



Physical Training Program on Physical Profiles and Success Rate of Skill Movement
in College Student Sanda Athletes

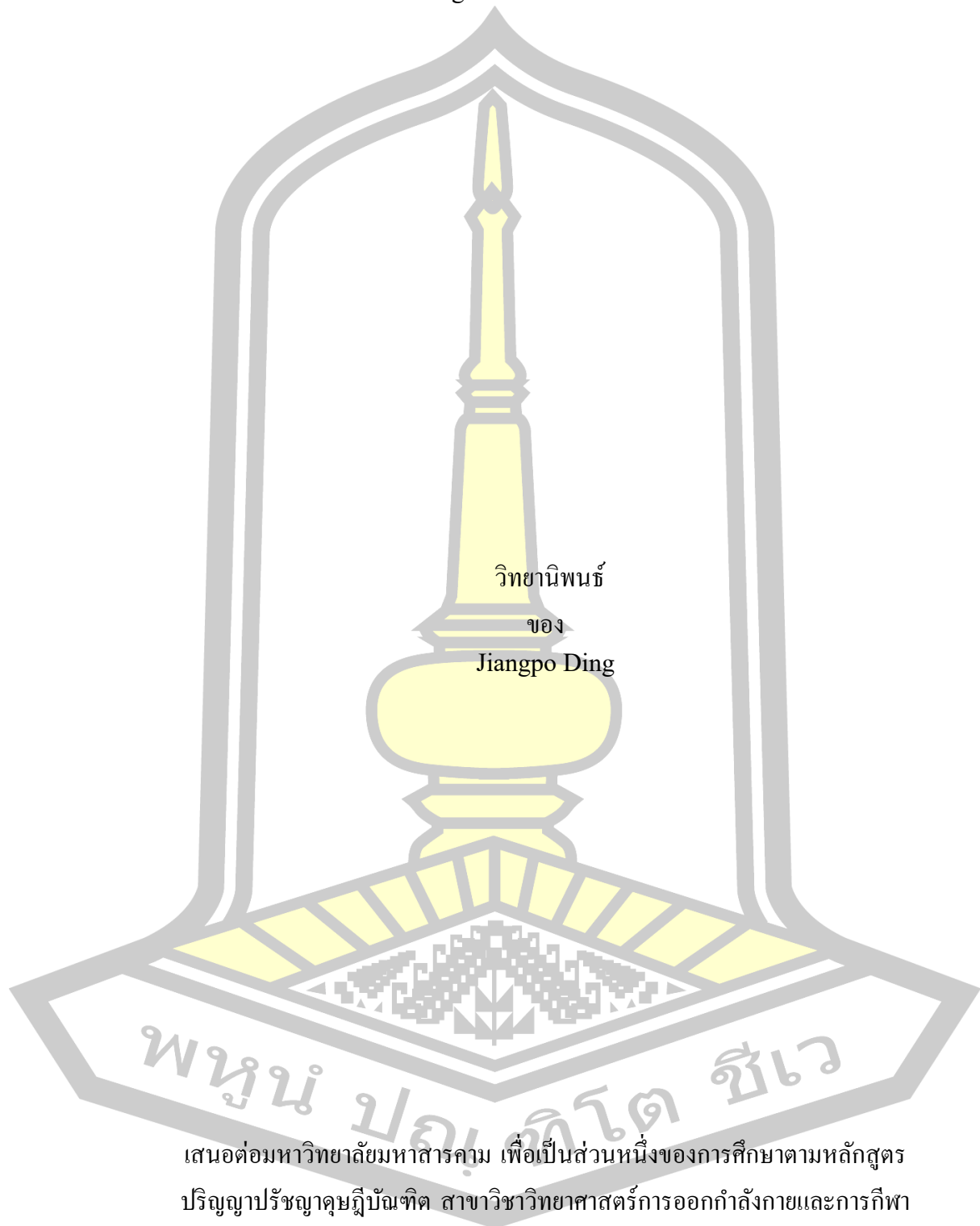
Jiangpo Ding

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Doctor of Philosophy in Exercise and Sport Science

July 2025

Copyright of Mahasarakham University

Physical Training Program on Physical Profiles and Success Rate of Skill Movement
in College Student Sanda Athletes



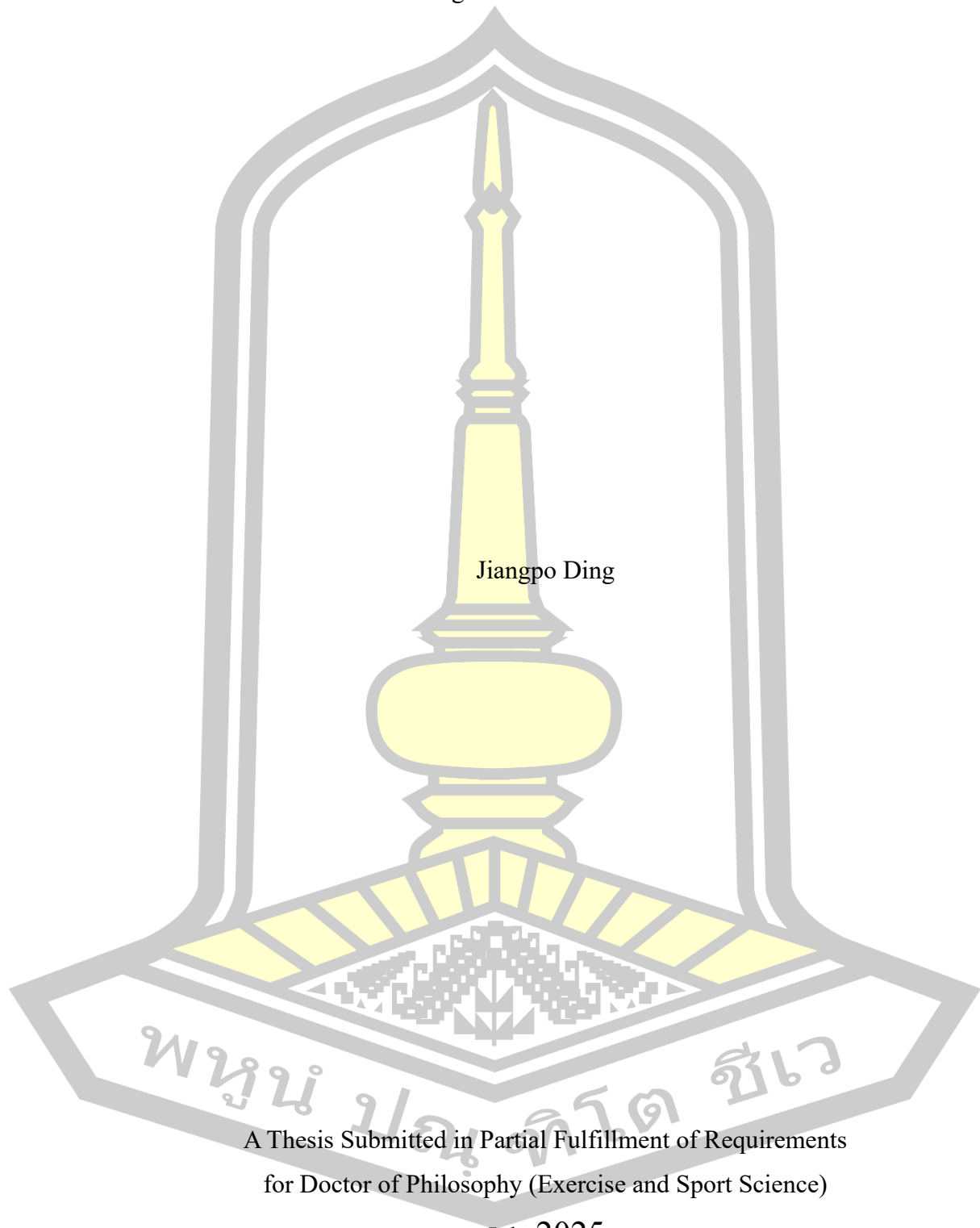
วิทยานิพนธ์
ของ
Jiangpo Ding

เสนอต่อมหาวิทยาลัยมหาสารคาม เพื่อเป็นส่วนหนึ่งของการศึกษาตามหลักสูตร
ปริญญาปรัชญาดุษฎีบัณฑิต สาขาวิชาวิทยาศาสตร์การออกกำลังกายและการกีฬา

กรกฎาคม 2568

ลิขสิทธิ์เป็นของมหาวิทยาลัยมหาสารคาม

Physical Training Program on Physical Profiles and Success Rate of Skill Movement
in College Student Sanda Athletes



Jiangpo Ding

A Thesis Submitted in Partial Fulfillment of Requirements
for Doctor of Philosophy (Exercise and Sport Science)

July 2025

Copyright of Mahasarakham University



The examining committee has unanimously approved this Thesis,
submitted by Mr. Jiangpo Ding , as a partial fulfillment of the requirements for the
Doctor of Philosophy Exercise and Sport Science at Mahasarakham University

Examining Committee

Chairman

(Asst. Prof. Arom Treeraj , Ph.D.)

Advisor

(Wannaporn Sumranpat Brady ,
Ph.D.)

Committee

(Asst. Prof. Chairat Choosakul ,
Ph.D.)

Committee

(Watthanapong Khongsuebsor ,
Ph.D.)

Committee

(Assoc. Prof. Vorapoj
Promasatayaprot , Ph.D.)

Mahasarakham University has granted approval to accept this Thesis as a
partial fulfillment of the requirements for the Doctor of Philosophy Exercise and
Sport Science

(Assoc. Prof. Chowwalit
Chookhampaeng , Ed.D.)
Dean of The Faculty of Education

(Asst. Prof. Pondej Chaowarat , Ph.D.)
Dean of Graduate School

TITLE	Physical Training Program on Physical Profiles and Success Rate of Skill Movement in College Student Sanda Athletes		
AUTHOR	Jiangpo Ding		
ADVISORS	Wannaporn Sumranpat Brady , Ph.D.		
DEGREE	Doctor of Philosophy	MAJOR	Exercise and Sport Science
UNIVERSITY	Maharakham University	YEAR	2025

ABSTRACT

This study aims to explore the effect of physical training program on the physical profiles and success rate of skill movement of college Sanda athletes, and verify its scientificity and effectiveness through experiments. Based on the special needs of Sanda sports and the theory of physical training, the study focuses on optimizing the core physical fitness indicators such as coordination, endurance, and flexibility of athletes, and analyzes the impact on the success rate of their skill movements. The physical fitness and success rate of skill movement of college Sanda athletes were measured. The effect of physical training program on the success rate of physical fitness and technical movements of college Sanda athletes was explored. And the comparison of the success rate of physical fitness and success rate of skill movement of college Sanda athletes in the physical training group and the control group was verified.

This study took 40 college Sanda athletes as the subjects, and they were randomly divided into an experimental group and a control group according to gender, sports level and average physical fitness scores after pre-testing. The experimental group implemented a 12-week customized physical training program, and the control group maintained the traditional training mode. Standardized test tools: speed, strength, endurance, coordination, flexibility, isokinetic muscle strength and success rate of skill movement were used, combined with the seven FMS movements to evaluate motor function. The data before and after the experiment were analyzed by SPSS 22.0, and paired t-test/Wilcoxon rank sum test was used to compare the horizontal improvement rate between groups.

The results showed that there were significant differences in physical fitness indicators between athletes of different genders. By implementing a targeted physical training plan, the study confirmed that the plan can significantly improve the physical fitness level and technical action success rate of college Sanda athletes. The experimental group showed significant progress in core physical fitness indicators such as speed, strength, endurance, flexibility and coordination, and the completion efficiency and stability of technical actions were improved simultaneously. The post-test comparative analysis of the experimental group and the control group showed that

the experimental group that received physical training was significantly better than the control group that did not receive special training in all test items. The experimental group had a significantly higher improvement in speed, strength, endurance and success rate of skill movement than the control group, especially in dynamic coordination items and the stability of complex technical actions.

Keyword : College Sanda athletes, Physical training, Physical profiles, Sports performance, Special endurance



ACKNOWLEDGEMENTS

To you who have illuminated the academic path in my life. As I pick up my pen, thousands of thoughts come to my mind. This is not only the end of the paper, but also a milestone that carries the expectations and efforts of countless people. Please allow me to use the simplest language to express my gratitude to all of you who have accompanied me through this long journey.

To my advisor Dr. Wannaporn Sumranpat Brady, you are the guide of my academic life. Thank you to my advisor. When we first met three years ago, I was like a traveler groping in the fog. It was you who lit the lamp for me with your profound knowledge. I can't forget that you didn't have lunch at noon and you were still helping me guide my thesis. I can't forget that my English is not good. I can't forget that you have been encouraging me all the time. I can't forget your careful teaching. You taught me not only scientific research methods, but also how to maintain awe of the truth in a fickle world.

To the Dean of the department, Assistant Professor Chairat Choosakul, I remember that you lost a lot of weight when you were hospitalized in Khon Kaen Hospital. The first thing you said when you saw me was congratulations on your passing of the ethics and morality. During your hospitalization, you were still concerned about my ethics and morality and were still concerned about the work of the college. The feeling of being moved cannot be expressed in words and language. You took us to your home for dinner, allowing me and my classmates to feel the warmth of home in a foreign country and make the lonely scientific research road full of flowers.

To blood relatives, you are my eternal backing. Thank you to my parents for holding up my dream of studying with both hands. I always say "everything is fine at home" on the phone. You use the most simple love to build a safe haven for me.

To the experimental team, thank you for my experimental team's encouragement and support. They never miss every training and cheer each other up when they are hard and tired. These times of fighting side by side have brought warmth to the cold equipment., To the leaders and teachers of the college. Every "come on" from you makes me feel warm; thanks to Jimmy, the academic affairs teacher of the college, for helping me organize the materials tirelessly: thanks to the anonymous review experts for their sharp but constructive comments. It is these seemingly small kindnesses that make this journey full of the brilliance of humanity.

Finally, the paper will eventually turn yellow, but this friendship will last forever. The road ahead is long, and I will give back to the society what I have learned and live up to your

trust. Thank you!

Jiangpo Ding

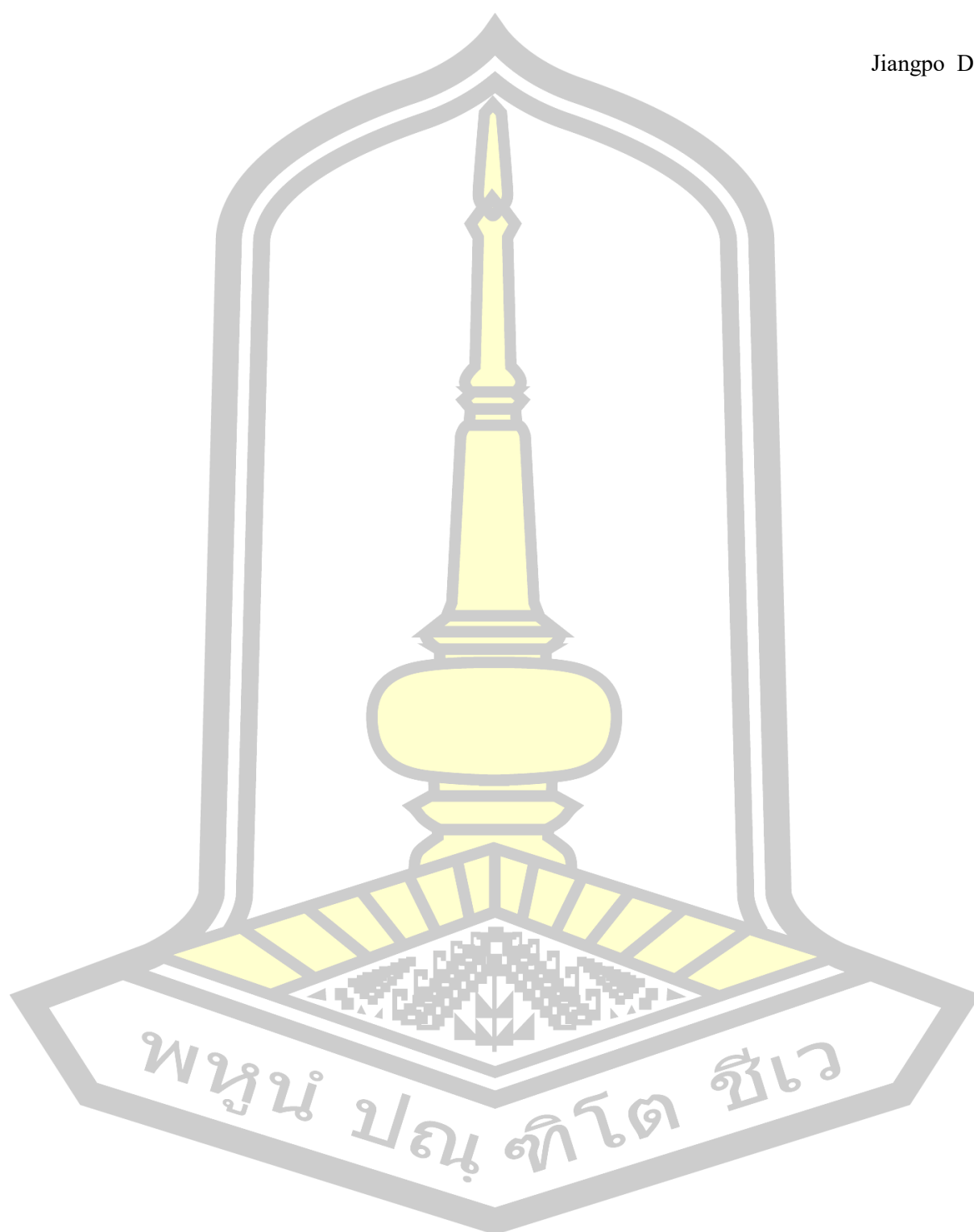


TABLE OF CONTENTS

	Page
ABSTRACT.....	D
ACKNOWLEDGEMENTS.....	F
TABLE OF CONTENTS.....	H
LIST OF TABLES	J
LIST OF FIGURES	K
CHAPTER I INTRODUCTION.....	1
Background.....	1
Research questions.....	4
Research objectives	4
Hypothesis of the research.....	5
Significance	5
Definitions	8
Conceptual framework.....	13
CHAPTER II REVIEW OF RELATED LITERATURE.....	14
1. Sanda sport.....	16
2. Physical training theory	45
3. A review of research related to Sanda Physical profiles.....	59
CHAPTER III METHODOLOGY	71
Phase I:.....	71
1. Population and Subjects.....	71
2. Instruments	72
3. Data collection procedures	73
4. Data analysis.....	74

Phase 2:.....	75
1. Subjects.....	75
2. Instruments	76
3. Data collection procedures	77
4. Data analysis.....	80
CHAPTER IV RESULTS	81
CHAPTER V DISCUSSION AND SUGGESTIONS	92
5.1 Summarize the results	92
5.2 Discussion	92
5.3 Conclusions.....	103
5.4 Suggestions.....	103
5.5 Research limitations	107
REFERENCES	109
APPENDIX.....	130
Appendix A Physical training program for 12 weeks.....	131
Appendix B Invitation letter for expert and the result of IOC.....	206
Appendix C Data collection permission request	212
Appendix D ICC of the measurements	214
Appendix E Ethic Certificate.....	224
BIOGRAPHY	251

พหุ ประถมศึกษา

LIST OF TABLES

	Page
Table 1 Standard norms of speed.....	22
Table 2 Standard norms of push-ups	23
Table 3 Standard norms of squats	24
Table 4 Standard norms of Sit-up.....	26
Table 5 Standard norms of Grip strength.....	27
Table 6 Standard norms of Endurance.....	29
Table 7 Standard norms of Coordination.....	30
Table 8 Standard norms of Flexibility	31
Table 9 Standard norms of Joint muscle strength.....	32
Table 10 Standard norms of FMS.....	35
Table 11 Evaluation Criteria	42
Table 12 Physical profiles test tools	72
Table 13 Fitness test tool	76
Table 14 Basic information of college Sanda athletes of stage 1	82
Table 15 Comparing Physical profiles and success rate of technical movements in college Sanda athletes between gender.....	83
Table 16 Basic information of college Sanda athletes of experimental and control groups.....	85
Table 17 Comparison of physical profiles and success rate of skill movement test score Pre and Post test within experimental and control groups	86
Table 18 Comparison of Physical profiles test score between experimental and control groups.....	89

LIST OF FIGURES

	Page
Figure 1 Conceptual framework	13
Figure 2 Speed.....	22
Figure 3 push-ups.....	23
Figure 4 squats.....	25
Figure 5 Sit-up.....	26
Figure 6 Grip strength.....	28
Figure 7 1000 meters (male)/800 meters (female)	29
Figure 8 Coordination.....	30
Figure 9 Flexibility	32
Figure 10 ISOMED2000	33
Figure 11 Squat test	35
Figure 12 Hurdle steps test.....	36
Figure 13 straight lunges test	37
Figure 14 leg raises test.....	37
Figure 15 trunk stability push-ups test	38
Figure 16 shoulder joint flexibility test	39
Figure 17 rotational stability test	39
Figure 18 Success rate of boxing.....	43
Figure 19 Success rate of kicking.....	44
Figure 20 Success rate of wrestling	45
Figure 21 Showing the research process of phase 1	74
Figure 22 Showing the research process of phase 2.....	79

CHAPTER I

INTRODUCTION

Background

Sanda is a product of the combination of Chinese Wushu. Sanda has developed rapidly and has now become an important competitive sports event in China (Wang Xiaodi, 2022; Li Gen, Yu Laikang, 2022). Excellent Sanda athletes have outstanding special skills and relatively comprehensive skills. When other conditions are basically the same, Sanda athletes can only have abundant physical strength to ensure the full play of their skills. Therefore, physical profiles become an important factor in determining the outcome of the competition (Liu Qingjun, 2022).

