International Journal of Sociologies and Anthropologies Science Reviews
Volume 5 Issue 6: November-December 2025: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training

Cui Yuyinlong[1], Suvachai Rittisom[2] and Kiattiwat Watchayakarn[3]
Faculty of Sports Science and Technology, Bangkokthonburi University, Thailand
[1]E-mail: dwppk497768@163.com, ORCID ID: https://orcid.org/0009-0002-6975-3177
[2]E-mail: chaivasu5348@gmail.com, ORCID ID: https://orcid.org/0009-0006-6435-8804
[3]E-mail: kiat2504@gmail.com, ORCID ID: https://orcid.org/0009-0005-5169-3761

Received 01/04/2025 Revised 21/04/2025 Accepted xx/xx/20xx

Abstract

Background and Aim: Wushu High-Intensity Interval Training improves cardiovascular endurance and builds explosive strength crucial for martial arts performance. It also enhances agility, coordination, and mental focus under physical stress. This study aimed to investigate the effects of alternating heavy and light-intensity Wushu training on anaerobic fitness among adolescent athletes and to compare the outcomes of different structured Wushu high-intensity interval training (HIIT) programs.

Materials and Methods: A quasi-experimental design was employed involving 30 male Wushu athletes aged 13–15 years from Xi'an No. 26 Secondary School, Shaanxi Province, China. Participants were randomly assigned to two groups: an experimental group (n=15) receiving an alternating-intensity HIIT Wushu training program, and a control group (n=15) undergoing conventional Wushu training. The intervention lasted eight weeks, with training conducted three times per week. Anaerobic fitness was assessed using the Wingate Anaerobic Test (WAnT) before and after the intervention. Data were analyzed using descriptive statistics and independent samples t-tests.

Results: Pre-test analysis revealed no significant difference in anaerobic capacity between groups ($p = 0.817$). However, post-test results showed a statistically significant improvement in the experimental group compared to the control group ($p < .001$). The experimental group achieved a higher mean anaerobic capacity (9.74 ± 0.15 W.kg¹) than the control group (8.93 ± 0.11 W.kg¹) after the intervention.

Conclusion: The findings indicate that Wushu training incorporating alternating high and low-intensity intervals significantly enhances anaerobic fitness among adolescent athletes. The structured HIIT-based program proved more effective than traditional training methods, suggesting its applicability for improving performance in martial arts conditioning.

Keywords: Wushu; Training; Students; High-Intensity

Introduction

Wushu is one of China's most popular sports, with origins deeply connected to the country's broader cultural and historical milieu. According to Xiaoyuan (2016), the modernization of Wushu in the mid-20th century was closely tied to state-led efforts that aimed to standardize and promote Chinese martial arts as part of national cultural and physical development. In 1952, the Central People's Government established the State Commission of Physical Culture and Sports to oversee the country's physical education initiatives. Subsequently, in 1958, the Chinese Wushu Association (CWA) was formed under this commission to unify traditional martial arts practices, codify techniques, and promote nationwide training and competitions. Through these coordinated efforts, modern Wushu evolved into a widely practiced sport characterized by graceful movements, intricate techniques, and dynamic energy. Its training methodology is notably comprehensive, combining physical conditioning with mental focus, discipline, and endurance—traits deeply influenced by China's longstanding philosophical traditions.

Wushu's value lies in its broad applicability, spanning physical exercise, combat preparedness, and mental cultivation. Historically, it has been developed and practiced across China's villages, communities, provinces, and national training centers, contributing significantly to both grassroots participation and high-level competitive sport. Okamoto et al. (2014) affirm that Wushu's integration into educational curricula underscores its everyday relevance, strengthening both amateur and professional pathways. Beyond its artistic and cultural significance, Wushu training now relies heavily on sports science methodologies, emphasizing muscular strength, cardiovascular endurance, flexibility, and systematic physiological

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

adaptations for performance. Adherence to these scientific principles enhances not only competitive success but also general fitness and well-being (Tian, 2023).

Competitive Wushu often features two main categories: forms (taolu) and sparring (sanda). Form competitions emphasize precision, fluidity, and difficulty of movements judged according to accuracy and technical execution. Sanda, or full-contact sparring, requires athletes to master kicking, throwing, defensive maneuvers, and other combative techniques (Jung, 2019). Training protocols alternate between intense drills and lower-exertion exercises to build both anaerobic capacity and cardiovascular fitness—key elements for athletic resilience (Jung, 2019). The importance of strong foundational fitness is highlighted by Osawa et al. (2014), who describe overall physical preparedness—including agility, endurance, and health resilience—as crucial to effective performance in sports.

