

# QUALITY IN BALANCE SENSITIVITY THROUGH MARTIAL ARTS APPLIED TO CHILDREN



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QUALIDADE NA SENSIBILIDADE DO EQUILÍBRIO PELAS ARTES MARCIAIS APLICADAS ÀS CRIANÇAS

CALIDAD EN LA SENSIBILIDAD DEL EQUILIBRIO A TRAVÉS DE LAS ARTES MARCIALES APLICADAS A LOS NIÑOS

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## ABSTRACT

**Introduction:** Martial arts training focuses on science, methodology, and practice. Martial arts are a symbol of physical fitness. The academic analysis of the influence of martial arts training on children's physical health is of great importance for promoting traditional Chinese culture. It can enrich sports intervention programs to improve children's physical health. **Objective:** Analyze the effect of sensory quality training on martial arts balance training in children. **Methods:** Children aged 8 to 12 years were selected as research subjects. After repeated deliberations, a children's martial arts set was designed and implemented. The pilot project analyzes the importance of sensory quality in the essential stage of children's martial arts training. **Results:** After the experiment, there was a significant difference in balance quality in the experimental group ( $p < 0.01$ ). After the experiment, the difference in balance sense between the experimental and control groups was significant ( $p < 0.01$ ). **Conclusion:** In the basic training phase of children's martial arts, coaches should require athletes to master basic martial arts skills more comprehensively. All movement combinations in martial arts require comprehensive physical fitness and balance sensitivity, including speed, flexibility, and coordination. **Level of evidence II; Therapeutic studies - investigation of treatment outcomes.**

**Keywords:** Martial Arts; Physical Education and Training; Postural Balance; Sports.

## RESUMO

**Introdução:** O treinamento em artes marciais concentra-se na ciência, na metodologia e na prática. As artes marciais são um símbolo de aptidão física. A análise acadêmica da influência do treinamento de artes marciais na saúde física das crianças é de grande importância para a promoção da cultura tradicional chinesa e pode enriquecer os programas de intervenção esportiva para melhorar a saúde física infantil. **Objetivo:** Analisar o efeito do treinamento de qualidade sensitiva no treinamento de equilíbrio das artes marciais em crianças. **Métodos:** Selecionou-se crianças de 8 a 12 anos como objetos de pesquisa. Após repetidas deliberações, foi elaborado e implementado um conjunto de artes marciais infantis. O projeto piloto analisa a importância da qualidade sensitiva na etapa essencial do treinamento das artes marciais infantis. **Resultados:** Após o experimento, houve uma diferença significativa na qualidade do equilíbrio no grupo experimental ( $p < 0,01$ ). Após o experimento, a diferença no sentido de equilíbrio entre os grupos experimental e de controle foi significativa ( $p < 0,01$ ). **Conclusão:** Na fase de treinamento básico das artes marciais infantis, os treinadores devem exigir que os atletas dominem as habilidades básicas das artes marciais de forma mais abrangente. Todas as combinações de movimentos nas artes marciais exigem aptidão física e sensibilidade de equilíbrio abrangentes, incluindo velocidade, flexibilidade e coordenação. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Artes Marciais; Educação Física e Treinamento; Equilíbrio Postural; Esportes.

## RESUMEN

**Introducción:** El entrenamiento de las artes marciales se centra en la ciencia, la metodología y la práctica. Las artes marciales son un símbolo de la condición física. El análisis académico de la influencia del entrenamiento de artes marciales en la salud física de los niños es de gran importancia para la promoción de la cultura tradicional china y puede enriquecer los programas de intervención deportiva para mejorar la salud física de los niños. **Objetivo:** Analizar el efecto del entrenamiento de la calidad sensorial en el entrenamiento del equilibrio en artes marciales en niños. **Métodos:** Se seleccionaron niños de 8 a 12 años como sujetos de la investigación. Tras repetidas deliberaciones, se diseñó y puso en marcha un conjunto de artes marciales para niños. El proyecto piloto analiza la importancia de la calidad sensorial en la etapa esencial del entrenamiento de artes marciales de los niños. **Resultados:** Después del experimento, hubo una diferencia significativa en la calidad del equilibrio en el grupo experimental ( $p < 0,01$ ). Tras el experimento, la diferencia en el sentido del equilibrio entre los grupos experimental y de control fue significativa ( $p < 0,01$ ). **Conclusión:** En la fase de formación básica de las artes marciales infantiles, los entrenadores deberían exigir a los deportistas un dominio más completo de las habilidades marciales básicas. Todas las combinaciones de movimientos en las artes marciales requieren una amplia aptitud física y sensibilidad al equilibrio, incluidas la velocidad, la flexibilidad y la coordinación. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptor:** Artes Marciales; Educación y Entrenamiento Físico; Equilibrio Postural; Deportes.



