treinamento aquático superisométrico no preparo físico de futebolistas aumentou a força geral dos atletas, também influenciou benéficamente em atividades específicas do esporte. Recomenda-se analisar as características do esportista e integrar o treinamento superisométrico ao treinamento de força geral especificamente à necessidade de cada esportista. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Educação Física e Treinamento; Futebol; Exercício Isométrico.

## RESUMEN

**Introducción:** Con la creciente importancia de la preparación física en el entrenamiento deportivo para la competición, se ha realizado un número cada vez mayor de investigaciones. Una de las técnicas poco exploradas es el entrenamiento acuático superisométrico. **Objetivo:** Estudiar la aplicación del entrenamiento acuático superisométrico a la preparación física de los deportistas de fútbol. **Métodos:** Se realizó una revisión de la literatura para elaborar un protocolo experimental. El método experimental se llevó a cabo con 24 voluntarios universitarios divididos aleatoriamente en grupos de control y experimentales. El entrenamiento clásico se realizó durante quince días entre los grupos, el entrenamiento acuático superisométrico se añadió sólo en el grupo experimental. Mediante el método estadístico matemático se elaboró un análisis comparativo de los resultados de la investigación y se discutieron los efectos de la intervención. **Resultados:** El tiempo de movimiento de los atletas del grupo de entrenamiento experimental se redujo en 1,89s. El rendimiento de la carrera, el golpeo, el salto de pie y los resultados de las pruebas de levantamiento de pesas no fueron significativamente diferentes de los del grupo de entrenamiento de fuerza tradicional. **Conclusión:** La aplicación del entrenamiento acuático superisométrico en la preparación física de los jugadores de fútbol aumentó



la fuerza general de los atletas, también influyó beneficiosamente en las actividades específicas del deporte. Se recomienda analizar las características del deportista e integrar el entrenamiento superisométrico al entrenamiento de fuerza general de forma específica a la necesidad de cada deportista. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptores:** Educación y Entrenamiento Físico; Fútbol; Ejercicio Isométrico.

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## INTRODUCTION

With the increasing importance of physical training in competitive sports training, more and more researches on physical training have been conducted, however, there are not many applied researches on physical fitness training of athletes, especially the applied research on specific physical fitness of athletes.<sup>1</sup>

Zen G et al. have confirmed that performing ultra-isometric training in water as deep as the waist can reduce the impact force when landing by as much as 33% to 54%, reducing the potential risk of injury.<sup>2</sup> Alarcón et al believe that this muscle soreness is mainly due to the damage of the muscle microcellular structure, therefore, muscle strength is decreased for at least 3 days.<sup>3</sup> Further research by Lopategui IG found that water training increased the subjects' nerve impulses by 19% to 54%, and the movement frequency by 33% to 62%.<sup>4</sup> It shows that water training makes better use of the nerve's innervation ability to muscles, through the ability of nerve recruitment and the improvement of coordination between different muscles, reducing the confrontation between muscles and muscle groups is conducive to alternate training of agonist and antagonist muscles, so that the transition from eccentric contraction to concentric contraction is more rapid and smooth. Zavalishina S Y super isometric training can also perform jumping exercises with and without weight, which leads to a new exercise form: For weight-bearing ultra-isometric training, it is also a hot issue for scholars to discuss the optimal weight-bearing problem for different groups of weight-bearing ultra-isometric exercises.<sup>5</sup> The study by Janueviius D et al showed that: 30% MVC weighted squat jump training is more conducive to improving the vertical jump performance of athletes than the unloaded squat jump.<sup>6</sup>

The author aimed at college football players in the general group (different from the high-level group), using the super isometric training method, through a certain period of training, and compared with the traditional training group for analysis. Combined with the special physical characteristics of football players, through the test and comparison of the athletes' mobility, jumping ability, flexibility and general strength, the author analyzes the advantages and disadvantages of the super isometric training method in the physical training of college football players, provide reference for the special physical training of football players.

## METHOD

### Research object

Taking the application of super isometric training in the physical training of college football players as the research object; Taking a total of 24 school football team members (12 men's volleyball players and 12 women's volleyball players) as the experimental subjects.

### Research methods

#### 1. Documentation Law

According to research needs, consult library books and related academic journals, and through CNKI, VIP database, Tsinghua Tongfang database to check the relevant literature, provide a theoretical basis for the author's writing.<sup>7</sup>

## 2. Experimental method

Before the experiment, the tested athletes (all with a certain strength base) were subjected to adaptive training for two weeks, and then randomly divided into groups. The subjects were randomly divided into two groups: The ultra-isometric training group (group A) and the traditional strength training group (group B). 6 male players and 6 female players were randomly selected from each group. There was no significant difference in age, weight, height and physical health status of each group of subjects ( $P > 0.05$ ). The experimental design is as follows.