In recent years, high-intensity interval training (HIIT) has become a central feature of Wushu regimens. Gibala (2012) defines HIIT as repeated bursts of intense exercise punctuated by low-intensity recovery intervals, a method proven to boost both aerobic and anaerobic capacity. Tabata (2016) underscores its particular utility for martial artists, noting that rapid bursts of high-exertion effort reflect the intensity of short-duration combats in Wushu. Likewise, Burgomaster (2018) and Gibala (2012) confirm that HIIT can measurably enhance physiological attributes such as maximal oxygen uptake, enzyme activity, and muscle efficiency. These factors directly influence an athlete's ability to sustain high-intensity efforts and recover quickly—an essential cycle in competitive Wushu (Laursen & Jenkins, 2002).

Wushu training blends traditional martial philosophies with modern sports science. By integrating structured interval training—including HIIT—coaches and athletes can effectively develop the anaerobic fitness crucial for competition. The growing body of research and practice in this area indicates further opportunities to refine Wushu training methodologies, thereby enhancing athletic performance, safeguarding cultural heritage, and increasing the sport's accessibility. As such, examining the effects of structured interval training on anaerobic fitness among Wushu practitioners can yield valuable insights for both competitive athletes and broader educational programs.

Objectives

1. To investigate the effects of alternating heavy and light-intensity Wushu training on anaerobic fitness among athletes.
2. To compare anaerobic fitness outcomes resulting from different structured Wushu alternating-intensity training programs.

Literaterature Review

Physical Fitness and Core Strength in Wushu Performance

Wushu is a dynamic martial art requiring strength, speed, agility, and precise control. Physical fitness, particularly core strength and stability, plays a critical role in supporting the demands of Wushu movements such as jumping, kicking, and twisting. This review synthesizes literature on the anatomy and physiology of core muscles, the impact of core training on athletic performance, and the relationship between core strength and jumping ability in martial arts. The core functions as the central link between the upper and lower body and is essential for balance, stability, and power generation. According to Gwak and Kim (2019), core muscles act as a "muscular corset," stabilizing the spine and pelvis. These muscles include the rectus abdominis, obliques, erector spinae, and multifidus, comprising both slow- and fast-twitch fibers to support endurance and explosive movements. Imbalances in core musculature can compromise posture, coordination, and injury prevention. Research highlights the importance of core strength in improving athletic performance. Stanton, Reaburn, and Humphries (2004) found that an eight-week Swiss ball training program enhanced core stability and running economy, indicating improved neuromuscular coordination and force transfer. Similarly, Hibbs, Thompson, and Wrigley (2008) emphasized that deep stabilizing muscles facilitate better control during dynamic movements. Strengthening these muscles improves trunk control and power transfer, both critical in combat sports such as Wushu. Core-strengthening techniques

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

range from traditional exercises like planks and crunches to equipment-based methods involving Bosu® balls and resistance bands. Ibrahim (2014) noted that although scientific support for performance enhancement continues to expand, core training improves motor control and spinal stability. These benefits are particularly relevant in sports requiring explosive trunk rotation and precise balance, including both golf and Wushu. Jumping, a fundamental Wushu skill, relies heavily on core strength. McGill (2016) explains that the core facilitates efficient force transfer during takeoff and landing, stabilizing the torso and improving jump execution. Kibler, Press, and Sciascia (2006) further identify the core as the central hub for kinetic energy transfer, linking upper and lower limb movements. A well-developed core can enhance jump height, body control in the air, and landing stability—crucial attributes in advanced Wushu techniques. Martial arts research supports these findings. Saeterbakken et al. (2011) and Sharrock et al. (2011) both reported strong correlations between core strength and vertical jump performance in athletes, while Nesser, Huxel, Tincher, and Okada (2008) observed similar outcomes in standing long jump tests. Though much of this research has focused on either general sports or other martial arts (e.g., Taekwondo, Karate), the implications for Wushu are clear: a strong, stable core supports movement precision, power generation, and injury resilience.