In recent years, many experts have carried out a comprehensive, systematic and valuable research on physical training. In this study, we searched, organized, summarized and analyzed related papers on Physical profiles, physical training, and Sanda physical training. Through literature research, researchers have found that the research results of physical training have increased significantly in recent years. The research results are as follows: focusing on the characteristics of excellent athletes participating in Olympic events, and more repetitive studies lacking innovative significance; the research content focuses on physical training, special physical training, diagnosis and evaluation of physical training process (Meng Yihao, 2021; Wang Ting, Lei Wei, Liao Rongrong, 2021). In general, compared with the physical training of other sports, the overall research of Sanda physical training is less, and the content mainly focuses on the physical evaluation and selection of excellent Sanda athletes, theoretical review of physical training, the monitoring of physical indicators and physical quality of physical training. The number of research results published in core journals has a low proportion of the total number of results, and the overall research quality is worse than that of football and basketball (Zhang Peicheng, 2021; Zhang Bo, Wei Liujie, 2021).

If an athlete does not have excellent Physical profiles or is in poor physical condition, it will have varying degrees of impact on the athlete's performance. (Du

Yuantong, 2020); Huang Pengcheng, 2020; Cheng Zhigang, 2021). In fact, under the premise of having the same skills, players with superior Physical profiles can easily gain an advantage in the competition. Athletes' physical profiles develop to different degrees in different sensitive periods of the body. Improving the level of various body organs allows the athletes to develop balanced development of all parts of the body. (Du Guangqiang, 2019; Jiang Desheng, 2019). Physical profiles is an athlete's basic athletic ability and a reflection of an athlete's competitive ability. An athlete with good development in all aspects should develop comprehensively in five aspects, such as speed quality, strength quality, endurance quality, coordination quality and flexibility quality. (Zhu Zhiqun, 2019).

The smooth completion of the training and competition can be guaranteed through the scientific monitoring of the physical functional state of the athletes. Experts suggest that the function level of Sanda athletes should be assessed according to the change of indicators in different training stages (Wang Jiajun, 2019; Wang Jiao, 2018). The research shows that the sensitive coordination factor, speed endurance factor, waist and abdomen fast strength factor, upper limb fast strength factor and lower limb fast strength factor constitute the physical quality of college students. The overall performance is outstanding coordination and sensitive quality, strong speed and endurance, and good fast strength of waist, abdomen and upper and lower limbs. The 5 indicators of 15S continuous jump standard challenge, 1500 m, 30S two ends, 30S arm push-up and standing long jump can be used as the physical quality evaluation indicators of Sanda athletes (Song Yiqing, 2018).

In recent years, the development of Chinese martial arts Sanda and its increasing activity on the international stage, the improvement of the comprehensive quality of Sanda athletes, especially their physical profiles, has become a key factor affecting competitive performance. The major reform of the competition rules of the "Sanda World-Chinese Wushu Sanda Professional League" in 2016 not only adjusted the technical evaluation standards, but also indirectly promoted the overall upgrade of the proportion of technical movements and the rhythm of the game. According to Luo Changqing (2020), after the rule revision, the proportion of boxing and legging technical movements increased significantly, tactical hugging behaviors decreased, the rhythm of the game was significantly accelerated, and the viewing experience was

enhanced. This change forces athletes to not only have a stronger sense of active attack, but also to have a higher level of physical profiles as a basic guarantee. Therefore, scientifically and rationally strengthening the physical training of Sanda athletes has become an important direction for the current Sanda training reform. Physical profiles is the most basic guarantee ability in competitive sports and a prerequisite for achieving technical and tactical movements. However, in previous studies, college Sanda athletes have certain shortcomings in their physical profiles structure. Studies have found that some athletes have problems such as insufficient endurance, weak explosive power, and poor recovery ability, which leads to a decline in the quality of technical movements and an increase in the risk of injury in high-intensity confrontations (Yin Guolong, 2020). These problems are particularly prominent among college students. On the one hand, they are limited by their academic burden and have relatively limited training time. On the other hand, the physical training system is not systematic enough and lacks scientific cycle arrangements and recovery mechanisms.

In addition, previous studies were also relatively extensive in the selection of physical profiles indicators, ignoring the special physical profiles elements that are closely related to actual competitions. For example, key factors such as reskill movement speed, attack and defense conversion ability, and resistance to blows were not included in the systematic evaluation, resulting in unclear training goals and a disconnection between content settings and actual combat. When building a scientific physical training, the body characteristics and gender differences of athletes must be fully considered. Studies have shown that there are significant differences between male and female Sanda athletes in muscle strength, lung capacity, reskill movement speed and explosive power. Wang Hao et al. (2022) pointed out that in the analysis of the competitive ability of tennis players, players of different genders have their own advantages in spatial movement speed and body coordination performance. Therefore, in Sanda sports, physical training should distinguish gender differences and adopt differentiated training methods to improve training efficiency and effectiveness. The practice of international Sanda competitions shows that female Sanda athletes have innate advantages in agility and flexibility, while male athletes have more advantages in strength and resistance to blows (Yongge & Junmin, 2022). This finding further

supports the necessity of research on gender differentiation of physical training. This study will further explore the characteristics and differences of different genders in endurance, speed, strength and recovery ability among college Sanda athletes, and optimize the matching degree of training content in combination with actual training feedback to improve the accuracy and individual adaptability of training intervention. The success rate of skill movements directly determines the conversion efficiency of scoring opportunities in Sanda competitions. In high-intensity and high-confrontation competitions, the stability and success rate of technical movements are important indicators for evaluating athletes' competitive ability. Existing studies have confirmed in other confrontational events such as wrestling and taekwondo that athletes with high success rates of technical movements often take the initiative in the game and are more likely to form effective attacks, defenses or counterattacks (Zhu Junchi, 2022). However, in the current research on Sanda, the research on the success rate of skill movements is relatively insufficient, lacking quantitative evaluation and data support. This study attempts to combine physical training intervention with the success rate of skill movements to explore whether the success rate of skill movements can be significantly improved by improving special Physical profiles (such as core stability, coordination ability, and reskill movement speed). By comparing the hit rate, scoring efficiency, reskill movement time and other indicators of technical movements before and after training, the actual impact of physical training on skill performance is evaluated, thereby providing scientific support for optimizing training content.

Research questions

1. Are there any deficiencies in the physical profiles and success rate of skill movement in college students' sanda athletes? and Do female and male have different in the physical profiles and success rate of skill movement?
2. Can the physical training program improve the physical profiles and success rate of skill movement in college students' sanda athletes and better than the control group?

Research objectives

1. To determine the physical profiles and success rate of skill movement in college students' sanda athletes and compare between male and female.

2. To investigate the effect of physical training program on the physical profiles and success rate of skill movement in college students' sanda athletes after 12 weeks of program

3. To compare the physical profiles and success rate of skill movement in college students' sanda athletes between physical training and control groups after 12 weeks of programs.

Hypothesis of the research

1. Both genders have some deficiencies in the physical profiles and success rate of skill movement and they have difference in the physical profiles and success rate of skill movement.

2. Physical training program can improve the physical profiles and success rate of skill movement in college students sanda athletes after 12 weeks of program.

3. After 12 weeks of program, physical training program and control groups can improve the physical profiles and success rate of skill movement in college students' sanda athletes differently.

Significance

1. Theoretical significance

From the theoretical point of view, this study makes a scientific theoretical and empirical analysis on the physical training of college students' Sanda athletes. To a certain extent, it expands the lack of theoretical research on the current research direction, and enriches the theoretical content of the research on physical training of excellent Sanda athletes, which has certain theoretical research significance:

(1) Explain the physical needs of college students' Sanda athletes and provide theoretical support for physical training. Different sports, physical needs also focus on. Wushu Sanda belongs to the fighting confrontation, which has the common characteristics of this group. Due to the technical characteristics of boxing and leg fall, and boxing, taekwondo and other projects are obviously different, with its own significant project characteristics and physical needs. The premise of physical training for college students must clarify the specific physical needs in the competition. From

the perspective of Sanda competition, this paper tries to explain the physical elements of college student Sanda athletes and the importance of each element, so as to provide solid theoretical support for the physical training of excellent Sanda athletes from the theoretical level.

(2) Build a physical training system for college students' Sanda athletes to provide theoretical guidance for their comprehensive and systematic physical training. At present, the research of physical training of college students Sanda athletes is relatively weak. The existing achievements are mainly the research on the Physical profiles evaluation system of excellent Sanda athletes, which lacks a scientific and systematic Physical profiles training system to guide the Physical profiles training practice of athletes. This study on the basis of the latest physical training research progress at home and abroad, combined with the characteristics of Sanda sports, relying on Henan Sanda team excellent athletes, coaches, according to the research needs, comprehensive research interview province Sanda team coaches, to obtain valuable first-hand information, and carefully combing the existing outstanding Sanda athletes physical training methods, means, from the multidisciplinary perspective, theory combined with practice, build our excellent Sanda athletes physical training system, provide theoretical guidance for training practice.

2. Practical significance

From a practical point of view, physical training has been widely recognized in the United States, Canada, Australia and other countries. With a very mature training system, whether in competitive sports, professional sports, or public fitness field, the practical value and effect of physical training have been fully shown. In China, in order to solve the bottleneck of the sports performance of the national team athletes and the injury problems, the Sports Department of the Chinese Olympic Committee hired the American AP team to help the Chinese athletes. Physical training is very important. For this study, the practical significance is mainly reflected in:

(1) It is conducive to guiding the practice of physical training and improving the physical level of college students Sanda athletes. The Sanda movement originated in China. In the process of promoting Sanda to the world, we always play the role of coach in terms of technical and tactical training methods and means, except for

physical training. Therefore, through the study of this paper, on the basis of scientific analysis of the physical needs of college students Sanda athletes, the advanced physical training concepts, methods and means for reference. Combined with the special technical movement characteristics of Sanda sports, the physical training system suitable for excellent Sanda athletes is designed, which is conducive to scientific guidance and training practice. The training system will be more reasonable arrangement of Physical profiles elements and the ratio between Physical profiles and technology, so that it can be greatly improved on the original basis, and comprehensively improve the Physical profiles level of athletes.

(2) It is conducive to maintaining the dominant position of Chinese Wushu Sanda in the world. All the time, the national level and folk martial arts people have been pushing Wushu into the Olympic family, and the pace of martial arts bid has never stopped. Wushu sports include Wushu routines and Wushu Sanda. Thanks to the joint efforts of all parties, the number of member states of the International Wushu Federation has been increasing. Steady progress was made in various domestic and international sports events. Wushu Sanda has now become an official competition event of various intercontinental and international competitions in addition to the Olympic Games. However, with the increase of international Sanda competitions, Chinese Sanda athletes also face many challenges in the international arena. Small and medium level are our dominant level. In recent years, some Asian countries have made rapid progress, and the major level has been "monopolized" by foreign athletes in the early years. In recent World Cup, Chinese athletes have achieved good results, but compared with major athletes in European and American countries, our Physical profiles is relatively at a disadvantage. If not targeted to improve, over time, foreign athletes will pose a serious threat to us. Therefore, it is necessary to strengthen the physical training of college students Sanda athletes, learn from each other, and balance the athletes' abilities in all aspects. Only in this way can we continue to consolidate the dominant position of Chinese Wushu Sanda in the world.

(3) It is helpful to enhance the appreciation of Sanda competition and improve the competitiveness and influence of Sanda sports. The appreciation of the event has an important influence on the economic value, social benefits and vitality of a certain sport. Only the competition with strong ornamental value can attract more people to

pay attention to the competition and the sport of the event, and then may become the practice group of the event. The appreciation of Wushu Sanda competition depends on the technical level of the athletes and the intensity of the competition, which is mainly based on the abundant physical strength of the athletes. In other words, the physical level of the athletes is directly related to the appreciation of the competition. With good strength quality, a sound or displacement strike skill movement in the competition, and KO; the fast-paced attack of the competition, the use of multiple fist and leg combinations, depend on the excellent endurance level of the athletes. Therefore, improving the physical level of college students' Sanda athletes is helpful to enhance the appreciation of Sanda competitions, and present more visual feast of high-quality competitions for the audience, so as to expand the social influence of Sanda sports

Definitions

1. Elements of physical profiles and success rate of skill movement

1.1 Anthropometric measurements

Anthropometry is a way to quantitatively evaluate the morphological structure of the human body through scientific methods and standardized tools. It is often used to assess the individual's physical development level and basic physical profiles, and is of great significance in sports training and health monitoring (Ministry of Education of the People's Republic of China, 2014). This study used the vertical measurement method for height measurement, using a measuring ruler to directly measure the athlete's height when standing. Body fat percentage measurement uses tools such as a bioelectrical impedance meter to measure body fat percentage, allowing for a more complete assessment of the distribution of body fat and lean mass. It is required that when measuring height and weight, the state of the subject should be kept relatively consistent, such as measuring at the same measurement period, in the same wearing state, and on the same equipment (Ministry of Education of the People's Republic of China, 2014).

1.2 Speed

Speed refers to the body's ability to complete movement or rapid displacement within a unit of time. It is an important indicator of the functional state of the central nervous system and the ability of nerve-muscle coordination and regulation. (Ministry of Education of the People's Republic of China, 2014).

1.3 Strength

Strength refers to the performance of the whole or local muscles of the body during control skill movement and relaxation. Sanda athletes in dealing with confrontations and technical movements, and then guiding targeted strength training to improve the overall competitive ability of athletes. Sanda athletes use strength of many muscles such as pectoral and arm muscles that using push up test and This article comprehensively reflects the muscle strength level of athletes through push-ups, squats, sit-ups, and grip strength tests (Ministry of Education of the People's Republic of China, 2014).

1.4 Endurance

Endurance refers to the ability of the human body to maintain muscle activity and resist fatigue for a long time. It covers muscle endurance, cardiopulmonary endurance and whole-body endurance, and reflects the comprehensive functional status of multiple systems of the body. This article uses 1000-meter (male) and 800-meter (female) running time tests as endurance evaluation indicators (Ministry of Education of the People's Republic of China, 2014).

1.5 Coordination

Coordination is a comprehensive athletic quality, which is manifested as the ability of the human body to respond quickly and accurately to external stimuli in a complex and changing environment and to complete skill movements flexibly. Coordination plays a key role in the fluency and reskill movement speed of Sanda athletes in actual combat, and helps to discover the shortcomings of athletes in skill movement continuity and technical conversion, thereby guiding targeted training and improving actual combat technical performance. This article evaluates the coordination ability of athletes through a shuttle run test (Ministry of Education of the People's Republic of China, 2014).

1.6 Flexibility

Flexibility refers to the range of motion, elasticity, and stretching ability of joints and their surrounding tissues (ligaments, tendons, muscles, skin, etc.) during exercise. It is an important basis for improving the range of motion, preventing sports injuries, and maintaining muscle elasticity and explosive power. Flexibility not only depends on structural characteristics, but is also affected by the nervous system's control function over skeletal muscles. It helps to understand the range of motion and physical adaptability of athletes during the completion of technical movements. This study used the sit-and-reach test to measure the flexibility of athletes (Ministry of Education of the People's Republic of China, 2014).

1.7 Joint muscle strength

Joint muscle strength refers to the force generated by muscle fiber contraction movement in the muscle groups around the joints, which is used to control and stabilize joint movement, so that the bones can complete precise and coordinated movements at the joints. Joint muscle strength is not only the basis for completing basic movements in daily life, such as walking and carrying objects, but also plays a key role in maintaining body posture stability and movement coordination. This study used the ISOMED2000 isokinetic muscle strength testing equipment to quantitatively evaluate the joint muscle strength of college Sanda athletes. This measurement can accurately reflect the dynamic changes in the athlete's muscle strength and joint control ability, providing a scientific basis for evaluating their physical profiles level and formulating personalized training plans, thereby helping athletes improve their control over technical movements and athletic performance.

1.8 The FMS

Functional Movement Screen (FMS) is a systematic assessment tool designed to detect the basic movement patterns of individuals in daily life and sports, and to identify and correct potential movement dysfunctions as early as possible. The FMS score covers seven basic movements: squats, reverse squats, single-leg standing stability, shoulder joint flexibility, leg raises, trunk stability push-ups, and rotational stability. Each movement has clear movement specifications and scoring standards. Through the FMS test of college Sanda athletes, this article can scientifically evaluate

their motor function integrity and movement quality, timely discover functional defects that affect the execution of technical movements, guide the focus of physical training, reduce the risk of sports injuries, and improve overall competitive ability. In this study, the FMS score is not only a quantitative indicator of functional status, but also provides a key reference for optimizing training programs.

1.9 Success rate of skill movement

The success rate of skill movement is an important indicator for evaluating the quality of special technical execution in Sanda training and competitions, reflecting the accuracy and effectiveness of athletes in completing specific martial arts skill movements in actual combat environments. This article specifically examines the success rate of three types of technical skill movements: boxing, kicking, copying, and turning whip punches. The boxing success rate includes the proportion of the number of scoring times of punching, punching, copying, and turning whip punches to the total number of attempts; the leg success rate includes the proportion of scoring times of whip kicks, sidekicks, front kicks, and turning back swing kicks; the wrestling success rate counts the success rate of skill movement such as receiving throws and close throws. The success rate of skill movement lies in objectively reflecting the role of physical training in promoting the improvement of technical level by comparing the accuracy and efficiency of athletes' skill movement execution in actual combat before and after training, and at the same time revealing the interactive relationship between physical profiles and the success rate of skill movement, helping the coaching team to scientifically adjust the training content and strategy, and further promote the comprehensive development of athletes' competitive ability.

