

# HEART RATE MONITORING IN SPECIAL TRAINING FOR BOXERS



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MONITORAMENTO DE FREQUÊNCIA CARDÍACA EM TREINO ESPECIAL PARA BOXEADORES

MONITORIZACIÓN DE FRECUENCIA CARDÍACA EN ENTRENAMIENTO ESPECIAL PARA BOXEADORES

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## ABSTRACT

**Introduction:** Chinese boxing is an aggressive, competitive, and combative sport. During its performance, good physical fitness and a stable heart rate can determine the athletes' sports performance. **Objective:** Study special physical training methods of Chinese boxing athletes by monitoring their heart rates. **Methods:** The implementation period of the experiment totaled eight weeks, performed three times a week. The control group did not get any specific physical training while the experimental group received special physical training, properly protocolled. Their indices were measured before, during, and after the experiment, with classification and data analysis by Excel and SPSS software. **Results:** The fitness data of the experimental group were significantly improved, with the heart rate more stable, corroborating the effectiveness of the special training. **Conclusion:** The use of special physical training can optimize and better adjust the pre-existing protocol according to the athletes' real competition needs, improving the specialized physical fitness and the athletes' competitive level. It also helps stabilize the heart rate, helping athletes get better results in combat. **Level of evidence II; Therapeutic studies - investigating treatment outcomes.**

**Keywords:** Boxing; Physical Fitness; Heart Rate.

## RESUMO

**Introdução:** O boxe chinês é um esporte agressivo, competitivo e combativo. Durante a sua execução, a boa forma física e a frequência cardíaca estável podem determinar o desempenho esportivo dos atletas. **Objetivo:** Estudar métodos especiais de treinamento físico dos atletas de boxe chinês monitorando suas frequências cardíacas. **Métodos:** O período de implementação do experimento totalizou oito semanas, executado três vezes por semana. O grupo de controle não obteve nenhum treinamento físico específico enquanto o grupo experimental recebeu um treinamento físico especial, devidamente protocolado. Seus índices foram mensurados antes, durante e depois do experimento, com classificação e análise de dados pelos programas Excel e SPSS. **Resultados:** Os dados de aptidão física do grupo experimental foram significativamente aprimorados, com frequência cardíaca foi mais estável, corroborando a eficácia do treinamento especial. **Conclusão:** O uso de treino físico especial pode otimizar e ajustar melhor o protocolo pré-existente, de acordo com as necessidades reais de competição dos atletas, melhorando a aptidão física especializada e o nível competitivo dos atletas. Também auxilia na estabilização da frequência cardíaca, ajudando os atletas a obterem melhores resultados em combate. **Nível de evidência II; Estudos terapêuticos - investigação dos resultados do tratamento.**

**Descritores:** Boxe; Aptidão Física; Frequência Cardíaca.

## RESUMEN

**Introducción:** El boxeo chino es un deporte agresivo, competitivo y combativo. Durante su ejecución, el buen estado físico y el ritmo cardíaco estable pueden determinar el rendimiento deportivo de los atletas. **Objetivo:** Estudiar los métodos de entrenamiento físico especial de los atletas de boxeo chinos mediante la monitorización de sus frecuencias cardíacas. **Métodos:** El periodo de aplicación del experimento fue de ocho semanas, realizado tres veces por semana. El grupo de control no obtuvo ningún entrenamiento físico específico, mientras que el grupo experimental recibió un entrenamiento físico especial, debidamente protocolizado. Se midieron sus índices antes, durante y después del experimento, con clasificación y análisis de datos mediante los programas Excel y SPSS. **Resultados:** Los datos de aptitud física del grupo experimental mejoraron significativamente, con una frecuencia cardíaca más estable, lo que corrobora la eficacia del entrenamiento especial. **Conclusión:** El uso del entrenamiento físico especial puede optimizar y ajustar mejor el protocolo preexistente, de acuerdo con las necesidades reales de competición de los atletas, mejorando la aptitud física especializada y el nivel competitivo de los atletas. También ayuda a estabilizar el ritmo cardíaco, ayudando a los atletas a obtener mejores resultados en el combate. **Nivel de evidencia II; Estudios terapéuticos - investigación de los resultados del tratamiento.**