Core strength is a key component of physical fitness in Wushu. It underpins biomechanical efficiency, supports explosive movement, and enhances athletic performance. Future research should focus on sport-specific core training interventions and their direct effects on technical Wushu performance metrics, such as rotational jump height and landing control.

The Role of Aerobic and Anaerobic Exercise in Physical Conditioning for Sport

Understanding the physiological principles underlying aerobic and anaerobic exercise is essential for designing effective sports conditioning programs. Both forms of exercise contribute uniquely to performance, health, and energy system development—an interplay that is especially relevant in sports demanding a combination of endurance, strength, and explosive power, such as Wushu.

Aerobic exercise refers to sustained, moderate-intensity activity that primarily relies on oxygen for energy production. Common examples include jogging, swimming, and cycling (Kenney, Wilmore, & Costill, 2019). During aerobic activity, the cardiovascular system delivers oxygen efficiently to working muscles, supporting prolonged effort. Benefits of aerobic training include improved cardiac function, increased maximal oxygen uptake (VO_2 max), enhanced endurance, and more efficient calorie utilization (American College of Sports Medicine [ACSM], 2021). Aerobic conditioning is also linked to better insulin sensitivity and blood glucose control, influencing long-term metabolic health (Kenney et al., 2019).

In contrast, anaerobic exercise involves high-intensity efforts of short duration, where oxygen supply cannot meet the immediate energy demands of the muscles (Hoff & Helgerud, 2004). Examples include sprinting, heavy resistance training, and explosive jumps. During these intense bouts, the body relies primarily on phosphocreatine (PCr) and anaerobic glycolysis for energy. Anaerobic training contributes to muscle strength, power development, increased lactate threshold, and the recruitment of fast-twitch muscle fibers (Helgerud et al., 2007). It also supports short-burst performance and muscle hypertrophy—attributes vital in many combat sports.

Although commonly discussed separately, aerobic and anaerobic systems work in tandem. In a Wushu routine, for example, sustained, flowing sequences may engage the aerobic system, while sudden bursts of speed or powerful kicks utilize anaerobic pathways. Effective training programs often use a periodized approach, developing a base of aerobic endurance before progressively introducing higher-intensity, anaerobic workloads (Bompa & Buzzichelli, 2019). This approach ensures comprehensive physical readiness while minimizing injury risk.

Heart rate monitoring is a practical tool for structuring both aerobic and anaerobic training. A frequently cited (though approximate) formula—220 minus one's age—can estimate maximum heart rate (Fox, Naughton, & Haskell, 1971). Aerobic Zone: Exercising at roughly 60–80% of max HR improves endurance and cardiovascular efficiency (ACSM, 2021). Anaerobic Zone: Training at intensities of 80–90% (or more) of max HR elicits adaptations in lactate threshold and muscular power (Helgerud et al.,

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

International Journal of Sociologies and Anthropologies Science Reviews
Volume 5 Issue 6: November-December 2025: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

2007). By targeting these zones appropriately, athletes and coaches can fine-tune workloads for optimal adaptation and safety.

Aerobic exercise is typically recommended as a foundation, especially for beginners or individuals returning after a period of inactivity. As baseline fitness improves, incorporating structured anaerobic sessions (e.g., interval training, plyometrics) facilitates gains in speed and power essential for advanced athletic performance (Bompa & Buzzichelli, 2019; Helgerud et al., 2007). For sports like Wushu, which demand both sustained effort and explosive bursts, a balanced approach integrating both aerobic and anaerobic components is paramount for modern athletic excellence.

Conceptual Framework

This study employs a quasi-experimental design to examine the effects of a structured Wushu high-intensity interval training (HIIT) program on anaerobic fitness among students at Xi'an No. 26 High School, Shaanxi Province, China.