## 3. Training method

Combined with the current actual situation and training level of the football team, deep jump training and medicine ball training were selected as the main training methods for athletes' super isometric training (group A). The subjects trained 3 times a week, and the training time was 3-5 pm every Wednesday, Friday, and July (Sunday), and the training continued for 16 weeks.

The training methods of group A include: (1) Low platform depth jumping exercises: 0.4~0.6m for boys and 0.2~0.4m for girls, 12 times/group, 4 groups each time, 3min rest between groups; (2) High platform deep jump practice: 0.6~1.0m for boys, 0.4~0.8m for girls, 12 times/group, 4 groups each time, rest 3 minutes between groups; (3) Practice of throwing and receiving a medicine ball: Supine throwing and receiving a medicine ball (1~3kg), 20 times/group, 4 groups each time, rest 3 minutes between groups.

Group B training methods include: (1) Weight-bearing half-squats (60% of the maximum weight): 10 times/group, 4 groups each time. (2) Weight-bearing full squat (60% of the maximum weight): 10 times/group, 4 groups each time. (3) Inclined board sit-ups: 30 times/group, 4 groups each time, rest 3 minutes between groups.

## 4. Mathematical statistics

The collected data were analyzed by Excel2003 and spss18.0.<sup>8</sup>

## Ethical Compliance

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

## RESULTS

### Super isometric training

Super isometric training is mainly a training mode developed on the basis of the theoretical basis of the lengthening-shortening cycle (SSC). The muscle force generated in the process of SSC is greater than the muscle force generated by simple concentric contraction, and the muscle is forced to be elongated in advance, immediately followed by a rapid shortening of the movement, it can produce a supernormal explosive force.<sup>9</sup> Moreover, the explosive power produced by super isometric training is easier to convert to special explosive power, and it is easier to show it in special sports. The difference between the touchdown time and coupling time of some common super isometric exercises in normal training is also very obvious. (Table 1)

**Table 1.** Various biomechanical characteristics of common super isometric movements.

Super isometric	Touchdown time			Total time for a single action
	Centrifugal drop	Coupling time	Centripetal rise	
Sprint run		0.01s		0.5s
Bounce		0.22s		0.5s
Squat jump		0.40s		1.0s
Deep jump		0.33s		1.0s

Poor body posture will affect the technical movements of super isometric exercises, thereby affecting the effect of the exercise, and even causing sports injuries. Maintain the balance and stability of the trunk and joints during the super isometric exercise. Those who perform super isometric exercises must have a certain basic strength, core strength is the basis of super isometric exercises, basic strength exercises can help improve the strength of muscle super isometric exercises, build muscle power further on a higher base. Incorporate super isometric exercises into general strength exercises and cross them with general strength exercises to achieve better results.

The action time required for intense football sports is generally less than 300ms, and the maximum force cannot be fully exerted in a short period of time (Figure 1), high-load super-isometric training will increase the touchdown time during deep jumping, therefore, it affects the contraction of SSC, affects the strength of stretch reflex, and is not conducive to the improvement of explosive power.

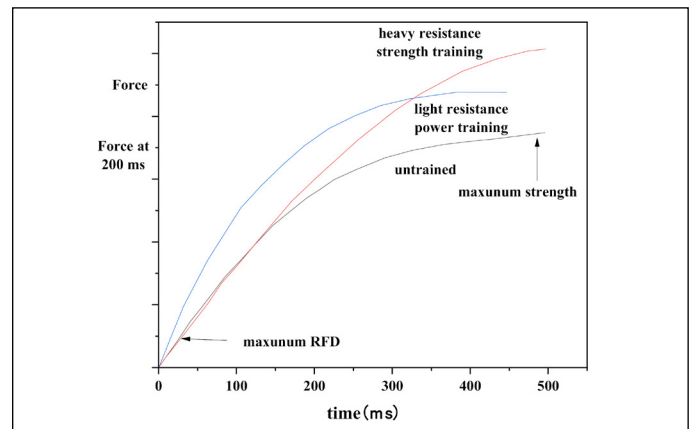
Heavy weight training resulted in a 27% increase in maximal strength, but not a significant increase in power rate (Figure 2). Therefore, compared with high-load super isometric training, low-load super isometric training is more conducive to improving explosive power. Low-load ultra-isometric training can be used as an effective training method to improve athlete's explosive power.