**Descriptorios:** Boxeo; Aptitud Física; Frecuencia Cardíaca.



## INTRODUCTION

Wushu Sanda is a competitive sport with strong antagonism. It is developed from the traditional martial arts project, and has been improved so far through the continuous evolution of modern sports theory and research. The project is characterized by a unique form of competitive confrontation, comprehensive and diverse technical characteristics, and simple and practical technical actions.<sup>1</sup> The development of Modern Wushu Sanda is aimed at improving the physical quality, strengthening the body, exercising the will quality of athletes, and increasing the competitive appreciation of the event. At the same time, it also inherits the core of traditional Wushu, that is, to enhance friendship through technical exchanges. Athletes arrange and combine different offensive and defensive technical movements and apply them in actual combat.<sup>2</sup> This arrangement is based on the premise that all basic technical actions can be skillfully used. Sanda has attracted people of different ages to participate since its development. Wushu Sanda has a strong inclusiveness, which can change the difficulty of the project according to age and needs. In project practice, from self-knowledge to self-improvement. Through different training channels, the athletes' field experience, body strength, body flexibility and various physical functions can be improved.<sup>3</sup> At the same time as the skills are improved, the will quality of the athletes is also gradually tenacious. Because of the super competitive nature of Wushu Sanda, it is necessary to have strong physical strength to support technical movements. Physical ability is the basic attribute for athletes to complete the competition content. Moreover, through the heart rate changes of athletes at different stages of the competition, we can better formulate training plans for athletes.<sup>4</sup> And through heart rate monitoring, we can get the effective data of athletes and directly get the physical function status of athletes. Therefore, in the training process, athletes participate in targeted special physical training, which is an effective way to improve project performance. At the same time, wear monitoring equipment during training to monitor heart rate. The heart rate data obtained by monitoring can reflect the change of training intensity in real time for coaches to analyze. Heart rate monitoring can reflect the current physical condition and sports status of athletes in real time.<sup>5</sup> Special physical training and heart rate monitoring provide effective support for the technical development and physical data analysis of the project. Moreover, it is conducive to the long-term development of the project.

## METHOD

In the summer semester, the author selected 20 Sanda athletes from University Wushu Sanda societies and divided them into experimental group and control group. The study and all the participants were reviewed and approved by Ethics Committee of Xi'an University of Technology (NO.2019XAUT08-CT). The basic information is shown in Table 1. There is no significant difference between them ( $P > 0.05$ ), which indicates that there is no significant difference, so as to reduce the interference to the experimental results.

This paper selects the control variable method, and the variable form is whether to carry out special physical training. Therefore, for the

**Table 1.** Basic information of two groups of objects.

Group	Height	Weight	Age	Years
Experimental group (n = 15)	173.867±2.691	71.540±6.513	18.975±0.568	7.509±4.085
Control group (n = 15)	174.234±2.270	71.169±5.383	19.018±0.602	7.017±2.970
T	0.65986	0.73409	1.12833	0.77004
p	0.29011	0.48647	0.38582	0.30294

control group, it is not targeted physical training, including running, frog jumping and so on. These are traditional physical exercise methods, which are applicable to many sports. For the experimental group, the relevant physical training forms were designed for the research object of this paper - special physical training. According to the basic movements of Wushu Sanda, special physical training programs including bench press, flat push, intermittent high leg lift running in situ, push ups and other forms are designed, supplemented by the form of simulated confrontation, to train according to the characteristics of Sanda from all aspects. The exercise duration and intensity of the experimental group and the control group are basically the same. The specific actions can be combined by the coach according to the actual characteristics of the students, but on the whole, the two groups are basically the same except for the different types of sports.

In order to make the research results more targeted and more in line with the actual characteristics of countless Sanda Sports, when analyzing the changes of physical fitness, we choose the special items of Wushu Sanda Sports when judging the physical fitness indicators. The indexes of physical fitness change include bench press, 1min leg whip times, 1min punching times, 30s sliding steps and 20s punching times.

The 8-week special physical training is a relatively long process. Therefore, after knowing the results of physical changes, it is necessary to analyze its trend. In this process, strength is selected as the judgment standard. After the last training every two weeks, the straight fist and whip leg strength of the experimental group and the control group are measured.

Finally, there is the change of heart rate. Martial arts athletes wear relevant heart rate monitoring instruments to comprehensively measure their heart rate change in a quiet state, during the warm-up process of preparation for sports, during sports, and 15 minutes after sports.