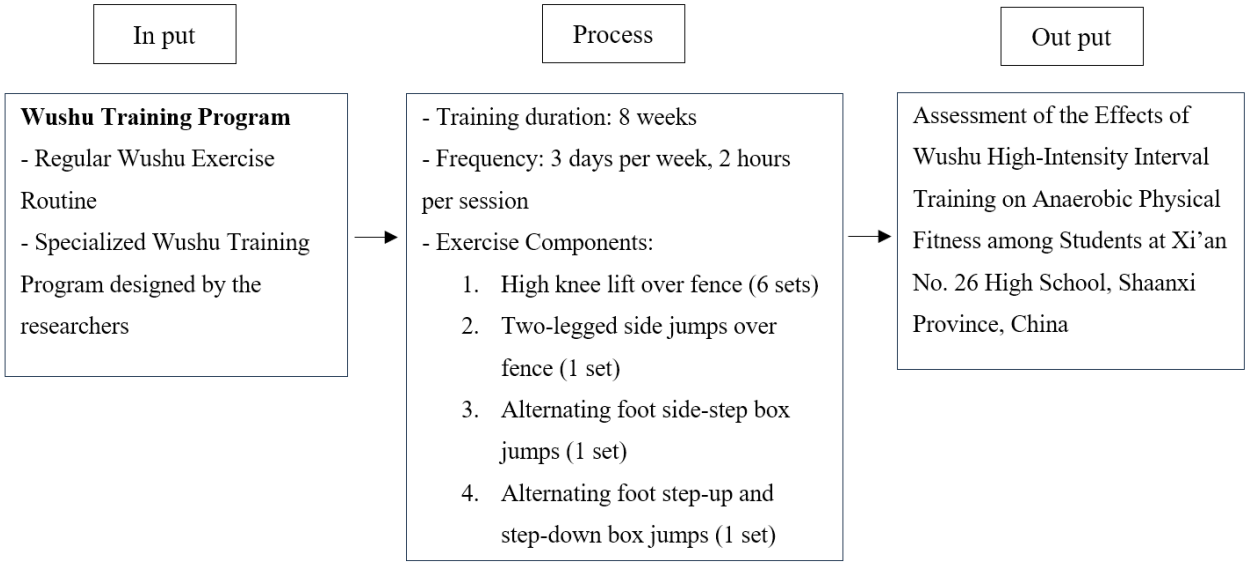

Figure 1 Conceptual Framework

Methodology

Population

The research population comprised 62 Wushu athletes, aged between 13 and 15 years, enrolled at Xi'an No. 26 Secondary School, Shaanxi Province, China.

Sample Group

The sample consisted of 30 male Wushu athletes, aged 13-15 years, selected from Xi'an No. 26 Secondary School. Participants were systematically divided into two groups (experimental and control groups), each containing 15 students, using a randomized zigzag selection method. The experimental group underwent the specialized Wushu high-intensity interval training program designed by the researcher, whereas the control group followed the standard training program. Both groups participated in training for 8 weeks, 3 days per week (Monday, Wednesday, and Friday). Anaerobic fitness was assessed and compared between pre- and post-intervention periods.

Wushu Skill Training Model

The Wushu training program employed in this study consists of four skill exercises, specifically developed and selected by the researcher for effective implementation among high school students.

Training Protocol and Schedule

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

The Wushu training intervention followed these protocols:

- Training frequency: Monday, Wednesday, and Friday
- Duration: 8 weeks
- Experimental group: 1:00 p.m. – 3:00 p.m.
- Control group: 3:00 p.m. – 5:00 p.m.

Training sequence and scoring methods were clearly explained and adhered to throughout the intervention. The experimental group engaged in the researcher-developed Wushu high-intensity interval training program, whereas the control group followed the standard Wushu training regimen.

Specific Wushu Exercises

The exercises utilized were: High knee lift over fence (6 sets). 2. Two-legged side jumps over the fence (1 set). 3. Alternating foot side-step box jumps (1 set). 4. Alternating foot step-up and step-down box jumps (1 set). The content validity of these exercises and the training equipment was verified by five experts in Wushu and sports science. The Index of Item-Objective Congruence (IOC) values for all items ranged from 0.80 to 1.00

Research Procedures

The methodological procedures were conducted systematically, following these steps:

1. Development of practical tests aligned with Wushu training exercises.
2. Consultation with experts for enhancing the effectiveness and accuracy of test administration.
3. Conducting pilot testing to establish the reliability and consistency of the instruments.
4. Content validity assessment by five expert evaluators, calculating IOC values.
5. Instrument tryout on a separate comparable group of 20 lower-secondary students, similar in age but without prior Wushu training, to refine measurement tools.
6. Implementation of final instruments with a total sample of 30 participants over 8 weeks.
7. Reliability testing and data collection with regular analyses performed according to established criteria.
8. Data collection from both experimental and control groups according to the 8-week training schedule, with subsequent analysis of collected data for comparative purposes.