2. Definition of physical training

Physical training is essentially the training of the human body system, which has systematic characteristics (comprehensiveness and integrity of training). Physical training must be closely combined with the characteristics of sports items and body system, based on the multidisciplinary research results, make full use of interdisciplinary, to optimize the body sports system, bone and muscle in the process

of physical training. Physical training should pay attention to the unity of special, that is, according to the characteristics of the characteristics of sports technology, the characteristics of physical training. Different sports events have their own specific characteristics. The goals and methods of physical training are also different. The physical training of athletes is to maximize the potential of athletes as much as possible in special sports, so that they can play to a higher level. Therefore, physical training should not be carried out independently from the sports and sports, and must be closely combined with sports to get twice the result with half the effort.

physical training refers to in the process of physical training, through a variety of effective general, special training methods, in order to obtain strength, endurance, speed, coordination, flexible physical elements and joint strength indicators such as ascend, to improve the Physical profiles level in sanda competition.

In this study, Physical training means 12-week training program follows a structured 5-day weekly schedule (Monday, Tuesday, Thursday, Friday + active recovery) over three progressive phases (Weeks 1-4, 5-8, 9-12). Each 60–90 minute session targets specific adaptations: Mondays emphasize maximum strength (bench press, squats) and explosive power (3-4 sets, 1-6 reps at 85%1RM); Tuesdays focus on aerobic/anaerobic endurance (4-6 running/combat intervals at 80-95% HRmax) and combat coordination; Thursdays combine strength with anaerobic conditioning (power cleans, reskill movement drills); Fridays develop fight-specific speed and endurance (variable target drills, sub-lactate threshold running). Recovery protocols (foam rolling, stretching, spa) follow each session. Key questions remain regarding exact session durations, intensity progression across weeks, standardized recovery implementation, athlete skill-level adjustments, and whether nutrition/sleep were controlled variables in the program design.

3. College Student Sanda Athletes were student from Sichuan Light Chemical University, 20 women and 20 men. Aged between 19-24 years old, have participated in at least 2 Sanda competitions at the municipal level or above, and have an athlete level.

Conceptual framework

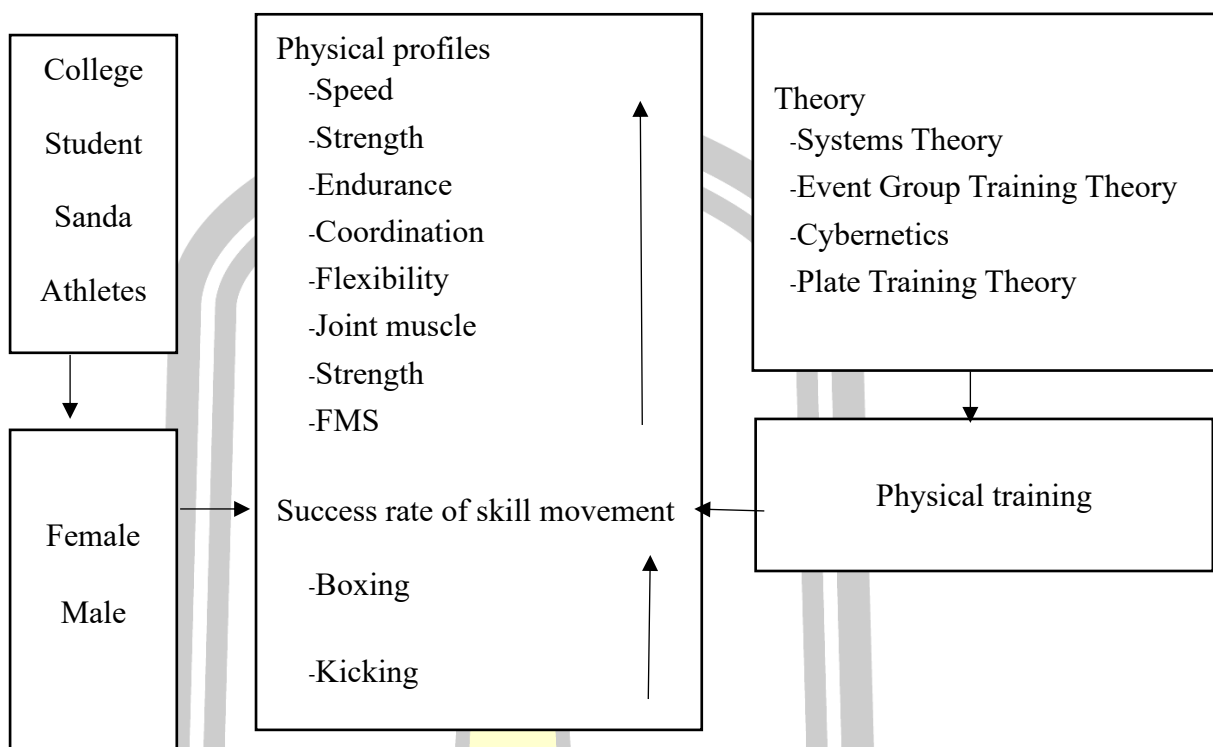
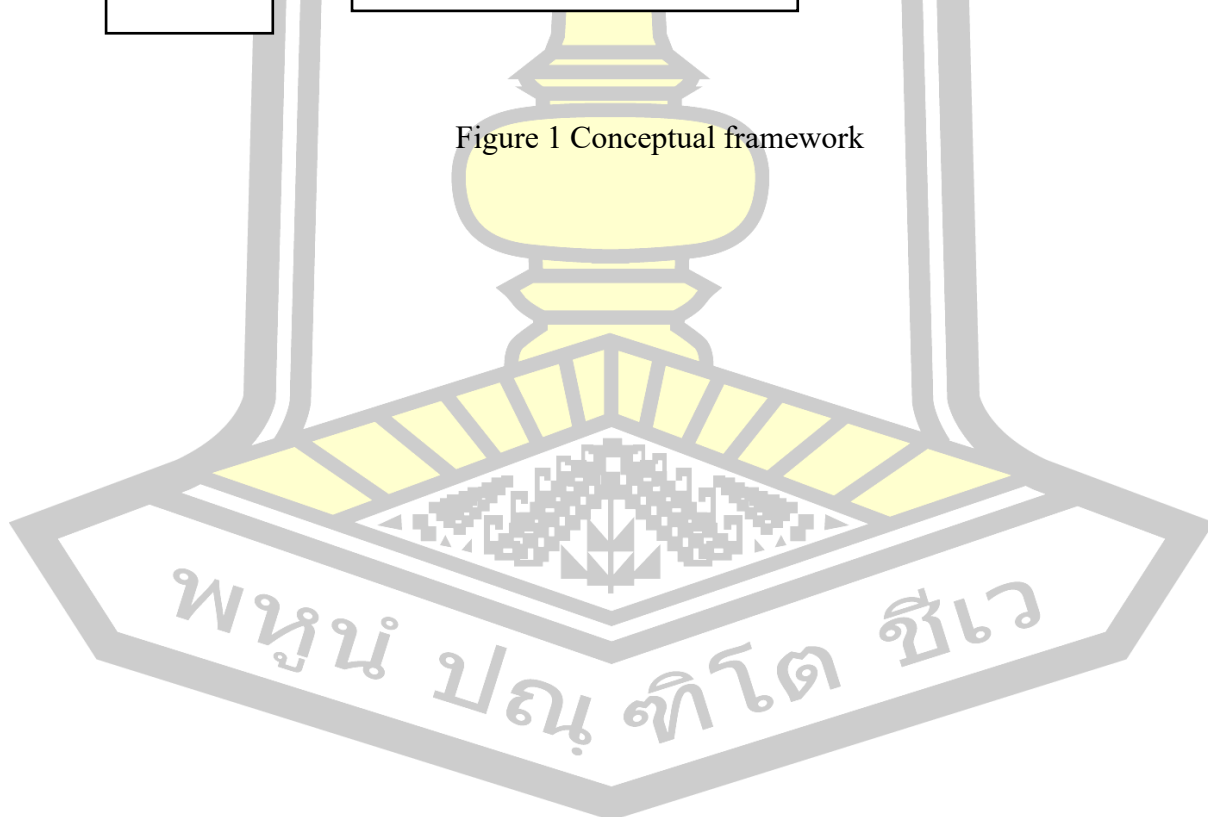


Figure 1 Conceptual framework



CHAPTER II

REVIEW OF RELATED LITERATURE

1. Sanda sports

1.1 History of Sanda sports

1.2 Sports level of Sanda athletes

1.3 Importance of Sanda athletes' sports

1.3.1 Anthropometric measurements

1.3.1.1 Weight

1.3.1.2 Height

1.3.1.3 Body Mass Index (BMI)

1.3.1.4 Body fat percentage

1.3.2 Speed

1.3.3 Strength

1.3.3.1 Push-up standard

1.3.3.2 Squat

1.3.3.3 Sit-up

1.3.3.4 Grip strength

1.3.4 Endurance

1.3.5 Coordination

1.3.6 Flexibility

1.3.7 Joint muscle strength

1.3.8 The Functional movement screening (FMS)

1.3.8.1 Squats test

1.3.8.2 Hurdle steps test

1.3.8.3 Straight lunges test

1.3.8.4 Leg raises test

1.3.8.5 Trunk stability push-ups test

1.3.8.6 Shoulder joint flexibility test

1.3.8.7 Rotational stability test

1.4 Success rate of important skills

1.4.1 Success rate of boxing

1.4.2 Success rate of legs

1.4.3 Success rate of wrestling

2. Physical training theory

2.1 Definition of physical training theory

2.1.1 System theory

2.1.2 Control theory

2.1.3 Plate training theory

2.1.4 Group training theory

2.2 Items/types of physical training

2.2.1 Research on systems theory

2.2.2 Research on control theory

2.2.3 Research on block training theory

2.2.4 Research on group training theory

3. Review of research on Physical Profiles in Sanda

3.1 Research on body shape of Sanda athletes

3.2 Research on body functions of Sanda athletes

3.2.1 Research on energy metabolism:

3.2.2 Research on cardiovascular function:

3.2.3 Research on respiratory function:

3.2.4 Research on some biochemical indicators in assessing athletes'

body functions

3.3 Research on the athletic quality of Sanda athletes

3.4 Current status of research on physical training of Sanda athletes

1. Sanda sport

1.1 History of Sanda sport

The origin of martial arts can be traced back to primitive society. In daily life and production activities, people began to constantly use martial arts movements such as punching, kicking, throwing, and grabbing to obtain food, compete for territory, and conduct security defense (Jiang Fei et al., 2022). Entering the private ownership society, martial arts technical sports were constantly updated during the war. The records in "Book of Rites·Wangzhi" show that the society at that time attached great importance to confrontational events, showing their strength through fighting and winning respect (Qu Qihao and Liang Yadong, 2021). "Shiming" explains: "To fight, to fight, is to fight extensively. However, if you raise your hand and hit the vital point, you will eventually pounce." "Guliang Zhuan" records that Confucius' master Liang Si and Qin Ya competed. Once the event is launched, more people will participate in it, and the scope of technical exchange and skill transfer will continue to expand (Guo Xian et al., 2019). During the Spring and Autumn Period and the Warring States Period, wars were already very common. During the Qin and Han Dynasties, the competition became more formal. During the Sui, Tang and Five Dynasties, with the establishment of the competition system, the activities of step fighting and hand fighting were widely spread. During the Yuan and Ming Dynasties, the exchange of martial arts skills continued to expand. After the Opium War, the invasion of foreign powers brought about the intrusion of Western culture, which further promoted the spread and development of Chinese martial arts culture (Li Jie et al., 2018). During the Kuomintang period, the Kuomintang established the Chinese Martial Arts Hall in Nanjing. Since then, many such martial arts halls have been established across the country. Many martial arts masters and experts were hired to provide Chinese martial arts courses for some universities and local military academies, and a large number of modern Chinese martial arts talents were trained (Han Yanpeng and Lu Yu, 2018). In 1933, the National Sports Conference was held in Nanjing, and Sanda was participated as a major event. Sanda competitions are divided into groups according to gender and weight. During the competition, both sides wear special protective gear and cannot hit the head or hips. The best-of-three system is adopted, and there is no time limit (Zheng Xuheng et al., 2018).

After the founding of the People's Republic of China, martial arts was officially listed as a promotion project in 1952. In 1979, with the rise of the martial arts craze, the State Sports Commission decided to develop Sanda in accordance with the modern competitive sports model, and the Zhejiang Provincial Sports Commission, Beijing Institute of Physical Education, and Wuhan Institute of Physical Education piloted it. Sanda took this opportunity to try to promote martial arts across the country, which to a certain extent eliminated the influence of superstition and metaphysics on people (Zhang Peishen, 2016). Sanda added the connotation of martial arts, emphasized offensive and defensive skills, improved the level of technical training, attracted more athletes to engage in professional Sanda work, inherited the essence of Chinese martial arts, and developed Chinese traditional culture (Li Fugang et al., 2015). In May of the same year, at the martial arts exchange meeting held in Guangxi, three pilot units reported on the promotion of Sanda. At the National Martial Arts Exchange Meeting held in 1980, Sanda flourished again. Beijing Institute of Physical Education and Wuhan Institute of Physical Education conducted on-site guidance, exchanges and learning, and more and more people began to participate in Sanda performances (Zhu Hongsheng, 2014). In September, during a martial arts performance held in Kunming, Yunnan Province, the Central Sports Commission organized pilot units to participate in the guidance of the national Sanda competition rules. After research and listening to opinions from all parties, the draft of the national Sanda competition rules was finally formulated for comments (Liu Dexin, 2014). In 1989, Sanda was officially approved by the Central State Sports Commission as a modern competitive sport. This will provide policy support for the further promotion and development of Sanda, allowing Sanda to be widely carried out across the country, attracting more people to participate, and continuously improving the level of competition, so that Wushu Sanda can go global as soon as possible, and prepare for Wushu to enter the Olympics in the future (Li Xiaohui, 2014). Since then, the development of Wushu Sanda has entered a golden development period of 10 years. 2005 was an important turning point in the development of Sanda. The 10th National Games officially included women's Sanda in the competition and established a women's Sanda team gold medal, marking the official inclusion of women's Sanda

in large-scale competitions. Since then, women's Sanda has entered a period of rapid development (Su Yong, 2013).

1.2 The sports level of Sanda athletes

Currently, the sports level of Chinese Sanda athletes is mainly divided into international top athletes, top athletes, level 1 athletes, level 2 athletes, and level 3 athletes (General Administration of Sport of China, www.sport.gov.cn). The specific requirements are as follows

1.2.1 International top athletes

Anyone who meets of the following conditions may apply for the title of international top athletes:

1.2.1.2 The first place in the World Wushu Games.

1.2.2 Top Athletes

Anyone who meets one of the following conditions may apply for the title of top athletes:

1.2.2.2 The top 3 in Group A (Youth Group) of the World Youth Championships, the Asian Championships, and the Asian Games; the National Games (preliminaries, finals), the National Championships, and the National Championships, the top 12 in the all-around, the top 6 in individual events, and the first place in each individual event of traditional events; the finals of the National Youth Games.

Anyone who meets any of the following conditions may apply for the title of Level 1 athlete:

individual events, and 2nd to 8th place in each individual event in the National Games (preliminary and finals), National Championships, and National Championships;

1.2.3.2 4th to 6th place in the finals of the National Youth Games;

1.2.3.3 Top 6 in individual events in Group A (youth group) and top 3 in individual events in Group B (juvenile group) of the National Youth Championships;

1.2.3.4 Top 3 in all-around in the National Wushu School Competition;

1.2.3.5 Top 3 in individual events in the National Sports Traditional School League. 4.

1.2.4 Level 2 Athletes

Anyone who meets any of the following conditions may apply for the title of Level 2 Athletes:

Games;

1.2.4.2 4th to 6th place in the individual events of Group B (Junior Group) of the National Youth Championship;

National Wushu School Competition;

events of the National Sports Traditional School League;

1.2.4.5 Top 3 in the individual events of the comprehensive sports games or championships hosted by the provincial (district, municipal) sports bureau.

Athletes

Anyone who meets any of the following conditions may apply for the title of Level 3 Athletes: 4th to 6th place in the individual events of the comprehensive sports games or championships hosted by the provincial (district, municipal) sports bureau.

1.3 Important Physical capacities for Sanda athletes

1.3.1 Anthropometric measurements

1.3.1.1 Weight

Weight is one of the important basic indicators for evaluating the physical quality of college Sanda athletes, which helps to determine whether their body structure meets the needs of special competitions. Changes in weight are often closely related to training intensity, nutritional intake and metabolic status. In Sanda events, reasonable weight management not only helps to improve athletic performance, but is also closely related to recovery and load control after physical training.

Required resources: Electronic weight scale

How to test: Before the test, the subject should be in an empty stomach state (or 2 hours after a meal), take off his coat and shoes and socks, stand on the electronic scale, keep his body upright, and his hands hang naturally, and record his weight value.

Analysis: The unit is kilograms (kg), recorded to one decimal place, and the second place is not carried. It is recommended to take the average of three times for multiple tests to facilitate monitoring of weight change trends during the training cycle. (Chen Long, 2023)

1.3.1.2 Height

Height is a basic indicator of body measurement. It is directly related to the power lever structure, the distribution of the body's center of gravity, etc., and indirectly affects the spatial control and movement flexibility of Sanda athletes in attack and defense. Evaluating height data helps to scientifically formulate individualized training content and tactical design.

Required resources: Height measuring instrument (or standard height ruler)

How to test: The subject takes off his shoes and stands in the center of the bottom plate of the height ruler, with his heels together, his body naturally upright, the back of his head, back, calves, and calf heels as close to the ruler as possible, and his eyes look straight ahead. Gently lower the ruler to touch the top of the head and record the reading.

Analysis: The unit is centimeters (cm), rounded to one decimal place, and the principle of no carry is adopted. It is recommended to combine weight for subsequent body mass index (BMI) calculation. (Ji Liu, 2023)

1.3.1.3 Body Mass Index

BMI is a standardized indicator to measure weight relative to height, reflecting whether an individual is underweight, normal, overweight or obese. For Sanda athletes, a reasonable BMI can improve agility and mobility efficiency, reduce joint burden, and help improve actual combat performance.

Required resources: Calculator or BMI calculation software

How to test: Use the standard formula: $BMI = \text{weight (kg)} \div \text{height}^2 (\text{m}^2)$, that is, first convert height to meters (m), and then calculate the square.

Analysis: The result unit is kg/m^2 , retaining one decimal place. Judge the physical condition according to the World Health Organization (WHO) standard or the Chinese adult physical classification standard. It should be noted that BMI does not reflect fat content, and needs to be combined with body fat percentage for comprehensive analysis. (Qi Shujun, Wang Chao, Song Cuizhu, etc., 2023)

1.3.1.4 Body fat percentage

Body fat percentage directly reflects the proportion of body fat in athletes and is an important parameter for measuring body composition. Too high a body fat

percentage will affect special abilities such as speed, endurance, and explosive power; while too low a body fat percentage may affect immune function and recovery ability. Accurately measuring body fat percentage helps optimize training nutrition strategies and improve competitive efficiency.

Required resources: Bioimpedance body fat meter

How to test: When using a body fat meter, the subject stands barefoot on the device electrode, holds the handle electrode, remains still, and the instrument will automatically detect.