## RESULTS

### Changes of special physical fitness of Wushu Sanda Athletes before and after the experiment

As shown in Table 2, such indicators as bench press, 1min leg whipping times, 1min punching times, 30s sliding steps and 20s punching times are selected as the judgment criteria for the change of special physical ability of Wushu Sanda athletes.

From the overall analysis, it can be seen that the relevant indicators of the experimental group and the control group have improved after 8 weeks of training. It can be seen from the inside of the experimental group that the strength of bench press increased from (60.396 ± 3.529) kg to (63.000 ± 4.086) kg before the experiment, the number of whips and legs in 1min increased from (98.883 ± 5.112) to (107.150 ± 4.648), the number of punches in 1min increased from (106.824 ± 4.346) to (114.194 ± 3.738), and the number of sliding steps in 30s increased from (15.642 ± 3.352) to (19.305 ± 3.753) before the experiment, The number of punches in 20s increased from (45.394 ± 2.211) to (50.633 ± 3.070), which proved the effectiveness of special training.

**Table 2.** Changes of special physical fitness of Wushu Sanda Athletes before and after the experiment.

Option	Test group		Control group	
	Before	After	Before	After
Bench press	60.396±3.529	63.000±4.086	61.284±4.007	63.810±4.293
1min whip leg	98.883±5.112	107.150±4.648	100.226±4.855	104.213±4.944
1min punch	106.824±4.346	114.194±3.738	106.505±5.104	111.423±4.037
30s change towards slide	15.642±3.352	19.305±3.753	15.819±4.086	17.583±3.316
20s punch	45.394±2.211	50.633±3.070	44.500±2.398	46.758±2.971

## Strength changes of Wushu Sanda athletes during the experiment

The experiment lasted for 8 weeks and was a step-by-step process. Therefore, strength was selected as the basis for judgment in order to analyze the physical changes during the whole experiment, as shown in Figure 1.

It can be seen from the change of straight fist strength that the average straight fist strength of the experimental group is slightly higher than the average straight fist strength of the control group before the start of the experiment. During the experiment, the lifting frequency of the straight fist strength of the experimental group fluctuated to a certain extent. The final average straight fist strength is that the experimental group is higher than the control group, and the gap between them is larger than the initial gap. It shows that special physical training can effectively improve the strength of straight punches of Wushu Sanda athletes, so that they can get more striking strength in the sports field.

By analyzing the strength of the whip legs, it can be seen that the average whip leg strength of the control group is greater than that of the experimental group before the start of the experiment. During the experiment, both groups showed an upward trend, but the increase rate of the leg strength of the experimental group was significantly higher than that of the control group. By the end of the experiment, the average whip leg strength of the experimental group was greater than that of the control group. This shows that the effect of special physical training on improving the lower limb strength of Wushu Sanda athletes is higher than that of traditional physical training.

## Changes of heart rate of Wushu Sanda Athletes after experiment

The change of heart rate can be regarded not only as the change of physical function of athletes, but also as the change index of emotional fluctuation. Therefore, in Wushu Sanda, heart rate control in a relatively stable state can facilitate Wushu Sanda athletes to better concentrate, calmly observe things and obtain certain initiative. From the data analysis, it can be seen that there is little difference in the psychological changes of athletes before the beginning of the experiment. After the end of the experiment, the heart rate changes of Wushu Sanda Athletes in simulated competitions are shown in Figure 2.

In the quiet state before the start of the competition, there was little difference between the heart rate changes of the two groups of athletes. In the warm-up process before the start of the competition, it can be seen that the heart rate level of the control group has been slightly higher than that of the experimental group. During the competition, the heart rate of the control group was significantly higher than that of the experimental group. 15 minutes after the competition, the heart rates of the two groups gradually began to drop. At this time, the heart rate data of the two groups of athletes were not different, and the experimental group was slightly lower than the control group. It can be seen from this that special physical training can not only improve the special physical functions of athletes, but also adjust the heart rate of athletes, so that they can maintain a relatively stable heart rate change value during the exercise, reduce the mental tension caused by excessive excitement or tension, and give athletes a more calm training mentality. It can also enhance the blood supply and oxygen supply ability of athletes, so as to stabilize their heart rate and prevent adverse effects on athletes due to excessive heart rate. From the changes of the two groups of data in the figure, it can be seen that the heart rate of the experimental group is much more stable than that of the control group, so the special physical training scheme used in this paper is effective.