Experimental Design

The research employed a quasi-experimental design, comparing pre-test and post-test results between experimental and control groups over an 8-week training period.

Data Collection

The data collection process was systematically conducted as follows:

1. Submitted an official letter requesting permission for data collection at Xi'an No. 26 Secondary School, Shaanxi Province, China.
2. Reviewed the instruments with the advisor and consulted experts for final validation before data collection.
3. Conducted an orientation meeting with the experimental group, control group, and research assistants, clearly explaining the data collection procedures and expectations.
4. Prepared and arranged the designated location and equipment for data collection according to established research protocols.
5. Administered pre-tests to participants in both the experimental and control groups to gather baseline anaerobic fitness data.
6. Implemented the training intervention and performed regular data collection assessments over 8 weeks.
7. Collected data from the experimental group on Monday, Wednesday, and Friday, from 1:00 p.m. to 3:00 p.m.
8. Collected data from the control group on Monday, Wednesday, and Friday, from 3:00 p.m. to 5:00 p.m.

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

International Journal of Sociologies and Anthropologies Science Reviews
Volume 5 Issue 6: November-December 2025: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

9. Analyzed collected data at designated intervals (pre-test, Week 2, Week 4, and Week 8) to determine changes in anaerobic physical fitness.

10. Summarized and documented experimental results comprehensively.

Data Analysis

Data collected from the study were analyzed systematically as follows:

1. Conducted pre-tests to establish baseline anaerobic fitness levels for both experimental and control groups.

2. Compared pre-test results between groups to ensure similarity in initial fitness levels.

3. Performed ongoing assessments of the experimental group during training sessions conducted three days per week (Monday, Wednesday, Friday), from 1:00 p.m. to 3:00 p.m.

4. Conducted parallel assessments of the control group three days per week (Monday, Wednesday, Friday), from 3:00 p.m. to 5:00 p.m.

5. Analyzed and compared test data collected throughout the 8-week training period, employing the following statistical methods: Mean comparison to evaluate differences between experimental and control groups. Inferential statistics with a significance level set at 0.05 is used to determine the statistical significance of observed differences. Calculation of mean ($\bar{x}$) values. Calculation of standard deviation (S.D.) values to assess variability within and between groups.

Results

In this study, the researchers collected and analyzed data on the effects of high-intensity interval training (HIIT) on the anaerobic performance of wushu athletes.

Table 1 General Information of the Experimental and Control Groups

	N	Mean	Median	SD	SE
Control Group Pre-test (W.kg¹)	15	8.79	8.81	0.0947	0.0244
Experimental Group Pre-test (W.kg¹)	15	8.80	8.77	0.0909	0.0235
Control Group Post-test (W.kg¹)	15	8.93	8.93	0.1138	0.0294
Experimental Group Post-test (W.kg¹)	15	9.74	9.70	0.1516	0.0392

Table 1 presents the general descriptive statistics of anaerobic capacity (W.kg¹) for both the experimental and control groups, measured at two time points: pre-test and post-test. In the pre-test phase, the control group recorded a mean anaerobic capacity of 8.79 W.kg¹ with a median of 8.81. The standard deviation was 0.0947, indicating low variability among participants, and the standard error was 0.0244, representing the precision of the sample mean estimate. The experimental group, during the same pre-test period, had a mean of 8.80 W.kg¹ and a median of 8.77. The standard deviation and standard error were 0.0909 and 0.0235, respectively, closely aligning with the control group, suggesting similar baseline performance between the two groups. At the post-test stage, the control group demonstrated a slight increase in anaerobic capacity, with a mean of 8.93 W.kg¹ and a median of 8.93. The standard deviation increased slightly to 0.1138, while the standard error rose to 0.0294. In contrast, the experimental group exhibited a more pronounced improvement, with a mean of 9.74 W.kg¹ and a median of 9.70. The standard deviation for the experimental group was 0.1516, and the standard error was 0.0392, indicating a wider spread in the post-test data but also a substantial increase in performance compared to their pre-test values.