Analysis: The unit is percentage (%), recorded to one decimal place. The change in body fat percentage before and after training intervention can effectively reflect the optimization effect of training on body composition. (Zhu Xiaoqing, Liu Xinyuan, Ruan Xiaogang, et al., 2023)

1.3.2 speed

In this study, speed, as one of the important indicators of Physical Profiles evaluation, is mainly used to reflect the ability of college Sanda athletes to complete fast movements in a short period of time, especially in the performance of attack and reskill movement. Since Sanda competitions emphasize the timeliness of punching, kicking, moving and reacting, speed is not only related to the timeliness and suddenness of technical movements, but also directly affects the efficiency of attack and defense in actual combat. Therefore, the measurement of speed indicators is of great significance for evaluating the improvement of athletes' explosive skill movement ability and neuromuscular reskill movement ability after high-intensity training intervention, and is one of the important bases for testing the effectiveness of physical training systems.

Required resources: Playground, timer

How to test: Speed measurement is usually combined with other physical indicators (such as strength, sensitivity, endurance, etc.). The subject tries to stand up and start. When the start signal is heard, start immediately and run to the finish line. The starter stands on one side of the starting line, waving the starting flag and giving the start signal. The timekeeper is on the side of the finish line and stops the timer when the subject and chest reach the vertical surface of the finish line.

Table 1 Standard norms of speed

Rating level	Male (s)	Female (s)
Excellent	≤ 6.6	≤ 7.4
Good	6.7–7.0	7.5–7.8
Qualified	7.1–7.4	7.9–8.2
Unqualified	≥ 7.5	≥ 8.3

Analysis: Record in seconds, accurate to one decimal place. The second digit after the decimal point is carried forward according to the principle of not converting "0" to "1". (Liu Dexin, 2014)



Figure 2 Speed

1.3.3 Strength

1.3.3.1 push-ups

As a basic Physical Profiles test movement, standard push-ups have important measurement value in this study. It not only reflects the comprehensive level of upper limb muscle strength, core stability and muscle endurance of college Sanda athletes, but also is one of the key indicators for evaluating the effect of physical training intervention. In Sanda sports, frequent punching, defense and wrestling movements put forward high strength and endurance requirements for the shoulders, chest and core areas, and standard push-ups can comprehensively measure the muscle function status of these key parts. Therefore, by comparing the number of standard push-ups completed before and after training, the actual effect of the physical training program on the improvement of the upper limb and core muscle group

capacity of athletes can be intuitively evaluated, providing a reliable basis for the quantitative analysis of the training effect.

Required resources: Leveling the venue or yoga mat

How to test: Before the test, the subject stretched his arms straight, shoulder-width apart, fingers forward, hands on the floor, torso straight, legs straight back. When the tester heard the "start" command, the subject stretched his arms straight to the same level as his shoulders and elbows; then kept his body straight and returned to the starting position. At this point, a push-up movement is completed.

Table 2 Standard norms of push-ups

Rating level	Male (times)	Female (times)
Excellent	≥ 70	≥ 45
Good	50–69	35–44
Qualified	30–49	25–34
Unqualified	< 30	< 25

Analysis: The subject must repeat the skill movement continuously. The tester records the number of times the subject cannot complete or continue to maintain the correct skill movement (Zhou Weifang, Zhao Guangsheng, 2013)



Figure 3 push-ups

1.3.3.2 squats

Purpose:As a basic strength training movement, squat has important measurement value in this study. It is not only an important indicator for evaluating the strength level of lower limb muscle groups (such as quadriceps, gluteus maximus, hamstrings, etc.), but also reflects the core stability, movement control ability and lower limb explosiveness of athletes. In Sanda, lower limb strength is directly related to the completion quality of key technical movements such as step movement, kicking skills and wrestling support. Therefore, through standardized squat tests, the changes in the comprehensive Physical Profiles of lower limbs of college Sanda athletes before and after training intervention can be effectively evaluated, providing a reliable reference for analyzing the role of physical training in promoting the performance of special skills.

Required resources:Barbell, barbell plate

How to test: first, keep the distance between feet and shoulder width. Keep the feet parallel and symmetrical, and the toes should not point outward. The subject places the bar above the head and adjusts the hands to the elbows at 90 degrees to the bar. Next, the subject is asked to straighten his arms. The subject is instructed to slowly squat as low as possible, with the heels on both sides, the head raised forward, and the barbell lifted as high as possible. The knees and feet should be in the same vertical plane, and the knees should not be turned outward. (Yu Bing, 2012).

Table 3 Standard norms of squats

Rating level	Male / Female (times)
Excellent	≥55
Good	45–54
Qualified	35–44
Unqualified	<35

Analysis: This study uses a safer method of counting bodyweight squats, that is, the athletes do not carry weight in the standard squat skill movement, and the number of squats is counted. The squats in non-standard postures are not counted. The standard squat skill movement requirements are: (1) Stand at shoulder width with

your feet parallel to your shoulders. (2) Your legs are slightly abducted and your toes are slightly pointed outward. (3) Straighten your back, tighten your core muscles, and keep your upper body straight. (4) Relax your shoulders and pull them back slightly to bring your shoulder blades closer together. (5) Slowly bend your knees and squat down. (6) Push your hips back, keep your back straight, and make sure your knees do not exceed your toes. (7) When squatting, bend your legs to approximately 90 degrees to ensure the effect of the squat. (8) Use the power of your heels to push the ground and stand up from the bottom of the squat. (9) Keep your core muscles tight and ensure that your upper body and hips rise synchronously. (10) After rising to a standing position, tighten the hip and thigh muscles to ensure that the body is vertical. (Wang Xiangquan, Song Tao, Liu Jian, 2007)



Figure 4 squats

1.3.3.3 Sit-ups

Purpose: Grip strength is an important indicator reflecting the strength of upper limb muscles and the development level of forearm and hand muscles. It has important measurement value in this study. By testing grip strength, the basic condition of upper limb strength of college Sanda athletes can be scientifically evaluated, which is particularly important for judging the physical reserve and strength level of athletes. Combining the ratio of grip strength to body weight (grip strength-weight index) for analysis can more objectively reflect the relative strength level of athletes and avoid the deviation of the simple grip strength value due to weight difference. Therefore, the grip strength test not only provides an effective means for quantifying upper limb strength for this article, but also provides a

scientific basis for formulating personalized physical training programs, monitoring training effects, and guiding the strength support of technical movements.

Required resources: Grip dynamometer

How to test: Before the test, the subject holds the inside and outside of the grip of the grip dynamometer with a strong hand and turns the grip adjustment wheel to the appropriate grip distance to prepare for the test. When the tester turns on the power switch, a flashing signal appears on the display screen, and finally freezes at the value of ".0", indicating that the grip dynamometer is in working condition. During the test, the subject stood upright with his feet naturally apart, shoulder-width apart, his arms hanging down, his palms facing inward, and gripped the inside and outside of the grip device with maximum force (Lee Jung-eun, 2012).

Table 4 Standard norms of Sit-up

Rating level	Male / Female (times)
Excellent	≥ 50
Good	40–49
Qualified	30–39
Unqualified	<30

Analysis: In this grip test, a fixed weight was used to measure the number of movements completed by the athlete under standard conditions.



Figure 5 Sit-up

1.3.3.4 Grip strength

Purpose: In the physical training of this study, endurance is a key indicator that reflects the ability of college Sanda athletes to maintain high-intensity exercise and complete continuous technical movements. The endurance level directly affects the athletes' sustained performance and technical and tactical performance in the game, so its measurement is of great value for evaluating the training effect and formulating scientific training programs. Through the systematic testing of endurance indicators, the physical reserve status of athletes can be accurately grasped, providing a reliable basis for optimizing training content and improving competitive ability.

Required resources: Playground, timer

How to test: The subject starts standing. When the start signal is heard, start immediately and run to the finish line. The starter stands on one side of the starting line, waving the starting flag while giving the start signal. The timekeeper is on the side of the finish line and stops the timing when the subject and the chest reach the vertical surface of the finish line.

Table 5 Standard norms of Grip strength

Rating level	Male (kg)	Female (kg)
Excellent	≥ 55	≥ 35
Good	50–54	30–34
Qualified	45–49	25–29
Unqualified	< 45	< 25

Analysis: Record in seconds, accurate to one decimal place. The second decimal place after the decimal point is carried according to the principle of not "0" to "1". This paper uses women's 800m and men's 1000m as endurance measurement methods (Zhang Yong, He Jian, Li Junfeng, 2011).



Figure 6 Grip strength

1.3.4 Endurance

In the physical training of this study, endurance is a key indicator that reflects the ability of college Sanda athletes to maintain high-intensity exercise and complete continuous technical movements. The endurance level directly affects the athletes' sustained performance and technical and tactical performance in the game, so its measurement is of great value for evaluating the training effect and formulating scientific training programs. Through the systematic testing of endurance indicators, the physical reserve status of athletes can be accurately grasped, providing a reliable basis for optimizing training content and improving competitive ability.

Required resources: Playground, timer

How to test: The subject starts standing. When the start signal is heard, start immediately and run to the finish line. The starter stands on one side of the starting line, waving the starting flag while giving the start signal. The timekeeper is on the side of the finish line and stops the timing when the subject and the chest reach the vertical surface of the finish line.

Table 6 Standard norms of Endurance

Rating level	Male (1000m)	Female (800m)
Excellent	$\leq 3'15''$	$\leq 3'16''$
Good	3'16''–3'35''	3'17''–3'40''
Qualified	3'36''–4'00''	3'41''–4'10''
Unqualified	$> 4'00''$	$> 4'10''$

Analysis: Record in seconds, accurate to one decimal place. The second decimal place after the decimal point is carried according to the principle of not "0" to "1". This paper uses women's 800m and men's 1000m as endurance measurement methods (Zhang Yong, He Jian, Li Junfeng, 2011)



Figure 7 1000 meters (male)/800 meters (female)

1.3.5 Coordination

Purpose: In the physical training system of this study, reskill movement speed is one of the key indicators and has important measurement value. Reskill movement speed reflects the athlete's ability to quickly identify and respond to external stimuli or signals, and is the core standard for measuring the agility of the nervous system and motor coordination. For Sanda athletes, fast and accurate reskill movement ability directly affects the timing of starting technical skill movements and the efficiency of defensive reskill movements, which in turn determines the actual performance in the game. Therefore, by scientifically measuring reskill movement speed, it is possible to objectively evaluate the changes in the athlete's neural reskill movement ability during physical training, and provide an effective basis for optimizing training programs and improving competitive levels.

Required resources: Indoor venue

How to test: When the timing starts, the subject starts from the starting point, runs to the other end, touches the endpoint obstacle, and then returns to the original starting point; then repeats again. During the test, hands are not allowed to support the ground. The recording is recorded in seconds, accurate to one decimal place.

Table 7 Standard norms of Coordination

Rating level	Male / Female (s)
Excellent	≤ 11.0
Good	11.1–12.0
Qualified	12.1–13.0
Unqualified	> 13.0

Analysis: The second decimal place is carried forward according to the principle that "0" is not "1". The sensitivity test results of the two groups of athletes before the experiment were used as indicators to evaluate the improvement of the two groups of athletes (Lu Xiaojian, Yu Hailan, 2011)



Figure 8 Coordination

1.3.6 Flexibility

Purpose: Flexibility index in Physical Profiles reflects the movement ability and elasticity of individual muscles and joints within a certain range, and is an important parameter for evaluating the physical function of athletes. In this study, flexibility, as one of the key Physical Profiles elements, has important measurement

value. Through the systematic measurement of the flexibility of Sanda athletes, we can scientifically understand their joint range of motion and muscle stretching ability, so as to evaluate their potential and risk of completing difficult technical movements. Good performance in flexibility not only helps to improve the fluency and accuracy of technical movements, but also effectively reduces the incidence of sports injuries. Therefore, the measurement results of flexibility provide an important basis for formulating targeted physical training programs, help optimize training content, and promote the overall improvement of athletes' technical and competitive levels.

Required resources: Sit-and-reach tester

How to test: Place the sit-and-reach tester on a flat ground. Before the test, use a ruler to calibrate the scale on the platform so that the cursor plane is level with the platform, and adjust the cursor scale to 0. The subject sits on a mat connected to the box, with legs straight, not bent, heels together, toes about 10-15 cm apart, stepping on the vertical board of the instrument, with hands together. With arms and hands straight, the upper body gradually bends forward, and the cursor on the ruler is gently pushed with the fingertips (do not move forward suddenly) until it can no longer be extended forward. The vertical board of the tester is the 0 point along the plane, negative inward and positive forward.

Table 8 Standard norms of Flexibility

Rating level	Male (cm)	Female (cm)
Excellent	≥ 18	≥ 20
Good	14–17	16–19
Qualified	10–13	12–15
Unqualified	< 10	< 12

Analysis: Record in centimeters, accurate to one decimal place. If it is a positive number, add a "+" sign before the value, and add a "-" sign before the negative value. Based on the results of the two groups of forward bending before the experiment (Liu Manjin, 2009)



Figure 9 Flexibility

1.3.7 Joint muscle strength

Joint muscle strength is the force generated by the muscle groups around the joints, which is responsible for controlling and stabilizing joint movement. In this study, joint muscle strength is an important indicator for evaluating the Physical Profiles level of college Sanda athletes, which can directly reflect the athlete's muscle strength and its ability to support joint stability. By measuring joint muscle strength, researchers can understand the changes in muscle strength of athletes under different physical training interventions and their impact on the quality of technical movements, thereby providing a scientific basis for optimizing physical training programs and improving athletes' overall competitive ability. Improving joint muscle strength not only helps to improve athletes' sports performance, but also effectively prevents sports injuries and ensures the safety of training and competition.

Required resources: Muscle strength tester

How to test: The ISOMED2000 isokinetic muscle strength test system developed and manufactured by DR Company of Germany is used to test the isokinetic muscle strength of the lateral elbow and knee flexor and extensor muscles before and after physical intervention training. (Hu Yihai, Wu Chuanzhong, Gao Ping, 2009)

Table 9 Standard norms of Joint muscle strength

Muscle groups	Excellent	Good	Qualified	Unqualified
Quadriceps	$\geq 60\%$	50–59%	40–49%	$< 40\%$
Hamstrings	$\geq 40\%$	35–39%	30–34%	$< 30\%$
Shoulder rotators	$\geq 30\%$	25–29%	20–24%	$< 20\%$

Analysis: The average value is taken after multiple tests.



Figure 10 ISOMED2000

1.3.8 The Functional movement screening

Purpose: Functional movement screening (FMS), as a systematic tool for evaluating the basic movement patterns and functional abilities of the human body, has important measurement value in this study. Through the FMS test, the potential functional defects of college Sanda athletes in terms of movement stability, flexibility and coordination can be fully identified, which may affect sports performance and increase the risk of injury. With the help of FMS scores, researchers can scientifically evaluate the physical functional status of athletes and provide a basis for the development of targeted physical training plans, thereby effectively preventing sports injuries, improving the execution quality of sports skills and the overall competitive level. Therefore, FMS is not only an important indicator for measuring the functional status of athletes in this article, but also a key tool for optimizing training programs and promoting the sustainable development of athletes.

Required resources: FMS scoring system, related venues and equipment

How to test: The advantages of FMS scoring are objectivity and repeatability. By evaluating standardized movement patterns, the interference of subjective factors can be eliminated, making the evaluation results more objective and reliable. In addition, FMS scores are also repeatable, and the same population can be evaluated at different

time points to understand the changes in their sports abilities. FMS scores have a wide range of applications, including preventive evaluation of athletes, follow-up monitoring during rehabilitation, and daily health management. Regular FMS scoring can detect motor dysfunction early and provide appropriate intervention measures to avoid potential sports injuries. At the same time, for athletes, improving FMS scores can improve sports performance and reduce the risk of injury.

The FMS test is used to evaluate the basic movement patterns and physical function status of athletes. Its main role in this study is to identify the potential functional disorders or injury risks of college Sanda athletes in stability, flexibility, coordination and movement control, so as to provide a basis for the formulation of scientific and reasonable personalized physical training programs. The FMS test includes seven basic movement tests: squats, hurdle steps, straight lunges, active straight leg raises, push-ups, shoulder flexibility tests, and trunk stability push-up tests, plus three supplementary tests. Each movement is scored according to the quality of completion, with a score of 0 to 3 points: 0 points means pain during the test, 1 point means the movement cannot be completed or the posture is seriously deviated, 2 points means the movement can be completed but there is compensation, and 3 points means the movement is standard and there is no compensation phenomenon. The total score is 21 points, and the lower the score, the more problems there are in the functional movement. Through the FMS test, researchers can scientifically evaluate the basic body functions of Sanda athletes before training, provide quantitative data support for physical intervention, reduce the risk of sports injuries, and improve training efficiency and sports performance.

Functional movement screening (FMS) was evaluated before and after the physical training experiment. The specific method is as follows: Before the test, the athletes jog for 15 minutes to warm up, and then perform seven movement tests: squats, hurdle steps, straight lunges, leg raises, trunk stability push-ups, shoulder joint flexibility, and rotational stability. Each movement is repeated 3 times. According to the scoring criteria, professional evaluators from the Physical Training Center of Sichuan University of Science and Chemical Engineering use evaluation equipment to score the athletes accordingly, and the highest individual score is taken. (Hu Yihai, Wu Chuanzhong, 2009)

Table 10 Standard norms of FMS

Rating level	Score range
Excellent	18–21
Good	14–17
Qualified	10–13
Unqualified	<10

Analysis: The test is strictly carried out in accordance with the FMS scoring criteria, and the data must be recorded accurately.

1.3.8.1 Squat test



Figure 11 Squat test

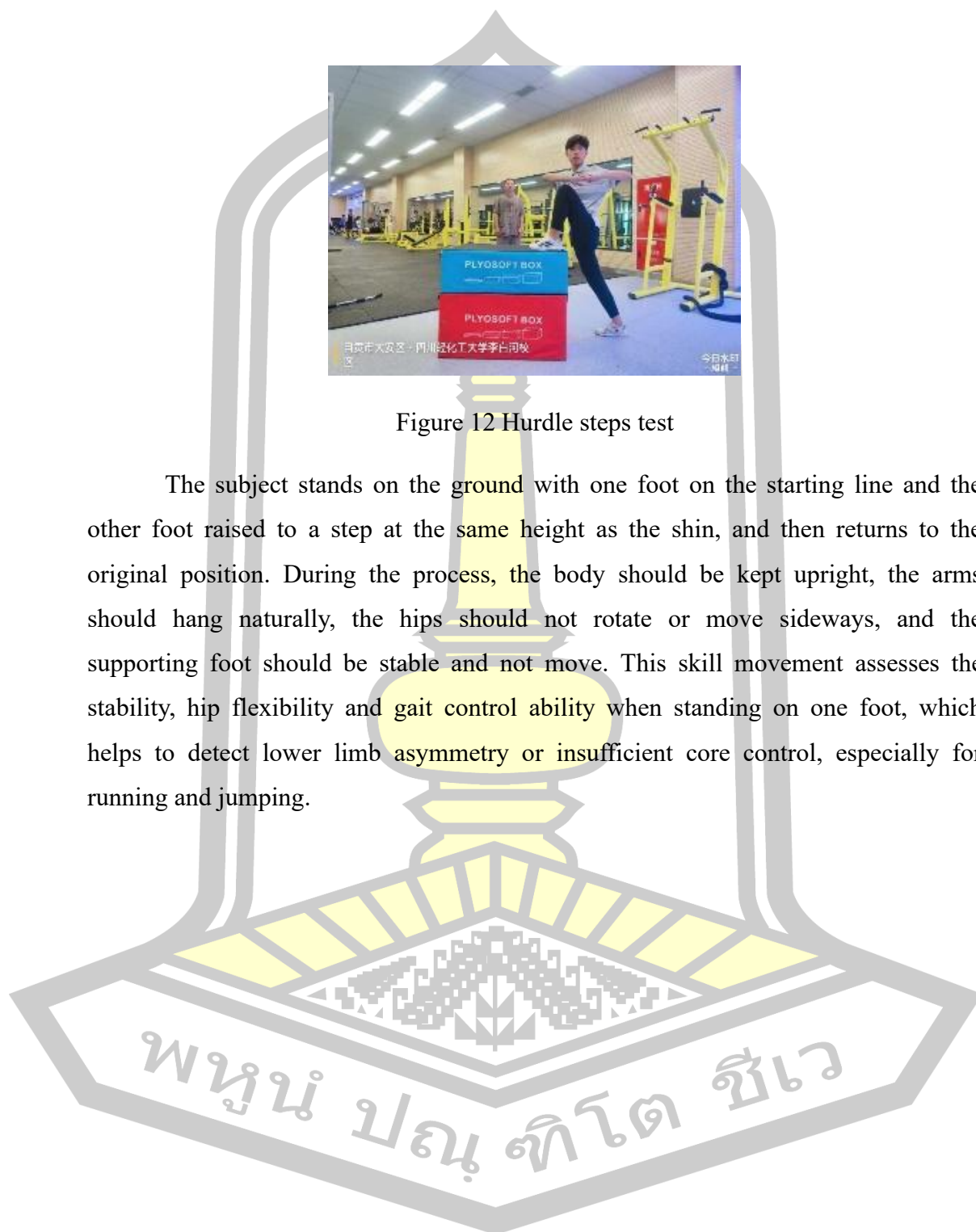
The test subject stands with his feet shoulder-width apart and arms straight up close to his ears. Keeping the torso straight, knees and toes in the same direction, slowly squat until the thighs are parallel to the ground. The heels cannot be lifted, the torso cannot be leaned forward, the arms must always be above the head, and the body must be stable and not shake during the movement. The test goal is to observe the flexibility of the shoulders, the range of motion of the hips, knees and ankles, and the core control ability, reflecting the integrated movement performance, which is one of the basic movements to evaluate the overall body coordination and mobility.