## INTRODUCTION

Chinese martial arts are a treasure of China. It is a traditional Chinese sports event with extensive social value and national cultural characteristics.<sup>1</sup> Sensitive quality is of great significance to improving the technical level of martial arts learners in the complex requirements of martial arts routines. The author created a set of children's martial arts movements and practiced them in the gymnasium. At the same time, we tested the sensitive period of sensitive quality by experimental method.

## METHOD

### Research objects

This study used children aged 8-12 in a physical training hall as the research object.<sup>2</sup> A total of 20 children were selected and randomly divided into two groups (experimental group and control group). There are ten children in each group. The experimental period of this study was from September 2020 to February 2021. The first test will be from September 10 to September 11, 2020. At the beginning of September 2020, the experimental group started the teaching practice of children's martial arts. The second test will be held from February 11 to February 12, 2021.

### Experimental method

This study was divided into an experimental group and a control group. The control group underwent physical training exactly as traditionally prescribed after completing the initial test.<sup>3</sup> The experimental group used the traditionally stipulated activity time for children's martial arts activities (every Monday to Friday. One hour of martial arts activities per day). During the test, the experimental group and the control group were tested simultaneously and the exact location. The test indicators include reaction time, 20m×2 round-trip running, long jump, standing on one leg with eyes closed, sitting forward, bending, and arm support.

### Linear characteristics of human body balance adjustment process

Suppose the steady-state value of the system is  $K$ . We substitute the three points  $A$ ,  $B$ ,  $C$  into the time domain function of the typical unit impulse response of the second-order system to obtain three equations, namely,

$$\frac{\omega_n}{\sqrt{1-\zeta^2}} e^{-\zeta\omega_n t_0} = (c_0 - K) \quad (1)$$

$$\frac{\omega_n}{\sqrt{1-\zeta^2}} e^{-\zeta\omega_n (t_0+(t_2-t_0)/2)} = (K - c_1) \quad (2)$$

$$\frac{\omega_n}{\sqrt{1-\zeta^2}} e^{-\zeta\omega_n (t_0+(t_2-t_0))} = (c_2 - K) \quad (3)$$

Approximate formula based on adjustment time

$$T_s = \frac{4}{\zeta\omega_n} \quad (4)$$

Using equations (1) to (3), we can get:

$$T_s = \frac{2(t_2 - t_0)}{\ln(c_2 - c_1) - \ln(c_0 - c_1)} \quad (5)$$

In this study,  $T_s$  was used as an index for quantitatively evaluating the balance ability of the human body to resist the displacement of the center of gravity.

## Mathematical Statistics

All measurement data were processed and counted using SPSS 13.0 statistical software.

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

## RESULTS

### The influence of children's martial arts on children's lower limb strength

Endurance refers to the ability of the body to perform muscle activity for long periods and fight fatigue. Endurance is essential in measuring a person's physical condition and labor ability. It is also an essential athletic quality for engaging in various sports. According to the parts involved in activities, endurance can be divided into local endurance and whole-body endurance.<sup>4</sup> This test only tests upper limb endurance in local endurance. An indicator that represents upper body endurance is arm support. (Table 1)

### Influence of children's martial arts on reaction ability

Responsiveness refers to the conscious response to stimuli caused by the automatic conditioned reflex of the central nervous system after an organism is subjected to external stimuli. We can divide the response into simple action responses and complex action responses.<sup>5</sup> Only simple responses were tested in this experiment. (Table 2)

### The influence of children's martial arts on children's balance ability

Balance ability is one of the fundamental physical qualities that a person has. It is the most basic kind of athletic ability. Balance ability is the ability of a person to maintain body posture and control the body's center of gravity. It is a comprehensive reflection of the coordination and cooperation of body organs and tissues such as the balancer and the central nervous system, vestibular analyzer, proprioceptor, and visual analyzer. Maintaining balance is an essential ability of the human body.<sup>6</sup> Good balance is essential to ensure that the human body can complete various movements and stand, stand, and walk. The balance ability of an appraiser should include two aspects: dynamic balance ability and static balance ability. When studying the effect of sports on human balance, we can only evaluate it by using the test to stand on one foot with eyes closed. (Table 3)

**Table 1.** Comparison of changes in standing long jump.

	Control group	Test group	df	t	p
Before experiment	82.52±12.50	85.05±15.09	58	0.51	0.687
After the experiment	87.28±10.93	98.25±11.68	58	-2.286	0.027
df	25	25			
t	-2.78	-7.712			
P	0.1	0			

**Table 2.** Comparison of changes in systemic response.

	control group	Test group	df	t	p
Before experiment	0.79±0.12	0.74±0.14	48	-1.3	0.202
After the experiment	0.74±0.11	0.66±0.12	48	4.46	0
df	24	24			
t	1.771	2.837			
P	0.89	0.009			

## The influence of children's martial arts on children's sensitive qualities

Agility is an integral part of physical fitness. The human body can adapt quickly during daily activities or sports.<sup>7</sup> At the same time, it is also the comprehensive performance of sports skills and various sports qualities in exercise. It is not only related to the sensitive response of nerves but also closely related to such qualities as strength, speed, and coordination. Sensitivity is a comprehensive quality.