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

International Journal of Sociologies and Anthropologies Science Reviews
Volume 5 Issue 6: November-December 2025: ISSN 2985-2730
Website: https://so07.tci-thaijo.org/index.php/IJSASR/index

Table 2 Pre and post-operative analysis results of the Wingate Anaerobic Test (HIIT) alternating with a high-intensity interval training (HIIT) program.

			statistic	df	p
Control	Experimental	Pre-test	-0.236	14.0	0.817
Control	Experimental	Post-test	-17.837	14.0	< .001*

P = significant at the 0.05 level

Table 2 presents the pre-test and post-test analysis results of the Wingate Anaerobic Test conducted as part of a high-intensity interval training (HIIT) program with alternating intensities. The table displays statistical values comparing anaerobic capacity between the control and experimental groups at two testing intervals: before (pre-test) and after (post-test) the intervention. In the pre-test phase, the comparison between the control and experimental groups yields a t-value of -0.236 with 14 degrees of freedom and a p-value of 0.817. According to the Interpretation column, this result is classified as "Not significant," indicating that the difference between the two groups before the intervention does not meet the threshold for statistical significance. In the post-test phase, the comparison between the same groups produces a t-value of -17.837 with 14 degrees of freedom. The corresponding p-value is reported as less than .001 and is marked with an asterisk (*), signifying statistical significance at the 0.05 level. The interpretation given in the table is "Statistically significant," which denotes that the observed difference in anaerobic capacity between the two groups after the intervention meets the criteria for significance.

Conclusion

The results of this study demonstrate that high-intensity interval training (HIIT) with alternating intensity significantly improves anaerobic capacity among Wushu athletes. As shown in Table 1, both the control and experimental groups had comparable anaerobic capacity scores during the pre-test phase, with mean values of 8.79 W.kg¹ and 8.80 W.kg¹⁻¹ respectively, and minimal variation in standard deviations. This indicates that the two groups began the intervention with equivalent baseline performance levels.

However, in the post-test phase, a clear distinction emerged. The experimental group, which engaged in the HIIT-based Wushu training program, achieved a notably higher mean anaerobic capacity of 9.74 W.kg¹, whereas the control group recorded a modest increase to 8.93 W.kg¹. These results are further supported by the statistical analysis in Table 2. There was no significant difference between groups in the pre-test ($t = -0.236$, $df = 14$, $p = 0.817$), confirming the equivalence of baseline values. In contrast, the post-test analysis revealed a statistically significant difference between the two groups ($t = -17.837$, $df = 14$, $p < .001$), indicating a strong effect of the training intervention on the experimental group.

Overall, the findings confirm that the structured Wushu training program incorporating alternating high-intensity intervals produces superior improvements in anaerobic fitness when compared to standard training. The results support the use of HIIT protocols in martial arts conditioning programs to enhance athlete performance.

Discussion

The aim of this study was twofold: first, to investigate the effects of alternating heavy and light-intensity Wushu training on anaerobic fitness among athletes; and second, to compare anaerobic fitness outcomes resulting from different structured Wushu alternating-intensity training programs. About the first objective, the findings suggest that Wushu training incorporating high- and low-intensity intervals can significantly enhance anaerobic fitness in adolescent athletes. The experimental group, which followed a high-intensity interval training (HIIT) protocol tailored to Wushu movements, demonstrated marked improvements in anaerobic capacity, as measured by the Wingate Anaerobic Test. These results are

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

consistent with previous research showing that HIIT protocols can lead to increased anaerobic power, faster phosphocreatine (PCr) resynthesis, and improved muscle buffering capacity (Gibala, Little, Macdonald, & Hawley, 2012; MacInnis & Gibala, 2017). Such adaptations are partly attributable to heightened recruitment of fast-twitch fibers, augmented glycolytic enzyme activity, and more efficient neuromuscular coordination (Laursen & Jenkins, 2002). Martial arts frequently involve short-duration bursts of intense effort, making the development of anaerobic capacity especially critical. Wushu, in particular, features high-speed kicks, jumps, and striking techniques that demand rapid power output and swift recovery. Previous research in combat sports has underscored the importance of anaerobic power for success in disciplines with intermittent high-intensity efforts, such as taekwondo, judo, and karate (Bridge, da Silva Santos, Chaabène, Pieter, & Franchini, 2014; Chaabène et al., 2014). The present study extends these findings to the context of Wushu, providing evidence that HIIT can be effectively integrated with traditional Wushu training to bolster anaerobic performance.