### Analysis of the effect of super isometric training and traditional strength training

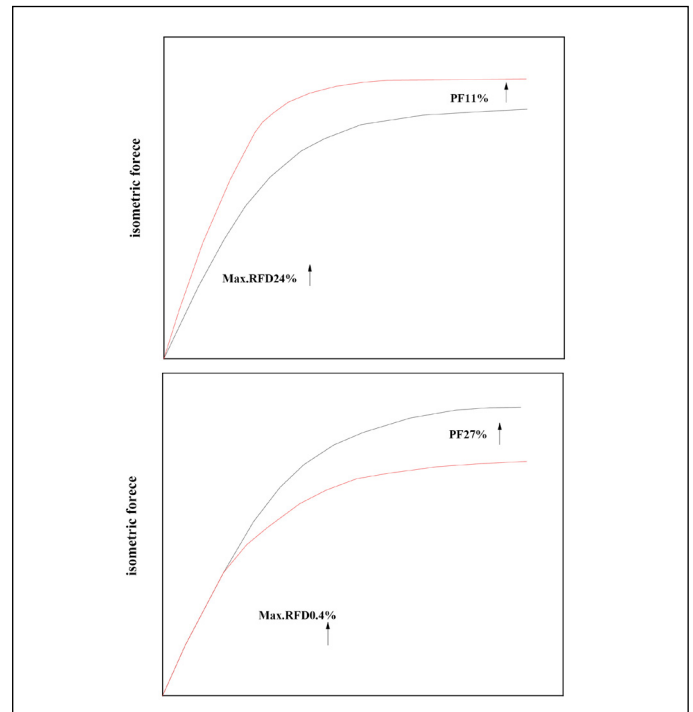
Research indicates, after 16 weeks of training, athletes in both the ultra-isometric training group and the traditional strength training group improved in all physical qualities. As shown in Table 2, after 16 weeks of training, the half-meter movement time of the athletes in the ultra-isometric training group was shortened by 1.89s, the traditional strength training group shortened by 1.32s, the super-isometric training group's approach-to-high performance increased by 12cm, and the traditional strength training group increased by 9cm; The standing long jump performance of the members of the ultra-isometric training group improved by 11cm, and the traditional strength training group improved by 8cm. However, compared with the traditional strength training group, there was no significant difference in the test results of supine two-head ups and forward flexion of the members of the ultra-isometric training group.

### DISCUSSION

In the "Chinese Youth Football Training Syllabus", the half-meter movement is used to test the movement ability of athletes; The run-up touch and standing long jump are used to test the athlete's jumping ability; Body forward flexion is used to test the athlete's flexibility; Lying on the back and starting from both ends belongs to the strength category in the physical fitness test category of athletes.<sup>10</sup> In the super-isometric training group: The test scores of half-meter movement, approach-running and standing long jump were better than those of the traditional strength training group, it shows that the effect of super isometric training on the movement ability and jumping ability of football players is better than that of traditional strength training, and there is no significant difference in the test results of football players' forward flexion and supine two-head



**Figure 1.** Force-time curve of force and force rate.



**Figure 1.** Strength-time curves of hyper isometric training (left) and weight training (right).

**Table 2.** Comparison of physical fitness before and after training.

	Group	Before training	After training	Effect
half "meter" word movement/s	A	19.2	17.3	-1.9
	B	19.3	17.9	-1.3
Approach touch height/cm	A	271	283	+12
	B	270	279	+9
Standing long jump/cm	A	220	231	+11
	B	221	229	+8
Lie on your back and get up at both ends/(times/min)	A	49	60	+11
	B	49	60	+11
Forward flexion/cm	A	19	23	+4
	B	19	23	+4

ups, it shows that the super isometric training method has no obvious advantage over traditional strength training in improving the flexibility and general strength of football players.

### CONCLUSION

The effect of super isometric training is better than that of traditional strength training methods in improving football players' specific movement

ability and jumping ability, but the effect of improving football players' flexibility and general strength is not obvious. In order to make super isometric training better applied to football-specific physical training, it is necessary to grasp the special characteristics of football, design training movements in a targeted manner, and combine them with other training methods, learn from each other's strengths to make up for the lack of super isometric training in improving the overall physical quality of football

players. It is recommended that follow-up researchers conduct research on the men's football players and women's football players' ultra-isometric training separately, and make a comparative analysis, so as to better apply the ultra-isometric training to the physical training of football players.

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The author declare no potential conflict of interest related to this article

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**AUTHORS' CONTRIBUTIONS:** The author made significant contributions to this manuscript. Hao Wu: writing, data analysis, article review and intellectual concept of the article.

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