1.3.8.2 Hurdle steps test



Figure 12 Hurdle steps test

The subject stands on the ground with one foot on the starting line and the other foot raised to a step at the same height as the shin, and then returns to the original position. During the process, the body should be kept upright, the arms should hang naturally, the hips should not rotate or move sideways, and the supporting foot should be stable and not move. This skill movement assesses the stability, hip flexibility and gait control ability when standing on one foot, which helps to detect lower limb asymmetry or insufficient core control, especially for running and jumping.



1.3.8.3 Straight lunges test



Figure 13 straight lunges test

The subject places one foot at the front of the straight line and the other foot at the back, with the feet standing in a forward and backward lunge. Hold a wooden pole with one end touching the head and the other end touching the lower back, fixed at three points. When squatting, keep the pole close to the spine, keep the knees close to or lightly touching the ground, and do not lean forward or sideways. This skill movement evaluates the range of motion and stability of the hip, knee, and ankle in a straight line, and at the same time tests the stability and coordination ability of the shoulder girdle and core, which is an important item for predicting sports injuries.

1.3.8.4 Leg raises test



Figure 14 leg raises test

The subject lies on his back with his legs straight. He slowly lifts one leg, keeping the knee straight, and the other leg flat on the ground. Observe the height of the leg and whether the pelvis is stable. The ideal state is that the leg can be lifted until the calf crosses the midline of the patella. This test mainly evaluates the range of motion of the hip joint, hamstring flexibility, and core control. The movement should avoid pelvic rotation or trunk compensation. It is often used to judge the flexibility of the lower limbs and the ability of core coordination, which is important for preventing lower back injuries.

1.3.8.5 Trunk stability push-ups test



Figure 15 trunk stability push-ups test

Men place their hands under their foreheads, and women place their hands under their chins. Do a standard push-up in a prone position. The body should rise steadily like a piece of wood, without waist collapse or shoulder compensation, and keep the torso moving forward in a straight line. This movement mainly evaluates upper limb strength and core stability, and is particularly important for spinal stability control and shoulder joint coordination. When scoring, it is important to observe whether there is torso shaking at the moment of starting. If the core control is not good, it is very easy to cause low back injury.

1.3.8.6 Shoulder joint flexibility test



Figure 16 shoulder joint flexibility test

The subject moves one hand from top to back and the other hand from bottom to back, trying to get the hands as close together as possible behind the back. The shortest distance between the hands is recorded. The arm movements must be performed simultaneously, and no other parts of the body can be used to exert force or compensate. Compare the differences between the two sides and evaluate the range of motion of the shoulder joint, scapular control, and flexibility of the chest and back muscles. This test can detect potential asymmetry, muscle tension, or limited mobility of the shoulder, which is particularly important for athletes who frequently move their upper limbs, such as those in throwing and swimming.

1.3.8.7 Rotational stability test



Figure 17 rotational stability test

The subject takes a four-point support posture, slowly stretches the ipsilateral arm and leg forward and backward at the same time, then retracts and tries to touch the knee and elbow, keeping the spine from shaking or collapsing and the pelvis stable during the process. If the ipsilateral movement cannot be completed, the contralateral side is tested instead. This test evaluates the ability of the deep core muscle groups to cooperate and the stability of the spine against rotation, which is of great guiding significance for projects with strong rotational movements such as throwing and swimming. The quality of movement control is greater than the completion range.

1.4 Important success rate of skill movement

The success rate of skill movement refers to the proportion of successful implementation that can be achieved to meet the standards and requirements in a specific technical or engineering project in accordance with the specified technical standards or requirements. Based on the standard number of push-ups before the two groups and the standard number of times after the experiment, the improvement degree was evaluated.

The success rate of skill movement refers to the ratio of the number of times a specific movement is successfully completed to the total number of attempts in Sanda training or competition. In Sanda sports, whether the actual combat application of skill movements such as boxing, kicking and throwing is efficient and accurate is directly related to the outcome of the game. By testing and comparing the success rate of skill movement, it can effectively reflect whether athletes can complete skill movements more stably and efficiently after improving Physical Profiles factors such as strength, speed, agility and coordination, thereby verifying the role of physical training in promoting the quality of skill execution. In addition, the improvement of the success rate of skill movement also shows that the athletes' movement control ability and actual combat awareness have been optimized, which is of great reference value for formulating scientific and reasonable training content, improving training efficiency and guiding the direction of subsequent training. Therefore, the change in the success rate of skill movements is not only one of the important observation indicators of this study, but also provides key data support for the comprehensive evaluation of the physical training effect of college Sanda athletes.

Required resources: Indoor venue

How to test: Before and after the group physical training experiment, in order to ensure the scientificity and fairness of the experiment, the research team introduced the expert IOC (Index of Item-Objective Congruence) scoring standard in the skill movement technology evaluation link. Five experts with relevant professional backgrounds evaluated the training effects of the three core technical skill movements of Sanda, "boxing", "kicking" and "wrestling". The IOC scores of boxings, kicking and wrestling were all 0.8, and the comprehensive score of the summary items was 0.79, indicating that the technical skill movement evaluation system has a high content validity and can more objectively reflect the training results.

On this basis, the experimental design adopts the method of pairing athletes of the same level, that is, each pair of athletes in the control group and the experimental group maintains the same strength, and the groups are divided into actual combat. Each group of athletes conducted 12 rounds of on-site actual combat observations of boxing, kicking and wrestling before and after training, and recorded the success rate of skill movement. And ensure that the confrontation pairing before and after the experiment is consistent, so as to eliminate the interference of opponent differences in the evaluation of training results, and further enhance the scientific and credibility of the experimental data.

Scoring criteria:

In this study, the success rate of skill movement is calculated as "the number of successful completions of the skill movement $\div$ the total number of attempts $\times$ 100%". In order to more comprehensively evaluate the impact of physical training on the improvement of college students' Sanda skills, this paper divides technical skill movements into three categories: boxing, kicking, and wrestling, and counts the changes in the success rate of each type of skill movement before and after training.

Sub-item calculation: The number of successful completions and the total number of attempts for the three technical skill movements of boxing, kicking, and wrestling are recorded respectively to obtain the single success rate of each skill movement. Percentage conversion: The success rate of each technical skill movement is converted into a percentage form (such as: 10 successes/12 attempts = 83.3%). Skill

movement scoring level division: Based on the percentage of success rate, four scoring levels of "excellent, good, qualified, and unqualified" are set to quantify the quality of technical skill movements. Total score calculation: The three skill movements each account for 1/3 of the total score, and the average of the three scores is taken as the "total score of the success rate of skill movement".

Table 11 Evaluation Criteria

Score range	Rating level
$\geq 90\%$	Excellent
80%–89%	Good
60%–79%	Qualified
$< 60\%$	Unqualified

Analysis: In order to ensure the objectivity of the statistical results, the Sanda team coach and I completed the statistics of technical indicators together, and used video playback to judge the controversial technical skill movements until the technical indicators of the two people were consistent. Based on the technical skill movement success rate and indicators of the two groups before the experiment, the degree of improvement was evaluated.

1.4.1 Success rate of boxing

The key to the skill movement is to actively rotate the front foot, slightly move the center of gravity forward, and use the shoulder to drive the forearm to strike forward quickly and straightly. During the punching process, the arm is naturally straightened, and the back hand remains in place to implement effective defense; at the same time, the punching route is quickly retracted, and the skill movement returns to the basic defensive posture. This skill movement key not only reflects the key link of force transmission and technical coordination in Sanda, but also is an important criterion for evaluating athletes' technical proficiency and reskill movement speed. In this study, by measuring and analyzing the execution quality of this skill movement, it can objectively reflect the athletes' mastery of technical skill movements and their application effects in actual combat. Accurately mastering and optimizing this skill movement can help improve the explosive power and accuracy of punching, while

strengthening defensive reskill movements, providing strong support for the improvement of the overall success rate of technical skill movements. Therefore, the evaluation of this skill movement key is not only an important part of the technical level evaluation, but also a key basis for guiding the targeted adjustment of physical training.



Figure 18 Success rate of boxing

1.4.2 Success rate of kicking

The skill movement starts with the left leg in the kicking preparation position: the left foot steps on the ground, the center of gravity quickly shifts to the right leg, and the right leg remains upright or slightly bent at the knee to provide stable support. The left foot is bent and raised, the thigh is close to the chest, the toes are facing up, the sole of the foot is facing forward, and the hips are extended and the knees are raised. Then, the left leg kicks forward in a straight line, and the power is concentrated on the entire sole of the foot, and the sole of the foot fully contacts the target when kicking. At the moment of kicking, the supporting foot turns inward, which promotes the strength of the hips, and the upper body can be slightly tilted backward to increase balance and power. In this study, the measurement value of this kicking skill movement is mainly reflected in evaluating the efficiency of force transmission and body coordination of athletes in technical skill movements. By accurately quantifying the stability of the skill movement, the order of force generation and the kicking force, it can scientifically reflect the effect of physical training on the quality of technical execution of athletes. In addition, the technical performance of this skill movement is closely related to the Physical Profiles level. Its evaluation helps to discover the shortcomings of athletes in power output, balance

control and movement coherence, providing a basis for formulating more targeted training programs and further promoting the development of athletes' comprehensive competitive ability.



Figure 19 Success rate of kicking

1.4.3 Success rate of wrestling

As a basic and key technical skill movement in Sanda, wrestling technique has its unique technical characteristics. It integrates various skill movements such as grabbing, tripping, blocking, and pushing in traditional Chinese wrestling, with holding, pushing, and tripping as the core methods. Compared with the throwing techniques in other competitive events, wrestling techniques in Sanda emphasize speed and explosive power. Because the rules of Sanda competitions have strict time limits on wrestling skill movements, athletes must complete the skill movements in a very short time. The decisiveness and continuity of the execution of the skill movements are particularly important. Wrestling skill movements not only need to be accurate, but also need to ensure the continuity and integrity of the skill movements to achieve the maximum effect. In this study, the measurement value of wrestling technical skill movements is reflected in the scientific evaluation of athletes' technical level and their performance in a high-intensity competition environment by quantifying the success rate and completion quality of wrestling skill movements. Through careful observation and data analysis of wrestling technical skill movements, the comprehensive qualities of athletes in speed, strength, and technical coordination can be accurately reflected. At the same time, this indicator helps to reveal the role of physical training in promoting the execution of wrestling techniques, guide the coaching team to adjust the training plan in a targeted manner, and improve the

athletes' ability to complete wrestling movements quickly and accurately in actual combat, thereby enhancing the overall competitive level.



Figure 20 Success rate of wrestling

2. Physical training theory

In this study, the physical training experiment was set to last for 12 weeks and was scheduled on Mondays, Tuesdays, Thursdays, and Fridays of each week, mainly based on the scientific basis of the principle of training periodicity and the law of physical adaptation. The 12-week training cycle is a medium-term intervention, which can ensure the gradual adaptation and systematic improvement of various elements of Physical Profiles, avoid the insignificant effect caused by too short training, and prevent the risk of sports fatigue or increased attrition rate caused by too long a time (Chen Long and Liu Shuaikang, 2023). Studies have shown that a training cycle of 8–12 weeks can significantly improve neuromuscular control, power output, and the quality of technical movements, and has a significant effect on improving competitive level (Xu Wenbao, 2023). This study chose to arrange training sessions on Mondays, Tuesdays, Thursdays, and Fridays of each week, reflecting the importance of the "training-recovery-retraining" cycle law. A reasonable interval is set between training days so that athletes can fully recover after completing high-intensity training, which not only ensures the continuity of training, but also avoids the accumulation of excessive fatigue (Qi Shujun et al., 2023). This arrangement also helps to form a systematic training rhythm during the week and leave complete recovery time on weekends, which is conducive to physical reserve and psychological adjustment.

Combined with the current college physical education teaching practice and sports skill development research, a reasonable training frequency (4 times a week) has been proven to effectively balance the relationship between teaching, training and recovery, and improve training compliance and sustainability (Ji Liu, 2023). Especially when integrating complex task goals such as coordination, explosive power and core stability, scientific planning of training frequency is particularly important (Zhu Xiaoqing et al., 2023).

2.1 Theoretical definition of physical training

2.1.1 System theory

Systems theory was proposed by Bertalanffy in the 1940s. In his representative works, *On the General Theory of Systems and General Theory of Systems*, he systematically expounded on the concept, structure and function of the system, laying the theoretical foundation for modern systems science (Ali Mohammad et al., 2023). He pointed out that a system is an organic whole composed of a number of interacting and interconnected parts and has a certain specific function. Each system is both subordinate to a larger system and relatively independent. Within it, there are not only complex relationships between elements, but also dynamic interskill movements between the system itself and the external environment (Jawad and MRG, 2023). In the field of sports training, the introduction of systems theory helps to examine the training process from a holistic perspective, and regard multiple elements such as Physical Profiles, technology, psychology, and recovery as components of an organic system. By analyzing the relationship between the various elements, the training process can be optimized and the systematic and scientific nature of the training can be improved (Yongge and Junmin, 2022). For example, in Sanda training, strength, speed or skills should not be viewed in isolation, but should be incorporated into the overall training structure for systematic design, so as to give full play to their interskill movement and improve comprehensive competitive ability (Zhu Junchi, 2022). System theory not only broadens people's understanding of complex problems, but also provides a solid theoretical support for practical applications in many fields such as sports science, medical rehabilitation, and ecology. It emphasizes analyzing

problems from a holistic perspective and promoting the transformation from traditional single-element research to multi-dimensional comprehensive research. It is an important guiding ideology of modern scientific research methods (Ali Mohammad et al., 2023; Jawad and MRG, 2023; Zhu Junchi, 2022; Yongge and Junmin, 2022).

2.1.2 Cybernetics

Cybernetics was founded by the famous American mathematician Wiener. Its core idea is to study the universal laws of information transmission, feedback and control in the system. Based on the trend of cross-integration of various fields in the development of modern science and technology, Wiener used emerging theories such as statistical science to explore the evolution of system functions, states and behaviors, aiming to find common control mechanisms between different systems, thereby improving the stability and goal orientation of system operation (Chen Simin, 2022).

In the field of sports training, especially in the physical training of college Sanda athletes, cybernetics has important guiding significance. As a multivariate and dynamically changing system process, physical training is affected by many factors, such as the selection of training content, arrangement of methods and means, load regulation and implementation of recovery strategies, etc. These links are interrelated and mutually restricted. If any link is out of control, it may affect the overall training effect. Therefore, physical training must be included in the scope of systematic management and control, and a training control chain must be constructed through planning, execution, monitoring, feedback and other links to achieve the controllability and scientificity of the training process (Wang Hao et al., 2022). Specifically, the main body of training control is the coach, who, with the assistance of the scientific research team, formulates a scientific physical training plan according to the preset training goals, and dynamically amends the plan in a timely manner according to the training feedback, so as to ensure the realization of the training goals. This process embodies the control system model of "controller-controlled-regulatory mechanism". While performing training tasks, athletes are also providers of feedback information, and coaches regulate according to feedback to maintain the closed-loop and high efficiency of the training process (Xia Xiaolin, 2022). Cybernetics also

emphasizes the importance of information feedback. During the training process, monitoring methods such as heart rate monitoring, fatigue assessment, and technical skill movement success rate statistics are all key channels for information collection, which help to detect training deviations in a timely manner and make effective interventions, thereby enhancing the self-regulation ability and target adaptation ability of the training system (Wu Yunhao, 2022). Applying cybernetics to the physical training process of college students' Sanda will help integrate training resources and links from a system perspective, realize scientific, systematic and dynamic training control, and thus maximize the training effect and sports performance (Chen Simin, 2022; Wang Hao et al., 2022; Xia Xiaolin, 2022; Wu Yunhao, 2022).

2.1.3 Theory of plate training

The traditional training periodization theory divides the training process of athletes into three stages: training, competition, and recovery, and each stage develops multiple abilities or qualities simultaneously. However, with the increase in the number of events and the requirement for adaptability to the new competition system, the athletes' special training cycle has also changed accordingly. Under this change, the training during the competition period has covered the relevant training content of the preparation period and the recovery period, thus forming a more refined training block cycle model. This change is mainly to meet the needs of athletes to maintain a high level of competitive state in multiple competitions and achieve continuous improvement of Physical Profiles (Li Jun, 2022). Based on the long-term study of Matveyev's training cycle theory, Verchoschanskij, a former Soviet training scholar, proposed a "cycle training" theory for guiding the training of high-level athletes, namely the block training theory (Chu Fucheng, 2022). The block training theory emphasizes the arrangement of highly concentrated training loads in a short period of time, and trains different athletic abilities through different training blocks. Each training block has its specific load arrangement and training goals to ensure that athletes can recover effectively in continuous high-intensity training, thereby maximizing their athletic ability. With the advancement of the national reform of sports event approval, the number and types of Sanda competitions have continued to

increase. For example, the National Sanda Championship, the National Sanda Championship, and the National Games Sanda Competition, the number of athletes participating has increased significantly compared with the past. In this context, how to effectively improve the Physical Profiles of athletes in a short period of time and how to maintain a good physical condition in high-frequency competitions has become an important topic. The plate cycle theory provides a theoretical basis for this issue and can effectively guide athletes to maintain a high level of Physical Profiles during the intensive period of competition (Zheng Xiangrong, 2022). In terms of training arrangements, the core goal of the accumulation plate is to improve the strength quality and aerobic endurance of athletes. Its load is large and the intensity is low, and the recovery after training is relatively sufficient; the conversion plate is mainly to improve the special quality, the exercise load is small but the intensity is high, and the athlete's recovery is insufficient; the training purpose of the realization plate is to help athletes maintain the high level of various Physical Profiles elements they have obtained, and recovery after training is extremely important (Qiu Suo, 2022). This plate cycle design can help athletes reduce the total amount of training while ensuring that the training effect of various Physical Profiles elements is maximized.