Regarding the second objective, the comparison between the experimental and control groups revealed clear distinctions in anaerobic fitness outcomes. Both groups started with comparable anaerobic capacity, yet only the experimental group achieved statistically significant improvements after the intervention. The control group, which followed a conventional Wushu training routine without targeted intensity modulation, showed a minor (non-significant) increase in anaerobic capacity. This result suggests that classic methods may lack the specific overload and high-intensity intervals needed to drive pronounced anaerobic adaptations. HIIT's superiority over moderate-intensity continuous training for boosting anaerobic performance has been demonstrated across various athletic populations (Buchheit & Laursen, 2013; Kemi & Wisloff, 2010). By stimulating both aerobic and anaerobic pathways, HIIT proves highly efficient for developing overall energy-system capacity. In younger athletes, appropriately structured HIIT has been deemed safe and effective, fostering cardiovascular and muscular development without an excessive total training volume (Baquet, Berthoin, & Van Praagh, 2010). Moreover, the specific design of the HIIT program used here—merging recognized intensity-progression principles with Wushu-specific techniques—appears pivotal for maximizing performance adaptations. Alternating between high-load explosive drills and active recovery periods likely enhanced lactate clearance and boosted the ability to sustain repeated high-intensity efforts, both of which are instrumental in competitive Wushu.

The results of this study strongly support the efficacy of structured, alternating-intensity HIIT programs for developing anaerobic fitness among Wushu athletes. Compared to conventional training routines, the HIIT-based approach yielded more substantial gains in physiological attributes central to Wushu performance. These findings have practical implications for coaches, trainers, and sport scientists seeking to optimize conditioning strategies for combat sport athletes.

Recommendation

Based on the findings of this research, the following recommendations are proposed for future practice and further study:

1. Integration of HIIT into Wushu Training Programs: Coaches and physical conditioning specialists are encouraged to incorporate high-intensity interval training (HIIT) with alternating intensities into Wushu training regimens.

2. Age-Appropriate HIIT Programming: Given the study's focus on adolescent athletes, it is recommended that similar HIIT protocols be tailored to the age, developmental stage, and fitness level of the athletes.

3. Further Research on Training Modalities: Future studies should explore the long-term effects of alternating-intensity HIIT in different age groups, female athletes, and elite-level competitors.

References

American College of Sports Medicine. (2021). *ACSM's guidelines for exercise testing and prescription* (11th ed.). Wolters Kluwer.

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

Baquet, G., Berthoin, S., & Van Praagh, E. (2010). Endurance training and aerobic fitness in young people. *Sports Medicine, 40*(6), 451–466.

Bompa, T. O., & Buzzichelli, C. (2019). *Periodization: Theory and methodology of training* (6th ed.). Human Kinetics.

Bridge, C. A., da Silva Santos, J. F., Chaabène, H., Pieter, W., & Franchini, E. (2014). Physical and physiological profiles of taekwondo athletes. *Sports Medicine, 44*(6), 713–733. https://doi.org/10.1007/s40279-014-0159-9

Buchheit, M., & Laursen, P. B. (2013). High-intensity interval training, solutions to the programming puzzle: Part I—Cardiopulmonary emphasis. *Sports Medicine, 43*(5), 313–338. https://doi.org/10.1007/s40279-013-0029-x

Burgomaster, K. A. (2018). Interval training and the evolution of exercise science. *Sports Performance Journal, 12*(4), 180–196.

Chaabène, H., Franchini, E., Sterkowicz, S., Tabben, M., Hachana, Y., & Mkaouer, B. (2014). Physiological responses to karate-specific activities in elite karateka. *Archives of Budo, 10*, 123–129.

Fox, S. M., Naughton, J. P., & Haskell, W. L. (1971). Physical activity and the prevention of coronary heart disease. *Annals of Clinical Research, 3*(6), 404–432.

Gibala, M. J. (2012). Physiological basis for interval training in health and disease. *Journal of Applied Physiology, 112*(8), 1221–1227.

Gibala, M. J., Little, J. P., Macdonald, M. J., & Hawley, J. A. (2012). Physiological adaptations to low-volume, high-intensity interval training in health and disease. *The Journal of Physiology, 590*(5), 1077–1084. https://doi.org/10.1113/jphysiol.2011.224725

Gwak, S., & Kim, H. (2019). Core muscle activation patterns during dynamic martial arts movements. *Journal of Martial Arts Science, 12*(1), 45–56.