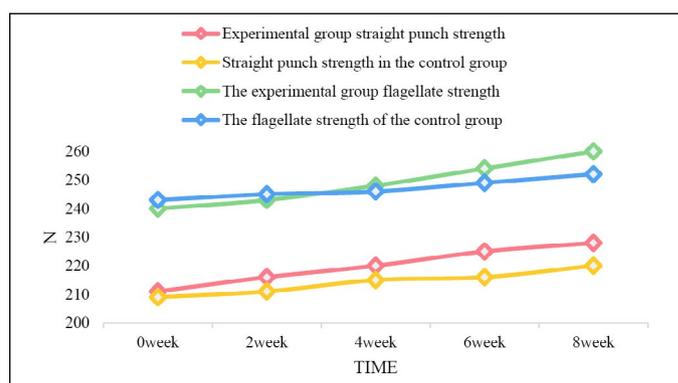


Figure 1. Strength change of Wushu Sanda Athletes in special physical training.

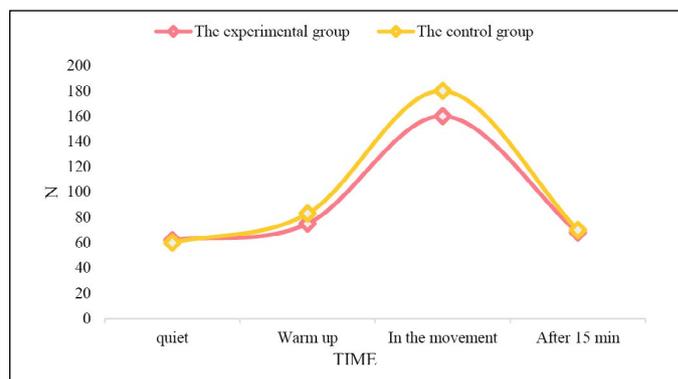


Figure 2. Heart rate changes of Wushu Sanda athletes during simulated competition.

## DISCUSSION

With the continuous development of the project, the rules and standards of Wushu Sanda continue to improve, and the level of competition is becoming more and more intense. In order to adapt to the competition rhythm of modern sports, Wushu Sanda athletes need to have better physical quality and technical level. Making a high-intensity training plan from the scientific direction is an important means for professional athletes to improve their performance. Strength training is very important in the special physical training. Especially for Wushu competitive events. Strength can help athletes to complete technical movements efficiently, and strength attribute is the basic attribute of physical fitness. In the strength training plan, we should start from the athletes' own physical conditions and strengthen the training difficulty with the improvement of the athletes' ability. Make a scientific analysis of the sequence of strength training, the choice of training methods, and the change of training difficulty. Clarifying the relationship between the amount of training and the body and performance is conducive to the improvement of the competitive level and their own strength. Secondly, speed training is also an important part of special physical training. Sportsmanship is also developing toward the goal of being faster and stronger. Wushu Sanda athletes should carry out special speed training according to the following sub items. They are: athlete's reaction speed, movement speed and movement speed. To complete the above speed specific training efficiently is the key goal of the coach training plan. Through a scientific training plan, the physical fitness of athletes can be improved in an all-round way and appropriate training methods can be adopted. This is an important means for the development of scientific Wushu Sanda. Athletes and coaches should deeply understand and summarize it. Physical training is the foundation of the event and the basic condition for athletes to complete technical movements and competitions. Physical fitness is an important factor affecting the result of competition.

## CONCLUSION

How to improve the special physical quality of Wushu Sanda athletes, stabilize their heart and improve their rate is a key research direction of Wushu. The research in this paper provides certain data for this direction. The experimental results show that the use of special physical training can better optimize and adjust according to the actual competition

needs of athletes, so as to improve the special physical fitness and competitive level of athletes, stabilize their heart rate, and help athletes achieve better results in the field.

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

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**AUTHORS' CONTRIBUTIONS:** The author has completed the writing of the article or the critical review of its knowledge content. This paper can be used as the final draft of the manuscript. Every author has made an important contribution to this manuscript. Zhiqun Tian: writing and execution. Feng Dong: data analysis. Xinbin Hei: article reviews. Chenfeng Liu: data collection.

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