Based on the plate cycle theory, the reasonable division and arrangement of the physical training blocks of college Sanda athletes can not only help enhance the athletes' various physical qualities, but also scientifically and reasonably arrange the training cycle to ensure that athletes always maintain a high level of physical reserves in different competitions and training cycles, thereby improving their overall competitive level.

2.1.4 Group training theory

Item group training theory is the general training theory of competitive sports and special training theory between a level, it is based on the nature of different project attributes caused by the similarities and differences between the project, to a set of similar competitive characteristics and training requirements of sports together for comparative study, explore the common characteristics and development law (de-sheng liu, 2009). Qun theory believes that the basic task of training activities is to improve and develop the competitive ability of athletes. Therefore, item groups

should be divided according to the classification system established to determine the dominant factors of athletes' competitive ability, and corresponding studies should be conducted (Liu Manjin, 2009). The research of sports training theory is mainly aimed at the four questions of "why to practice, what to practice, how much to practice and how to practice", that is, training objectives, training content, load measurement and training organization. Training theories of different levels are responsible for the task of answering the above questions at their respective levels. In addition, the formation and development of the group should also be considered as the theoretical research of the group training (Hu Yihai, 2009).

2.2 Items / types of physical training

2.2.1 Related research on sports training system theory

The physical training system for college student Sanda athletes is a complex system. In order to ensure the overall function of the system, the subsystems should cooperate with each other, adjust and optimize the organizational structure of the system, coordinate the relationships between the subsystems, and improve the supervision and management of each link. Fully exploit the overall emergent nature of the system, aiming to improve athletes' Physical profiles levels and provide sufficient guarantee for the full use of techniques and tactics and even the improvement of sports performance. Therefore, the physical training system for college student Sanda athletes should be constructed under the guidance of systematic ideas and methods, and a comprehensive and systematic analysis and study of its constituent elements and their interrelationships should be conducted.

The explanation of sports training in "Explanation of Sports Training Words" is: an important part of competitive sports activities. In order to improve athletes' competitive ability and sports performance, specially organized planned sports activities are organized under the guidance of coaches. Qiu Kai (2021) believes that: Sports training is the entire process of preparation for athletes to create or maintain the highest performance in a special sport. Zhang Shuo (2021) defines sports training as: a kind of training that gradually arises with the interest in competitive sports and continues to deepen with the development of competitive sports practice, with athletes

as the main body and winning in sports competitions as the ultimate goal. , an exploratory practical activity with multi-disciplinary comprehensive intervention and multi-system collaborative operation, with the goal of continuously improving or maintaining the highest performance of athletes in special events as a means to achieve the goal.

Wushu Sanda projects are beneficial to promoting Chinese culture and promoting the diversification and cultural diversity of world sports culture. The development and dissemination of Wushu Sanda projects are of great significance (Qiu Naimin, 2021). Hu Yuxi analyzed the development process of Wushu Sanda and pointed out that the Wushu Sanda project needs to solve problems such as inconsistent name recognition and lagging theory. After studying the current situation of Chinese Wushu Sanda, Ding Dexi pointed out that modern Wushu Sanda needs to increase its appreciation and popularity through the reform of its competition rules, implement multiple operating mechanisms and multi-level vertical promotion of Wushu Sanda projects, so as to effectively promote Wushu Sanda projects. The rapid development of Sanda projects. Liu Xianwei studied the current situation of Chinese Wushu Sanda and pointed out that the development of Wushu Sanda projects must comply with the needs of the times. At the same time, it is necessary to improve the management mechanism and competition rules to promote the development of a more complete Wushu Sanda technical system.

To sum up, the development process of Chinese Wushu Sanda over the past 40 years has not been smooth sailing. However, by studying the characteristics of the development process of Wushu Sanda from the perspective of system theory, the development direction is relatively clear, and the analysis of its problems and competitions. The improved research on rules and mechanisms has gradually enabled the martial arts Sanda project to achieve considerable development (Yi Jianbin, 2021). It is necessary to combine the development of Wushu Sanda with the needs of the times, give full play to the advantages of Wushu Sanda, promote the development and improvement of its own technical system, and combine traditional technology with modern technology to promote the development of Wushu Sanda. A good future (Guo Xian, 2019). Reform and improve the corresponding competition rules and referee methods according to actual needs, enhance the appreciation and popularity of Wushu

Sanda projects, strengthen publicity and promotion efforts, and promote the development of Wushu Sanda projects at multiple levels and vertically, in line with the current development trend of economic and social projects, in this way, we can more effectively promote the faster and better development of Wushu Sanda projects.

2.2.2 Related research on cybernetics

General sports training (theory) is a subject based on special training practice, special training theory and the development of modern sports science and technology. It systematically clarifies common and universal theoretical issues in sports training and reflects the basic principles of sports training. Emerging sports interdisciplinary subjects with general rules. "Scientific Exploration of Sports Training" explains sports training theory as the science of studying the inherent laws of sports training activities, as well as the corresponding training principles and training methods (Li Fugang, 2015). Yin Haili conducted a statistical analysis of the techniques and tactics of China's outstanding martial arts Sanda athletes and found that China's outstanding Sanda athletes used more boxing techniques in competitions but the success rate was not satisfactory. The boxing techniques used were straight punches and swing punches. Mainly, in terms of kicking, whip kicks are the main method, but it is difficult to produce mid-to-high kicks, and the scoring relies too much on wrestling techniques, so wrestling is frequently used in competitions. Hu Wanxiang and Yan Xiaoyan conducted a statistical analysis on the use of offensive and defensive techniques and tactics by athletes in the competition and found that in terms of usage rate, China's outstanding Sanda athletes were lower in counterattack than in attack, but in terms of success rate, the counterattack was much higher than in counterattack. In attack, there is no obvious difference in scoring rate between the two. Mao Aihua and Liang Yadong conducted statistical analysis on the techniques of domestic and foreign high-level male Sanda athletes and found that high-level Sanda athletes use punches, legs and wrestling as the main components of their offensive techniques. Straight punches and swing punches have become the main offensive techniques of boxing. In terms of kicking, the whip kick has the highest usage rate and success rate, and is the main technique of kicking. In terms of wrestling, the use and scoring of close-fitting wrestling are the main ones. Wang Yizhi pointed out through statistical analysis of the technical application of lightweight athletes that boxing and kicking

constitute the main offensive techniques of outstanding lightweight Sanda athletes, while the use of wrestling is significantly different from boxing and wrestling. In terms of boxing, The success rate is low, the leg method is the main means of offense and scoring, and the wrestling method is mainly based on a single wrestling method. Shi Wenqi pointed out through statistical analysis of the use of female athletes' skills that China's outstanding female Sanda athletes use kicking techniques the most in competitions, followed by boxing techniques. The use of wrestling techniques in competitions is compared to the use of boxing and kicking techniques. Relatively few. Straight punches and swinging punches are the main offensive techniques of boxing. The kick method relies on whip kicks to hit the trunk and thighs as the main scoring method. The wrestling method mainly uses close throws as the main method, with leg throws as an assist. The main techniques used in martial arts Sanda can be divided into offensive techniques, defensive techniques, offensive and defensive conversion techniques and other scoring techniques. Chen Chao, Li Yindong and other scholars pointed out through relevant research that offense in martial arts Sanda is when athletes actively use kicking, hitting, throwing and other techniques to attack opponents during the competition, forcing them to be in a passive state. Defense is when athletes passively use movement, grid and other techniques during competition. Blocking and other technical methods to avoid and resolve the opponent's attack, protect oneself and prepare to attack the opponent's alert state, and the offensive and defensive transition is the transformation of the actual combat type of Sanda confrontation from offense to defense or from defense to offense.

Yan long pointed out that when counterattacking, you must have excellent offensive and defensive skills, strong counterattack awareness, keep a distance from the opponent, and pay attention to the opponent's playing style. In fierce competitions, situations where one side attacks while the other side defends often occur. The transition between offense and defense is completed in an instant. The athletes' offense and defense promote the progress of the entire game, and at the same time, they also It promotes the development of attack, defense and counter-confrontation skills in martial arts Sanda. There have also been quantitative studies on the body shape of outstanding athletes in boxing, judo, yikwondo, wrestling and other sports (Peng Yuhai, 2013). Judging from these research results, in terms of overall body

shape, there is not much difference in the body shape of athletes in unarmed combat events, that is, the height and weight ratio is appropriate, the body shape is well-proportioned, the limbs are strong and strong, and the body fat content is low, and the performance ranges from small to large levels. There is a certain regular difference, that is, the body fat percentage of large-level athletes is higher than that of small-level athletes. Generally speaking, scholars have done more descriptive research on the external appearance of excellent martial arts Sanda athletes and less empirical research, and there are large inconsistencies in the research results (Meng Fanjun, 2013).

Motor quality refers to the ability of the body to exercise under the instructions of the central nervous system. It usually includes basic qualities such as strength, speed, endurance and flexibility, and also includes composite qualities such as agility, coordination, and balance. Wushu Sanda is a one-on-one direct confrontation event using kicking, hitting, throwing and other techniques, which requires high athletic quality of athletes (Zhou Weifang, 2013). Cai Zhonglin pointed out that the special characteristics of Sanda have very comprehensive requirements for athletes' Physical profiles, and have high requirements for speed, strength, endurance, agility, flexibility and the composite qualities formed by their combination. Its mode characteristics include: speed, reskill movement speed mainly tests visual stimulus responses and complex reskill movements; skill movement speed mainly tests the frequency of movements within 10 seconds or 30 seconds; displacement speed mainly tests the speed of body initiation, short-distance disguised movement and turning movement. Strength, mainly speed, power and momentum (Cui Jiangong, 2013). Endurance, mainly strength endurance and speed endurance, can be measured by measuring the number of punches and kicks within 2 minutes or 3 minutes, or by measuring the total time spent punching and kicking a fixed number of times and groups. Sensitivity. Sensitivity should be demonstrated in confrontation practice. Its pattern characteristics cannot simply be measured by the level of test indicators in non-competition conditions. The general test method that reflects the sensitivity and coordination of the whole body includes repeated across-the-board tests (Wang Sen, 2013). Flexibility. Excellent athletes have a large range of rotation of the spine, shoulder circumference, and longitudinal axis. They have a large range

of movement of the spinal cord, knees, and joints, and have good flexibility and elasticity. Commonly used measurement methods include shoulder rotation, crossing, vertical fork, and kicking. It points out that there is an unbalanced development relationship between various sports qualities, that is, there is a relationship of mutual influence and restriction between each other. Such as strength and flexibility, endurance and speed, etc. Therefore, the special characteristics of martial arts Sanda should be combined. For example, when there is a conflict between speed and endurance, speed should be the main focus, and when there is a conflict between strength and flexibility, strength and quality should be the main focus (Zhou Wei, 2012). Of course, the ideal model should be that the more comprehensive the development of sports quality, the better.

2.2.3 Related research on plate training theory

The theory of special training takes the "special laws" of each special training as its main research object, that is, it focuses on the basic theory, methods and means of special training, and special techniques and tactics are its main research objects (Lee Jung-eun, 2012). The relationship between general training theory and special training theory is the relationship between commonality and individuality. General training theory originates from special training theory and guides special training (Wu Fan, 2011). Special training theory is at the bottom of training science and is the closest contact with special training. It provides the basis for event group training theory and general training theory (Zhang Yong, 2011).

Chen Juxuan analyzed the use of various techniques by lightweight college martial arts Sanda athletes in competitions and pointed out that the use of offensive techniques by Chinese lightweight college martial arts Sanda athletes mainly focuses on boxing. The success rate is unsatisfactory. , and did not achieve the corresponding scoring effect. Although the leg method has good performance in terms of usage and scoring efficiency, it lacks the use of heavy legs. The wrestling method has achieved good results, but the frequency of its use should be further improved. Overall Technically, they all lack the ability to win with one strike. Chen Xinxing analyzed the use of various techniques by mid-level college student martial arts Sanda athletes in the competition and pointed out that the use of boxing techniques by Chinese mid-level college student martial arts Sanda athletes mainly focuses on straight punches

and swing punches. The speed and hit rate need to be further improved. The use of kicking techniques is relatively simple, with the whip kick as the main technique, and the front kick and side kick as auxiliary kicks in the game. Although the whip kick is used in kicking It has certain advantages in terms of hitting strength, but the speed of kicking still needs to be further improved. In terms of throwing methods, although the use of close-fitting throws has certain advantages, the success rate is not satisfactory. At the same time, the technical movements of leg throws are slightly Rough still needs further optimization (Yuan Xinguo, 2010). Mao Aihua made a statistical analysis of the technical application of large-level college student martial arts Sanda athletes in competitions and pointed out that the boxing techniques of China's large-level college student martial arts Sanda athletes have significant advantages. At the same time, straight punches are more lethal. The combination of boxing techniques also changes. There are certain deficiencies that need to be further strengthened. Although the kicking method has been further improved compared to before, the success rate is still not ideal. The wrestling method is relatively weak compared to the other two core technologies, and there are some deficiencies. problems, which must be strengthened in a targeted manner. Li Liang analyzed the application of various techniques by large-level college student martial arts Sanda athletes and small and medium-level college martial arts Sanda athletes and pointed out that the main technique of large-level athletes is boxing, while the main technique of small and medium-level students is kicking. The use and efficiency of wrestling methods are lower than those of the small and medium levels, and the overall offensive skills are not as diverse as those of the small and medium levels. College student martial arts Sanda athletes at different levels have their own advantages and disadvantages, and their application characteristics of various techniques are different. The technical application characteristics of small-level athletes are mainly based on the speed of use of each technique. The overall technology is relatively It is flexible and diverse and has more playing characteristics. However, due to its own weight, it is relatively weak in strength and lacks the use of heavy blows, making it difficult to win the game with one hit. It often wins the game by hitting points. victory. The technical characteristics of intermediate-level college student martial arts Sanda athletes are relatively balanced, with a good combination of strength and speed. There is a lack of diversity

in the use of individual techniques. At the same time, there is room for further improvement in the speed and strength of fists and legs. In addition, in terms of throwing techniques The technique is a bit rough and still needs to be strengthened in a targeted manner in daily training. Due to their larger body weight, large-level college student martial arts Sanda athletes are known for their strength and are often able to deliver good heavy blows. While their larger weight has a certain attack power, large-level college student martial arts Sanda athletes are also able to Lack of certain flexibility and diversity in the use of overall techniques. The use of overall techniques by large-level college student martial arts Sanda athletes is relatively single, and there is a lack of balance among various techniques, which also indirectly reduces the excitement of the competition. Accurately and timely understand the characteristics of the current technical application of college students' martial arts Sanda athletes at different levels, and conduct research and analysis on them. Continuously optimize their advantages and continuously strengthen their disadvantages, which can not only improve the performance to a large extent. The athletes' own competitive ability, the intensity and excitement of the competition, can also promote the development of Wushu Sanda in a healthier direction.

2.2.4 Related research on item group training theory

Sports intelligence is a type of intelligence, which refers to the ability of athletes to participate in sports training and sports competitions based on general intelligence and use multi-disciplinary knowledge including sports theory (Hu Yihai, 2009). Wushu Sanda is a one-on-one high-confrontation, open-ended sport that directly pursues the best attack results. It contains factors such as technical and tactical limitations and restrictions. Its physiological, psychological, and biochemical change characteristics are also different from other The projects are different and there is no certain cultural foundation. It is also difficult for martial arts athletes to improve their sports performance (Mao Nongxuan, 2008). Only by learning and mastering the scientific and cultural knowledge related to Wushu Sanda can we have an in-depth understanding and mastery of the technical principles, physiological mechanisms and training methods of Wushu Sanda with modern scientific knowledge, technology and means, so that we can better adapt to competitions and improve sports performance. Systematic cultural theory learning can have a certain impact on athletes' cognition.

Through cultural learning, after athletes' analytical and judgment abilities are improved, they will view the results more correctly, treat the gains and losses of the game correctly, and evaluate their opponents and themselves relatively objectively. If you pay too much attention to external influencing factors and maintain a normal mentality, you can relatively easily focus on the current competition, thereby maintaining a low cognitive state anxiety, which is conducive to achieving good results in the competition (Zhu Lin, 2008). Judging from the current research on the intelligence of martial arts Sanda athletes, only Cai Zhonglin summarized the intellectual characteristics of outstanding martial arts Sanda athletes from an empirical perspective as: average to upper IQ.

In summary, the theory of athletes' competitive ability and its structural model provides theoretical basis and research ideas for this study. Therefore, to establish a structural characteristic model of each element of competitive ability of excellent Wushu Sanda athletes, we need to take excellent Wushu Sanda athletes as test subjects, use qualitative and quantitative research methods, summarize and summarize the specific characteristics and functions of each component of competitive ability, and establish a reflection. The competitive ability of excellent martial arts Sanda athletes constitutes a common model. Judging from the current research on the various elements of the competitive ability of excellent Wushu Sanda athletes, there are many valuable studies. However, in general, there are still many deficiencies in our research on the structural characteristics and standards of the various elements of the competitive ability of excellent Wushu Sanda athletes. The specific manifestations are as follows: (1) There are relatively many studies on the characteristics of one of the seven elements that constitute the competitive ability of martial arts Sanda athletes, but a comprehensive study on the structural characteristics of each element of athletes' competitive ability has not yet been seen. (2) There is insufficient understanding of the competitive characteristics of martial arts Sanda events, and the differences in competitive ability evaluation standards between athletes of different levels are ignored, which makes the research results divorced from specific practice and greatly reduces the application value of theoretical research. (3) There are few studies on the technical, tactical and other characteristics of the competitive ability of outstanding martial arts athletes. Most of them focus on

simple technical statistics or descriptions, lacking in-depth structural quantitative research. (4) The sample content of test objects is too small, and the definition of excellence standards is not uniform, making the research results less representative. (5) In terms of research methods, it is satisfied with the comparison of competitive ability characteristics between athletes of different levels or different events, and lacks the exploration of in-depth competitive ability indicators. With the changes in the competitive conditions of Wushu Sanda, the structural characteristics of competitive abilities of outstanding Wushu Sanda athletes are also undergoing adaptive changes. It is necessary to conduct further comprehensive and in-depth research on the theory and practice of competitive abilities of outstanding Wushu Sanda athletes under the new competitive conditions.

3. A review of research related to Sanda Physical profiles

Whether it is Sanda or other competitive events, research on Physical profiles mainly focuses on three aspects: body shape, physical function and athletic quality of athletes (Ji Benping, 2008). Some studies are in-depth and detailed studies on a certain aspect, and some studies are comprehensive studies. However, the trend in Physical profiles research is towards comprehensive research.

3.1 Research on the body shape of Sanda athletes

He Ziwen pointed out in "The Principles of Training for Skill-Dominant Fighting Confrontational Groups" that athletes in fighting events usually have taller heights and longer limbs, and this body shape is conducive to the use of skills and tactics. Long limbs make it easier to reach the target when attacking and easier to quickly evacuate the opponent when defending. However, within the same weight class, although long limbs have a larger range of motion, their speed is relatively slow and their strength is relatively small; while those with shorter limbs move faster and have more concentrated strength, especially in close combat (He Ziwen, 2022). Cai Zhonglin also emphasized that the ideal body shape of athletes in fighting events should be: at the same weight, well-proportioned, arm length (finger distance) greater than height, wide shoulders, small hips, flat hips, less body fat, well-developed muscles, large limb circumference, and wide chest circumference. In general, the ideal

body shape should have the characteristics of long attack distance, relatively large strength, and dominant muscle strength (Cai Zhonglin, 2022).