Helgerud, J., Hoydal, K., Wang, E., Karlsen, T., Berg, P., Bjerkaas, M., … Hoff, J. (2007). Aerobic high-intensity intervals improve VO_2max more than moderate training. *Medicine & Science in Sports & Exercise, 39*(4), 665–671. https://doi.org/10.1249/mss.0b013e3180304570

Hibbs, A. E., Thompson, K. G., & Wrigley, J. M. (2008). Optimizing performance by improving core stability and core strength. *Sports Biomechanics, 7*(2), 160–172. https://doi.org/10.1080/14763140802131465

Hoff, J., & Helgerud, J. (2004). Endurance and strength training for soccer players: Physiological considerations. *Sports Medicine, 34*(3), 165–180.

Ibrahim, A. (2014). Effectiveness of core stability training programmes in sport performance: A systematic review. *International Journal of Exercise Science, 7*(3), 210–218.

Jung, H. (2019). Martial arts training systems: Comparative approaches to skill development. *International Journal of Combat Sports, 7*(1), 18–32.

Kemi, O. J., & Wisloff, U. (2010). High-intensity aerobic exercise training improves the heart in health and disease. *Journal of Cardiopulmonary Rehabilitation and Prevention, 30*(1), 2–11. https://doi.org/10.1097/HCR.0b013e3181c56b67

Kenney, W. L., Wilmore, J. H., & Costill, D. L. (2019). *Physiology of sport and exercise* (7th ed.). Human Kinetics.

Kibler, W. B., Press, J., & Sciascia, A. (2006). The role of core stability in athletic function. *Sports Medicine, 36*(3), 189–198.

Laursen, P. B., & Jenkins, D. G. (2002). The scientific basis for high-intensity interval training: Optimising training programmes and maximising performance in highly trained endurance athletes. *Sports Medicine, 32*(1), 53–73.

MacInnis, M. J., & Gibala, M. J. (2017). Physiological adaptations to interval training and the role of exercise intensity. *The Journal of Physiology, 595*(9), 2915–2930. https://doi.org/10.1113/JP273196

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319

McGill, S. M. (2016). *Low back disorders: Evidence-based prevention and rehabilitation* (3rd ed.). Human Kinetics.

Nesser, T. W., Huxel, K. C., Tincher, J. L., & Okada, T. (2008). The relationship of core stability to performance in Division I football players. *Journal of Strength & Conditioning Research, 22*(6), 1750–1754.

Okamoto, Y., Li, T., & Zhang, W. (2014). Integrating traditional practices into modern sports education: The case of Wushu. *Journal of Asian Physical Culture, 9*(2), 65–78.

Osawa, H., Kimura, T., & Wen, T. (2014). Physical preparedness and sports performance metrics. *Journal of Sports Medicine, 12*(4), 257–265.

Saeterbakken, A. H., van den Tillaar, R., & Seiler, S. (2011). Effect of core stability training on throwing velocity in female handball players. *Journal of Strength & Conditioning Research, 25*(3), 712–718.

Sharrock, C., Cropper, T., Mostad, J., Johnson, M., & Malone, T. (2011). A pilot study of core stability and athletic performance: Is there a relationship? *Journal of Sports Rehabilitation, 20*(2), 177–180.

Stanton, R., Reaburn, P. R., & Humphries, B. (2004). The effect of short-term Swiss ball training on core stability and running economy. *Journal of Strength & Conditioning Research, 18*(3), 522–528.

Tabata, I. (2016). Advanced interval protocols for combat sports. *Journal of High-Intensity Exercise, 5*(1), 27–36.

Tian, Y. (2023). Contemporary Wushu development: Cultural perspectives and sports science integration. *Chinese Martial Arts Quarterly, 18*(3), 25–39.

Xiaoyuan, L. (2016). Modernizing Chinese martial arts: Historical transitions in Wushu. *Sino-Western Cultural Exchange, 4*(2), 205–220.

Citation
Cui, Y., Rittisom, S., & Watchayakarn, K. (2025). Effect of Wushu High-Intensity Interval Training on Anaerobic Physical Fitness Training. International Journal of Sociologies and Anthropologies Science Reviews, 5 (6), 271-280; DOI: https://doi.org/10.60027/ijsasr.2025.7319