Good agility allows for quicker, more accurate technique and practice techniques.<sup>8</sup> This makes the current physical fitness more fully used in practice. In this experiment, the index representing the agility quality is the 20m round-trip running. There was no difference between the experimental and control groups after the experiment ( $p>0.05$ ). After the experiment, the difference between the two tests before and after the control group was significant ( $p<0.01$ ). (Table 4)

## DISCUSSION

After the experiment, the jumping ability of both the experimental and control groups was enhanced. The experimental group was significantly improved, and the performance was better than the control group. The reason may be that jumping is one of the primary motor abilities of children.<sup>9</sup> It is an essential skill in a child's life. This is also a necessary action for children in sports activities. The lower extremity strength of the children in the control group also improved compared to before the test. The apparent improvement in the experimental group compared to the control group is because the children's leg strength is exercised in martial arts.

Excitement is transmitted along the reflex arc. Long-term training improves the strength, balance, and flexibility of neural processes. This exercise can improve the excitability and flexibility of muscle tissue. In

addition, in martial arts, children often have to listen to teachers talk about the methods and rules of martial arts, and devote themselves to martial arts. Studies have shown that an athlete's high concentration makes the muscles tense and ready to go.<sup>10</sup>

The time of standing on one leg with eyes closed in the experimental group was significantly improved after the experiment.<sup>11</sup> It may be related to the following aspects. Improvement of physiological functions. In Plum Blossom Pile Martial Arts, children's vestibular organs, vision, and proprioceptors sense information such as the transformation of the body's center of gravity and the change of the forward direction, then transmit the information to the central nervous system. The information is comprehensively analyzed by the central nervous system, and commands to adjust body posture in harmony with technical movements are issued. Various information continuously stimulates the receptors and the central nervous system, which will gradually improve the sensitive functions of the receptors. This can shorten the time to complete the reflex arc. The above process is the process of improving and improving the balance ability. Improvement of lower limb muscle strength and technical movement coordination. Children who are just beginning to participate in martial arts in balance competitions always have poor control over the body's center of gravity in the generalization stage of movements. Although they know that martial arts require one foot to support the body's center of gravity, they cannot control the center of gravity due to insufficient muscle strength of the lower limbs and the lack of dynamic stereotypes for technical movements.

The results showed that the sensitivity of both the experimental and control groups was improved. The main reason is that even if they do not participate in training in childhood, their agility will gradually increase as their physical functions mature. Although the data indicated that the experimental group was better than the control group (Table 4), there was no difference. Sensitive quality is primarily restricted and influenced by strength, speed, endurance, flexibility, and other qualities. It is the all-around performance of various qualities and abilities. Children in the control group also regularly participated in sports. Speed quality is an essential factor in the 20-meter round trip. Because the children in the experimental group did not have special speed training, the performance of the 20-meter round-trip running was not significantly improved.

## CONCLUSION

After four months of martial arts exercise, the children in the experimental group showed statistically significant differences in various physical fitness indicators such as flexibility, balance, reaction speed, lower limb explosiveness, and agility. It is proven that children's martial arts have a good effect on improving the quality of children above.

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**Table 3.** Comparison of the time of standing on one leg with eyes closed.

	control group	Test group	df	t	p
Before experiment	8.58±5.19	11.51±5.33	58	1.3	0.192
After the experiment	12.15±7.13	27.72±16.11	58	3.32	0.002
df	25	25			
t	-2.785	-5.912			
P	1.1	1			

**Table 4.** Comparison of changes in the 20-meter round trip between the experimental group and the control group.

	control group	Test group	df	t	p
Before experiment	14.30±1.33	14.19±1.22	48	-0.31	0.761
After the experiment	13.88±0.92	13.43±1.00	48	-1.11	0.117
df	24	24			
t	3.048	3.298			
P	0.006	0.001			

**AUTHORS' CONTRIBUTIONS:** Each author made significant individual contributions to this manuscript. HH: writing; SY: data analysis; JC: article review; WX: intellectual concept of the article.

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