Further quantitative research also conducted a detailed analysis of the body shape of athletes in different fighting events. Zhao Guangsheng et al. tested the morphological indicators such as height, weight, limb length, circumference and body composition of 119 outstanding Wushu Sanda athletes and found that outstanding Chinese Wushu Sanda athletes generally have the following characteristics: well-proportioned upper and lower limbs, large chest circumference, upper arm circumference, thigh and calf circumference, and high body fullness. The skeleton and muscles are well-developed, the limbs are relatively strong, and the body fat content is relatively low, about 11.4% (Zhao Guangsheng, 2022). When these data are compared with other fighting events (such as judo, taekwondo, etc.), it is found that the body fat content of Sanda athletes is similar to that of other events within a certain range, but the thickness and strength density of their limbs are more prominent, showing their unique Physical Profiles requirements (Wang Lejun, 2022). Multiple studies have shown that the body shape characteristics of athletes in different fighting events are different. Among boxing and taekwondo athletes, the body shape is relatively similar, mainly manifested in the balance of height and weight ratio, and relatively low body fat content. In contrast, the physical characteristics of judoka and wrestlers are relatively similar, mainly reflected in the concentration of strength and a higher percentage of body fat. These differences are closely related to the technical requirements and competition characteristics of each event (Şimşek, 2022). For Sanda athletes, their body shape seems to be between boxing and taekwondo, but they also have some characteristics of wrestling and judo. This unique body structure is closely related to the technical and tactical characteristics of Sanda, especially in terms of rapid movement and explosive power (Cai Ruijin, 2022). With the support of these quantitative studies, we can have a deeper understanding of the ideal body characteristics of Sanda athletes and further provide a theoretical basis for their special training.

3.2 Research on physical functions of Sanda athletes

Body function refers to the working ability of various internal organs of the human body (such as cardiovascular organs, respiratory organs, central nervous

system, etc.). Like most competitive sports that require high Physical profiles, in terms of research on the physical functions of Sanda athletes, research on the energy supply methods and characteristics of the athletes' bodies during competition, the cardiovascular system, the respiratory system, and the endocrine system is relatively common.

(1) Research on energy metabolism:

The movement of the human body depends on the contraction and relaxation of skeletal muscles. The direct energy source for muscle contraction movement is adenosine triphosphate (ATP). During exercise, actomyosin ATPase consumes ATP, causing the myofilaments to slide relative to each other, thereby achieving muscle contraction movement and work. At the same time, the calcium pump (Ca-ATP) on the sarcoplasmic reticulum also needs to consume ATP to transport calcium ions, thereby regulating muscle relaxation; the sodium pump (Na, K-ATPase) on the sarcolemma needs ATP to transport Na^+/K^+ ions and regulate membrane potential. However, the ATP reserves in muscle cells are limited, so ATP must be continuously synthesized through other pathways to provide a continuous energy supply. There are three main energy supply pathways in muscle cells, namely: (1) creatine phosphate decomposition-phosphocreatine energy supply system; (2) anaerobic decomposition of sugar-glycolysis energy supply system; (3) aerobic oxidation of sugar, fat, and protein-aerobic metabolism energy supply system. The first two pathways are anaerobic metabolic processes, while the third requires the participation of oxygen and is called the aerobic metabolism energy supply system. Due to different exercise intensities, the energy supply ratio of each energy system will also change in different sports (Li Wenlong, 2022). The energy supply characteristics of Sanda are similar to those of other fighting sports. Lin Wentao et al. conducted biochemical monitoring studies on Taekwondo athletes and found that the energy metabolism of Taekwondo mainly relies on anaerobic energy supply, especially the contribution of the phosphagen system. The ratio of anaerobic and aerobic energy supply in the competition is affected by the technique and the intensity of the competition (Lin Wentao, 2022). Hong Shanglai also pointed out that the high-intensity training and competition of Taekwondo athletes mainly rely on anaerobic energy supply, but good aerobic metabolic capacity is still indispensable (Hong

Shanglai, 2022). Similarly, the energy supply of Sanda athletes is also mainly anaerobic metabolism, but aerobic metabolism also plays an auxiliary role in some cases. Guan Huanyuan et al.'s study on judo athletes showed that the energy contribution of the phosphagen and glycolysis systems was very significant in high-intensity training and competition (Guan Huanyuan, 2022). Feng Meiyu and others also found that wrestlers mainly rely on the glycolysis system, and a mixed energy supply mode of anaerobic and aerobic metabolism is more common (Feng Meiyu, 2022).

These studies show that Sanda, like other fighting sports, mainly relies on the anaerobic metabolic system for energy supply, but the participation of the aerobic metabolic system cannot be ignored. Especially during the competition, the proportion of energy supply depends on the technical characteristics and intensity of the competition. Through the analysis of blood lactate concentration after the game, it was found that the proportion of anaerobic metabolic energy supply of judo and wrestling athletes was relatively high, which was closely related to the time characteristics and exercise intensity of their games (Li Wenlong, 2022; Feng Meiyun, 2022).

(2) Research on cardiovascular function:

The quality of cardiovascular function directly affects whether athletes can withstand high-intensity exercise during training and competition, so it is an important indicator reflecting athletes' athletic ability. Many scholars have conducted in-depth research on the cardiovascular function of Sanda athletes, exploring how to help coaches scientifically and rationally arrange training intensity and exercise volume by effectively monitoring physiological and biochemical indicators. In order to ensure the effectiveness and safety of training, physiological and biochemical indicators such as blood lactate, blood testosterone, urine protein, urobilinogen and bilirubin are widely used in athlete monitoring, but in actual training, these indicators are often difficult to directly reflect exercise intensity. Relatively speaking, heart rate, as a common physiological monitoring tool, has been proven to have high practical value for controlling exercise intensity and adjusting training load. Research by Zhao Guangsheng and others shows that the maximum heart rate percentage of Sanda athletes during competition is about 96%. During training, the heart rate should be

kept above 180 beats/minute, and the heart rate should be reduced to 120-140 beats/minute during intervals. Monitoring exercise intensity through changes in heart rate can effectively improve training results and help coaches adjust training loads according to the heart rate recovery of athletes (Zhao Guangsheng, 2022). Li Jiyang and others monitored boxing athletes of different training intensities through blood lactate (Bla) and heart rate (HR), and found that evaluating training intensity through heart rate and blood lactate values can effectively optimize training methods (Li Jiyang, 2022). In addition, Gu Jun and others also used morning pulse and other physiological indicators to monitor the pre-match high-volume training of Taekwondo athletes, and achieved remarkable results (Gu Jun, 2022). Researchers such as Feng Meiyun, Pang Xiaojie and Su Xuemei also used the method of combining heart rate with other physiological and biochemical indicators in judo and wrestling to monitor the intensity and volume of training, achieving good results (Feng Meiyun, 2022; Pang Xiaojie, 2022; Su Xuemei, 2022). Through a large number of research results, it can be seen that athletes in hand-to-hand combat generally have good cardiovascular function, their heart reserve is sufficient, their heart rate is low when they are at rest, and their heart rate is usually as high as 180-210 beats/minute during high-intensity training and competition. These studies have shown that when evaluating the physical function of athletes in such events, cardiac function is undoubtedly an important indicator, especially the changes in heart rate during high-intensity training and competition, which can reflect the athlete's sports adaptability and cardiovascular health status (Zhang Xuejun, 2022; Zou Chaoshun, 2022).

(3) Research on respiratory function:

During exercise, the human body needs more oxygen than when it is at rest. At the same time, due to vigorous metabolism, a large amount of carbon dioxide produced also needs to be discharged from the body in time. This process requires the respiratory system to have good functions to ensure the supply of oxygen and the discharge of carbon dioxide. For hand-to-hand combat sports, although the body's energy supply mainly depends on the anaerobic energy supply system, good aerobic capacity as a foundation can enhance the athlete's anaerobic endurance, help consume glycogen and ATP and promote their resynthesis. Therefore, the respiratory function of athletes has become an important area of concern for researchers. In the study of

the pulmonary ventilation function of boxers, Yang Haiping et al. found that excellent boxers had higher vital capacity, timed vital capacity and maximum ventilation, which indicates that their respiratory muscles are strong, their respiratory muscles are well coordinated, and their respiratory muscles are highly efficient. However, after high-intensity training, the athlete's vital capacity usually decreases, and the maximum ventilation decreases significantly. The change in maximum ventilation can be used as an effective indicator for monitoring training intensity (Yang Haiping, 2022). In addition, Tong Lisheng reflected the pulmonary ventilation function of boxers by measuring the oxygen consumption per stroke, and achieved good results (Tong Lisheng, 2022). Regarding the respiratory function of Taekwondo athletes, Hong Shanglai found through research that with the improvement of training level, the maximum oxygen uptake (VO_{2max}) of Taekwondo athletes also increased accordingly, indicating that the aerobic metabolic capacity of athletes is enhanced with the increase of training (Hong Shanglai, 2022). Liu Yanping and others' research also showed that the VO_{2max} of Taekwondo athletes is closely related to the level of exercise (Liu Yanping, 2022). In addition, Gao Binghong's research pointed out that Taekwondo athletes have basically the same VO_{2max} level as athletes of other events (such as judo and wrestling athletes), and the oxygen pulse (O_2 -pulse) is positively correlated with the level of exercise, that is, the higher the level of exercise, the higher the oxygen pulse (Gao Binghong, 2022). The respiratory quotient (RQ) of Taekwondo athletes changes in an "S" shape during incremental load exercise, and the RQ of excellent athletes is always higher than that of ordinary athletes (Gao Binghong, 2022). Although studies have shown that wrestlers have a low ratio of vital capacity to body mass index and average VO_{2max} levels, this result may be related to the characteristics of the research sample (Gao Binghong, 2022). In summary, good respiratory function is very important for Sanda athletes. In the process of athlete selection and training, the evaluation of respiratory function should be given full attention to help improve athletes' competitive performance and endurance level (Zhang Xuejun, 2022; Zou Chaoshun, 2022).

(4) Research on the use of some biochemical indicators in evaluating athletes' physical functions:

During exercise, a series of biochemical changes in the human body are the body's direct response to the exercise load it bears. These changes reflect the body's stress resistance. Therefore, by monitoring relevant biochemical indicators, the athlete's physical function and training load can be scientifically assessed. Lactate, as a product of the glycolysis pathway, is one of the substrates of aerobic metabolism and can be converted into glucose. Therefore, the metabolic changes in the production and elimination of lactate become an important indicator for evaluating exercise intensity and energy metabolism. Similarly, the content of urinary protein is affected by exercise intensity and duration. Especially in high-intensity exercise dominated by anaerobic energy supply, the excretion of blood lactate and urinary protein will increase, thus providing important information for assessing exercise load and physical function.

In addition, skeletal muscle creatine kinase (CK) is an important enzyme involved in ATP synthesis during short-term high-intensity exercise, and its activity is closely related to the body's recovery state after exercise. Increased exercise intensity will cause an increase in CK. Therefore, the activity measurement of CK can effectively reflect the athlete's physical function and exercise recovery. Hemoglobin (Hb), as the main component of red blood cells, is not only responsible for the transport of oxygen and carbon dioxide, but is also closely related to the body's athletic ability. For endurance athletes, higher hemoglobin values usually mean better functional status and stronger athletic ability. Therefore, hemoglobin values are widely used to assess athletes' physical functions.

During high-intensity exercise, protein catabolism increases, urea production increases, and the content of blood urea (BU) also increases. Blood urea, as an important indicator of physical fatigue and functional status, can also help assess the intensity of exercise load.

Many researchers have conducted extensive research on the changes in these biochemical indicators during the training and competition of Sanda athletes. For example, Li Jiyang et al. found in their study that as the functional level of boxers improved, the levels of serum creatine kinase (CK) and lactic acid (Bla) decreased after exercise, and hemoglobin (Hb) did not change much (Li Jiyang, 2022). Lin Jiandi et al.'s training monitoring of boxers also showed that hemoglobin (Hb) showed

a rising and falling pattern in different training stages, but the overall difference was not large (Lin Jiandi, 2022). Similarly, Lin Wentao et al.'s study showed that when the intensity of Taekwondo training was high, biochemical indicators such as hemoglobin, blood urea, and serum creatine kinase changed significantly, and these changes can be used to guide training scientifically and rationally (Lin Wentao, 2022). In addition, Zhang Li et al.'s study on wrestlers found that hemoglobin, urine bilirubin, and urobilinogen were effective training intensity assessment indicators, while serum creatine kinase (CK) could sensitively reflect the intensity of pre-match training (Zhang Li, 2022). Guo Yucheng et al. concluded through research that changes in hemoglobin (Hb) and blood urea (BU) can be used to assess the physical function status of Sanda athletes (Guo Yucheng, 2022). Guo Ziyuan's research shows that blood lactate (Bla) is an effective indicator for evaluating the intensity of Sanda athletes' training confrontation (Guo Ziyuan, 2022). However, Zhang Chunhua's research pointed out that there are still certain limitations in relying solely on blood lactate values to monitor and assess the training effects of Sanda athletes, which needs further verification (Zhang Chunhua, 2022).

In summary, the research on these biochemical indicators not only helps to assess the training load and physical function of athletes, but also provides an important reference for scientific training and athlete selection. (Wu Hongyu, 2021; Jia Lili, 2021; Zhu Bin, 2021; Zhang Jingyi, 2021).

3.3 Research on the Physical capacities for sports of Sanda athletes

Sports quality refers to the various basic sports abilities that the organs and systems of the body exhibit under the control of the central nervous system during exercise, usually including strength, speed, endurance, flexibility and agility. The quality of sports quality depends on the athlete's body shape, the functional status of various organ systems, the reserve of energy substances, and the overall health of the athlete. Good sports quality lays the foundation for improving the athlete's technical, tactical ability and sports performance. Among the three components of Physical Profiles - body shape, function and sports quality, sports quality is the external manifestation of Physical Profiles. Therefore, in sports training practice, the development of sports quality is often the main goal. When evaluating athletes' Physical Profiles, sports quality is an important evaluation indicator, especially for

Sanda, which has extremely high physical requirements, the study of sports quality is particularly important.

He Ziwen pointed out that wrestling, judo, boxing and Sanda all require athletes to have quick reskill movements, great strength, high flexibility, and be able to maintain the endurance of these functions within the specified competition time, so as to defeat the opponent. Although these fighting events require the comprehensive development of Physical Profiles, the degree of requirements for each quality in each event is different. Hu Yihai and others found that the athletic qualities of excellent boxers need to be developed comprehensively and deepened in special areas. The study pointed out that speed quality, agility quality and speed-strength quality are the core qualities of boxers and should be the focus of training. In addition, the second largest quality of boxers is limb and waist and abdominal strength, while the third largest quality is basic endurance and lactic acid endurance quality. The study also selected 50-meter run, 30-second continuous squat, 400-meter run and other items as the main detection indicators through factor analysis, and established a quality development model for boxers (Hu Yihai, 2022). Zhu Yong pointed out through his research on Taekwondo athletes that speed endurance, speed, strength, agility and flexibility are the main factors affecting athletes' performance (Zhu Yong, 2022). Wei Xiangming also mentioned in his research on outstanding Taekwondo athletes in Taiwan that speed, agility, endurance, flexibility and strength have different importance in the Physical Profiles of Taekwondo athletes, and speed and agility are particularly prominent (Wei Xiangming, 2022).

In the training of Taekwondo athletes, speed and speed endurance exercises are considered dominant, while strength training focuses on the leg and waist and abdominal muscles (Liu Hongwei, 2022). These studies reveal the different demands for athletic qualities in different events, especially in hand-to-hand combat events, where speed and endurance are usually the key qualities that determine the competitive level. In addition, judo and wrestling athletes place more emphasis on strength, especially explosive power. Li Fuxuan et al. believe that the strength quality of wrestlers is the most critical, while in judo training, explosive power and agility are the main Physical Profiles requirements (Li Fuxuan, 2022). Chen Guiling emphasized that judo athletes should have good strength qualities, especially explosive power, and

agility and movement speed should not be ignored (Chen Guiling, 2022). These research results show that although different hand-to-hand combat events have different requirements for athletes' athletic qualities, in general, speed, endurance, strength, agility and flexibility are key indicators for assessing athletes' Physical Profiles. The level of development of an athlete's athletic quality directly affects their performance in competitions, especially in high-intensity and highly confrontational events such as Sanda, where the improvement of athletic quality is crucial (He Ziwen, 2022). Researchers have conducted extensive discussions on the athletic quality of athletes in unarmed combat events, and have basically determined that speed, strength, endurance, agility, and flexibility are important factors affecting the competitive level of athletes. However, how to scientifically select appropriate indicators for athletic quality assessment in different events and training cycles still requires further research and verification (Zou Chaoshun, 2022; Ren Jieying, 2022).

3.4 Current status of research on physical training of Sanda athletes

In recent years, research on the physical structure and training methods of Sanda athletes has made significant progress, but there are still many problems and deficiencies that need to be solved in practical applications. This article combines the research views of many experts and scholars, explores key issues such as current physical structure, coach ability, scientific training, technical and tactical connection, and the correlation between morphology and function, and provides a theoretical basis and practical reference for the improvement of Sanda physical training. Gao Liang pointed out that most of the current Sanda physical research focuses on the measurement of a single dimension, such as strength and speed, ignoring the multidimensional characteristics of physical composition. He believes that Physical Profiles is not just a single strength or explosive power, but also covers multiple aspects such as the athlete's morphological structure, functional state, athletic quality and overall health level. Therefore, a single-dimensional evaluation is prone to fragmentation of training content and is difficult to fully reflect the actual physical condition of athletes. He suggested constructing a comprehensive evaluation model that covers physiological, psychological and technical factors, so as to grasp the athlete's physical structure as a whole and provide more scientific guidance for training design (Gao Liang, 2023).

Meng Yihao found through expert interviews that Chinese Sanda coaches have obvious shortcomings in the knowledge reserve of physical training. Many Sanda coaches still use traditional training methods and lack cross-border exchanges and learning with international advanced Olympic events, resulting in relatively backward and lack of targeted training methods. Meng Yihao suggested introducing international advanced concepts, strengthening professional training and academic exchanges for coaches, and thus optimizing training methods and technical means (Meng Yihao, 2023). Liu Chengyi pointed out from the perspective of scientific training that there is a phenomenon of "focusing on technology and neglecting Physical Profiles" in current physical training. Over-emphasizing technical and tactical proficiency, neglecting the systematic cultivation of Physical Profiles, and even relying solely on traditional training methods such as long-distance running, it is difficult to meet the needs of individual differences among athletes. He proposed that it is crucial to develop targeted special training programs in combination with biomechanical analysis, such as improving explosive power and rapid response ability through specialized exercises (Liu Chengyi, 2023). Anson Long is concerned about the disconnection between physical training and technical and tactical skills, and recommends the use of "simulated confrontation training method", that is, integrating physical training content into technical and tactical drills to help athletes perform physical reserve and energy regulation training in actual combat situations, so as to better connect technical and tactical needs (Anson Long, 2023). Zhang Hua and his team's research found that there is a significant correlation between the cross-sectional area of lower limb muscles and striking speed, suggesting that Sanda athletes should give priority to the cultivation of lower limb explosive power rather than just pursuing an increase in muscle mass (Zhang Hua, 2023). This provides a new idea for training: through a scientific and reasonable strength training program, explosive power and reskill movement speed can be improved, helping athletes improve their ability to switch between offense and defense in actual combat (Zhang Hua, 2023).

Wang Ming pointed out in his research that traditional training does not pay enough attention to flexibility, especially in difficult movements (such as back swinging legs), there is a problem of low completion quality. He suggested introducing dynamic stretching and PNF training methods to improve joint mobility

and neuromuscular coordination, thereby improving the overall flexibility level of athletes (Wang Ming, 2023). Li Qiang's research shows that there is a two-way influence between psychological stress and physical performance. Psychological factors such as competition anxiety can cause athletes' anaerobic endurance performance to decrease by 15% to 20%. He suggested adding psychological stress resistance training to physical training plans to help athletes maintain stable performance under high-pressure environments (Li Qiang, 2023).

Chen Tao proposed a new energy metabolism theory model, believing that Sanda sports have typical "high-intensity intermittent" characteristics, and need to complete high-intensity attack and defense conversions in a short period of time and recover quickly. Based on this, he suggested designing a differentiated energy supply system training program to improve athletes' explosive power and recovery ability by alternately strengthening the phosphagen system and the glycolysis system (Chen Tao, 2023). Zhao Lin found through research that female Sanda athletes are better than men in core stability tests, but are weaker in rapid strength recovery ability. Based on this finding, she proposed that personalized training programs should be developed according to gender differences, such as increasing eccentric contrskill movement training for female athletes to improve their ability to recover quickly (Zhao Lin, 2023). Zhou Wei focuses on the long-term development of young athletes and proposes a "pyramid model". That is, at the age of 12 to 14, focus on cultivating coordination, agility and basic Physical Profiles; at the age of 15 to 17, gradually strengthen strength and endurance training to lay the foundation for special skills. This phased training plan can ensure the comprehensive development of adolescent Physical Profiles and avoid sports injuries caused by premature specialization (Zhou Wei, 2023).

The research of the above scholars provides multi-dimensional improvement ideas for Sanda physical training, including strengthening the professional ability of coaches, optimizing the scientific nature of physical training, focusing on the connection between skills and tactics and Physical Profiles, gender-differentiated training, and long-term development planning. The various research results complement each other, promote the improvement of Sanda physical training theory, and provide strong support for the optimization of training methods in practice.

CHAPTER III METHODOLOGY

This study was observational and experimental research. Through the physical training program designed in this study, the experiment is conducted to test the effect of the physical training system for college students' Sanda athletes in the training practice, improve the athletes' Physical profiles level, enhance their physical reserve, further tap their technical potential, and provide guidance for the physical training of college students' Sanda athletes. This study was conducted on college student Sanda athletes from Sichuan University of Light and Chemical Technology.

Phase 1:

1. Population and Subjects

This study aims to test the application effect of the physical training system of college Sanda athletes in actual training through experimental intervention, further improve the overall Physical Profiles level of athletes, enhance physical reserves, and promote the release of technical potential, so as to provide theoretical basis and practical guidance for the scientific physical training of college Sanda athletes. This study adopts an observational experimental design, with the Sanda team of Sichuan University of Science and Chemical Technology as the research object, and selects a total of 40 Sanda athletes who are active in school-level competitions and daily training as subjects, including 20 male athletes and 20 female athletes.

To ensure the scientific nature of the study and the representativeness of the data, this study set clear inclusion and exclusion criteria:

1. Inclusion criteria

- (1) Age 19-24 years old, regardless of gender.
- (2) Volunteers are interested in this study and sign;
- (3) College Sanda athletes from Sichuan University of Science and Chemical Technology who have participated in municipal competitions;
- (4) National first-, second- or third-level athletes;
- (5) Strong communication and cooperation skills.

2. Exclusion criteria

(1) Those with congenital diseases or physical defects; (2) Those with mental illnesses such as depression and cognitive impairment; (3) No second-level or above athletes; (4) College Sanda athletes who have received mindfulness training; (5) College Sanda athletes who have been injured or have not fully recovered from injuries within the past three months; (6) Those who are unwilling to participate in this experimental research; (7) Those who conflict with the competition/training time.

The above screening criteria ensure that the physical conditions, training backgrounds and experimental compliance of the research subjects are basically consistent, thereby ensuring that the results of the experimental intervention have high internal validity and generalizability. This study will conduct systematic physical training on the subjects according to the group intervention plan, compare the changes in multiple physical and technical performance indicators of the athletes before and after the experiment, and objectively evaluate the effectiveness of the training system.

2. Instruments

Table 12 Physical profiles test tools

Item		Index	Test-re test (The Intraclass Correlation Coefficient:ICC))
Physical Elements	Speed	50m	0.975
	Strength	Push-up	0.996
		squats	0.978
		Sit-up	0.977
		grips strength	0.911
	Endurance	1000 meters (male)	0.922
		800 meters (female)	0.917
	Coordination	return runs	0.925
	Flexibility	Sitting forward bend	0.944
Joint muscle strength		Test the peak torque of athletes' elbow and knee joints under concentric contrskill movement conditions	0.974

Table 12 Physical profiles test tools (Continue)

Item	Index	Test-re test (The Intraclass Correlation Coefficient:ICC))
FMS Score	A test of 7 movements: squat, step-up, straight lunge, shoulder mobility, active leg raises, push-up, and rotational stability, with each movement repeated 3 times	0.922
success rate of skill movement	Boxing, kicking, wrestling	0.968

Note: All the instruments used in the test are in accordance with the athlete testing specifications of the General Administration of Sport of the People's Republic of China. In this study, the test-retest method was used to measure multiple physical indicators of 40 athletes twice, with an unclear interval. Most of the measured indicators changed very little between the two measurements, with T values of 0 or close to 0 and P values of 1 or close to 1. The test-retest method plays a key role in verifying the reliability of measurement tools and methods. By measuring multiple indicators of 40 athletes twice and conducting statistical analysis, the stability and consistency of these indicators over time were proved, thus ensuring the accuracy and validity of the data in this study.

3. Data collection procedures

After signing the consent form, athletes will receive Physical profiles elements, joint strength, FMS scores, and success rates of skill movements (figure showing the research process of phase 1).

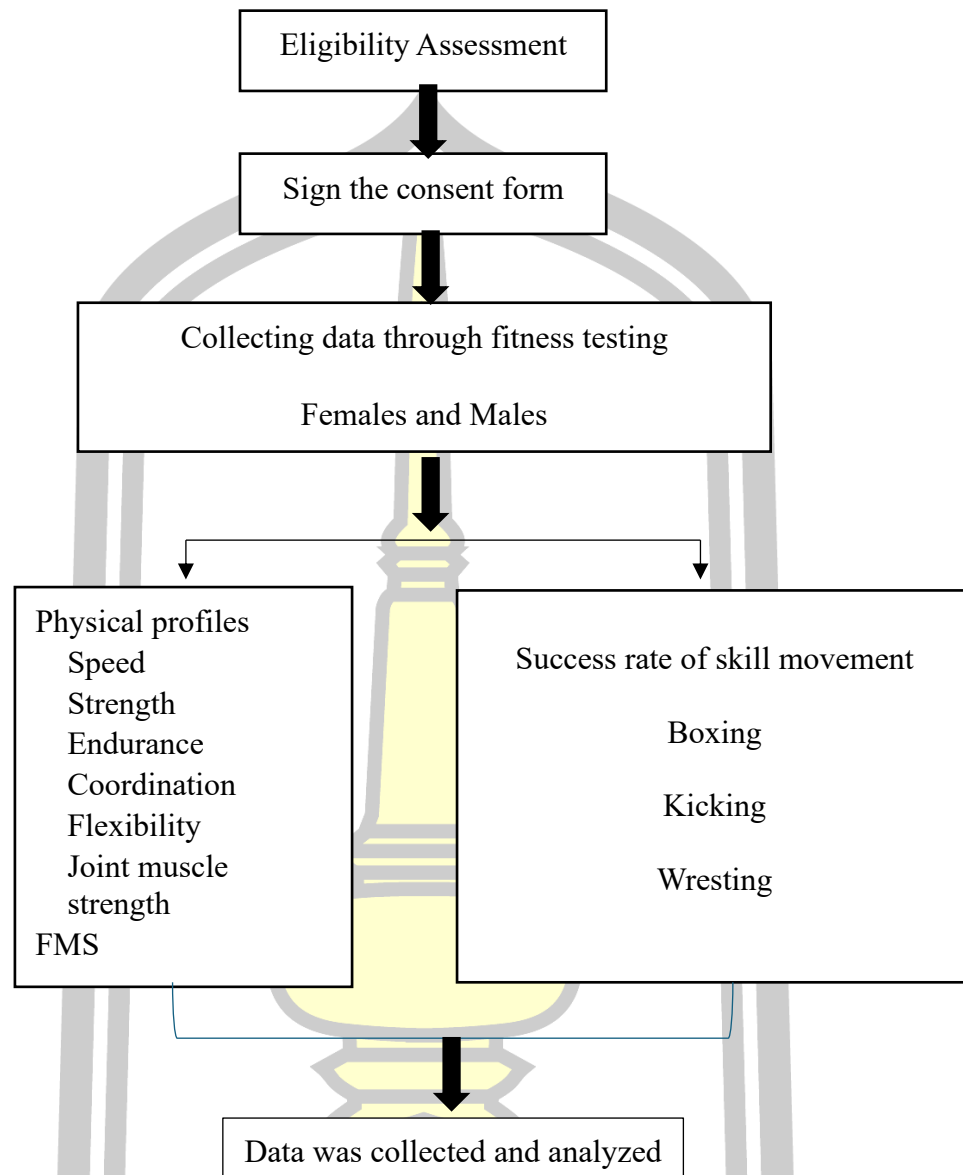


Figure 21 Showing the research process of phase 1

4. Data analysis

College Sanda athletes were grouped according to their sports level and gender. The athletes' sports measurement data were statistically analyzed using SPSS 22.0 statistical software. The mean (standard deviation ($\bar{x}$ (sd))) was used to represent the measurement data in the table. The k-s test was performed on age, height, weight, BMI, body fat percentage, sit-ups, sitting forward bend, and FMS scores. If the data followed a normal distribution, a two-sample paired t-test was used. The Wilcoxon rank sum test was used for data that did not follow a normal distribution, such as

push-ups, squats, return runs, grip strength, muscle strength tests, success rate of skill movements, and endurance tests. $p < 0.05$ indicates a significant difference, and $p < 0.01$ indicates a very significant difference.

Phase 2:

1. Subjects

This study first conducted a pre-test to measure the Physical Profiles, joint muscle strength, success rate of skill movement of the athletes participating in the experiment, and used FMS to test whether the athletes had possible sports injuries. The results of various Physical Profiles tests of 40 athletes were determined. In order to ensure that the athletes in the experimental group and the control group were at the same Physical Profiles and competitive level before the experiment, this study comprehensively measured Physical Profiles, joint muscle strength, technical skill movement success rate and FMS scores, and used the comprehensive average scores of these indicators to stratify and rank the athletes. The athletes were reasonably allocated to the experimental group and the control group using the stratified random allocation method to ensure that there were no significant differences in gender ratio, sports level and various Physical Profiles indicators between the two groups, thereby effectively controlling the impact of the previous level differences on the experimental results and ensuring the fairness and scientificity of the experiment. According to the level and gender of the athletes, the experimental group was divided into 10 boys and 10 girls, and the control group was divided into 10 boys and 10 girls. Due to individual differences, this study could not guarantee the consistency of Physical Profiles tests for each athlete. Therefore, the experimental group and the

control group were divided into the same group according to the average physical profiles test scores.

All athletes signed a participation agreement before the experiment, which clarified the training process, precautions and related requirements, ensuring the standardization of the experiment and the active participation of the athletes. Through the above grouping method, this study effectively controlled variables such as gender and competitive level, ensuring the reliability and validity of the experimental results. Athletes of different genders and sports levels were randomly assigned to the experimental group and the control group by random allocation. There were 4 first-level athletes, 6 second-level athletes, and 10 third-level athletes in the experimental group and the control group.

2. Instruments

Table 13 Fitness test tool

Item		Index	Instruments
Physical Elements	Speed	50m	Standard playground, stopwatch
	Strength	Push-up, squats, Sit-up, grips strength	Squat rack, horizontal bar, seat cushion, gripper, etc.
	Endurance	1000 meters (male), 800 meters (female)	Standard playground, stopwatch
	Coordination	Return runs	Standard playground, stopwatch, high-speed camera
	Flexibility	Sitting forward bend	Cushion
Joint muscle strength		Test the athletes' elbow and knee passes Peak moment in the condition of node centripetal contrskill movement	The ISOMED2000 constant-speed muscle strength test system is developed and manufactured by DR company in Germany

Table 13 Fitness test tool (Continue)

Item	Index	Instruments
FMS Score	Squat, upper step, straight lunge, shoulder flexibility, active leg lift, push-up and rotation stability 7 movement tests, each movement is repeated 3 times	Covered court
success rate of skill movement	Boxing, Leg method, Wrestling	Covered court

Note: All the instruments used in the test are in accordance with the athlete test specifications of the General Administration of Sport of the People's Republic of China

3. Data collection procedures

Before the formal training intervention, this study conducted preliminary experiments to verify the scientificity and suitability of the designed training program. The training program was evaluated by five experts from our school with rich backgrounds in physical training and Sanda. The content validity index (IOC) was used for quantification. The results showed that the overall IOC value was 0.92, indicating that the training content was highly consistent with the actual level of the target athletes in terms of difficulty, training intensity and technical requirements. In the preliminary experiment, experimental training was implemented on some athletes, and their Physical Profiles response, fatigue recovery and technical skill movement completion rate were systematically monitored. The results showed that the training intensity was moderate, which could effectively stimulate Physical Profiles improvement without causing excessive fatigue or injury risks to athletes, verifying the safety and operability of the program. The training program of the experimental group covers multi-dimensional training content such as maximum strength, explosive power, and aerobic endurance, which meets the requirements of Sanda for comprehensive Physical Profiles. The training method focuses on progressive load

and periodic adjustment to ensure that athletes can gradually adapt to the training intensity and avoid excessive training load leading to adaptation barriers or too light training load leading to insignificant training effects. Compared with the traditional physical training model, the experimental program has more advantages in terms of systematic content and pertinence, and can more effectively promote the improvement of athletes' competitive ability. Overall, the preliminary experimental results fully prove that the designed training program is scientific and reasonable in terms of difficulty and training load, suitable for the Physical Profiles foundation and training level of the subjects of this study, and lays a solid foundation for the subsequent 12 weeks of intervention training.

Sanda athletes undergo 12 weeks of physical training. The athletes are clearly informed of the training process, precautions before intervention, and relevant requirements during the training process, and are required to ensure that the athletes attend each training on time. A meeting is held before the experiment to explain the experimental requirements to ensure that all subjects can maintain quality and attend each practice on time. Then an agreement is signed to conduct an intervention experiment with an exclusive training plan for the experimental group. The experiment of this subject is designed through an ABA experiment, which has prediction, intervention and tracking functions. The experimental design is to evaluate the changes in the competitive ability level of Sanda athletes by comparing before and after the training intervention. The experimental design must include three aspects: determining the measurement tools and repeated measurement samples; secondly, the independent variables must be introduced and withdrawn according to the formal rules; thirdly, through professional data analysis, the effect analysis of the data construction stage is carried out.

(1) Experimental group

The 12-week training plan is mainly divided into six modules: strength, endurance, speed, coordination, explosive power and core stability. Aerobic training is arranged twice a week, focusing on aerobic endurance and anaerobic endurance training. Strength training includes maximum strength, rapid strength, explosive power, impact resistance, etc., and special core stability training is set up every week. Impact resistance and coordination and agility training are arranged on Tuesdays and

Fridays respectively. The training goal is to comprehensively improve various physical qualities and combine aerobic and anaerobic training to improve overall physical ability and endurance level.

(2) Control group

Use stopwatches and other timing and counting tools to record and calculate the physical training data of the experimental group and the control group, understand the changes in physical training of the experimental group and the control group during the training process, and adjust the training intensity. Formulate training plans in a timely manner. The original data are entered in Microsoft Excel format, a database is established, and the SPSS22.0 software package is used for processing.

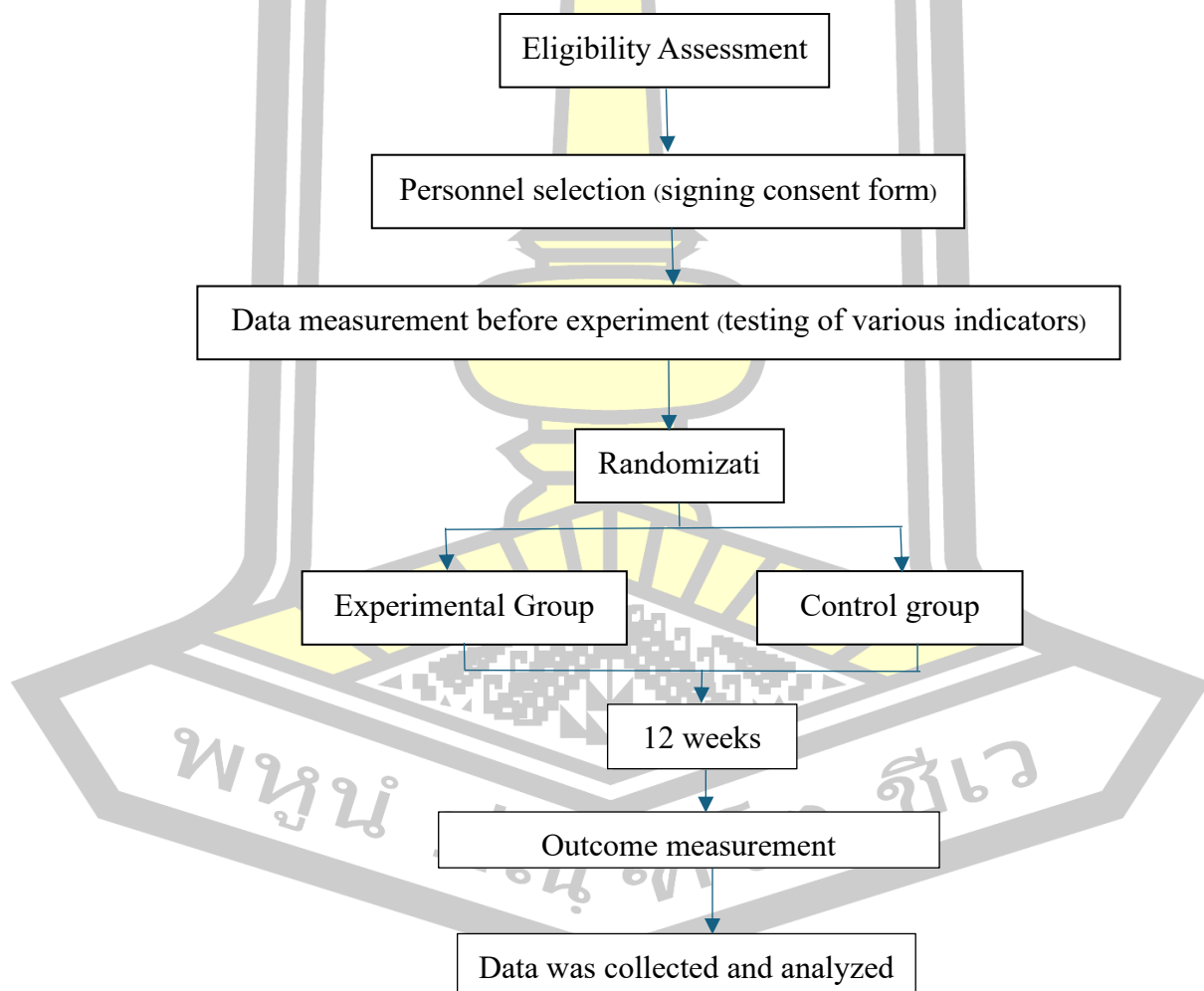
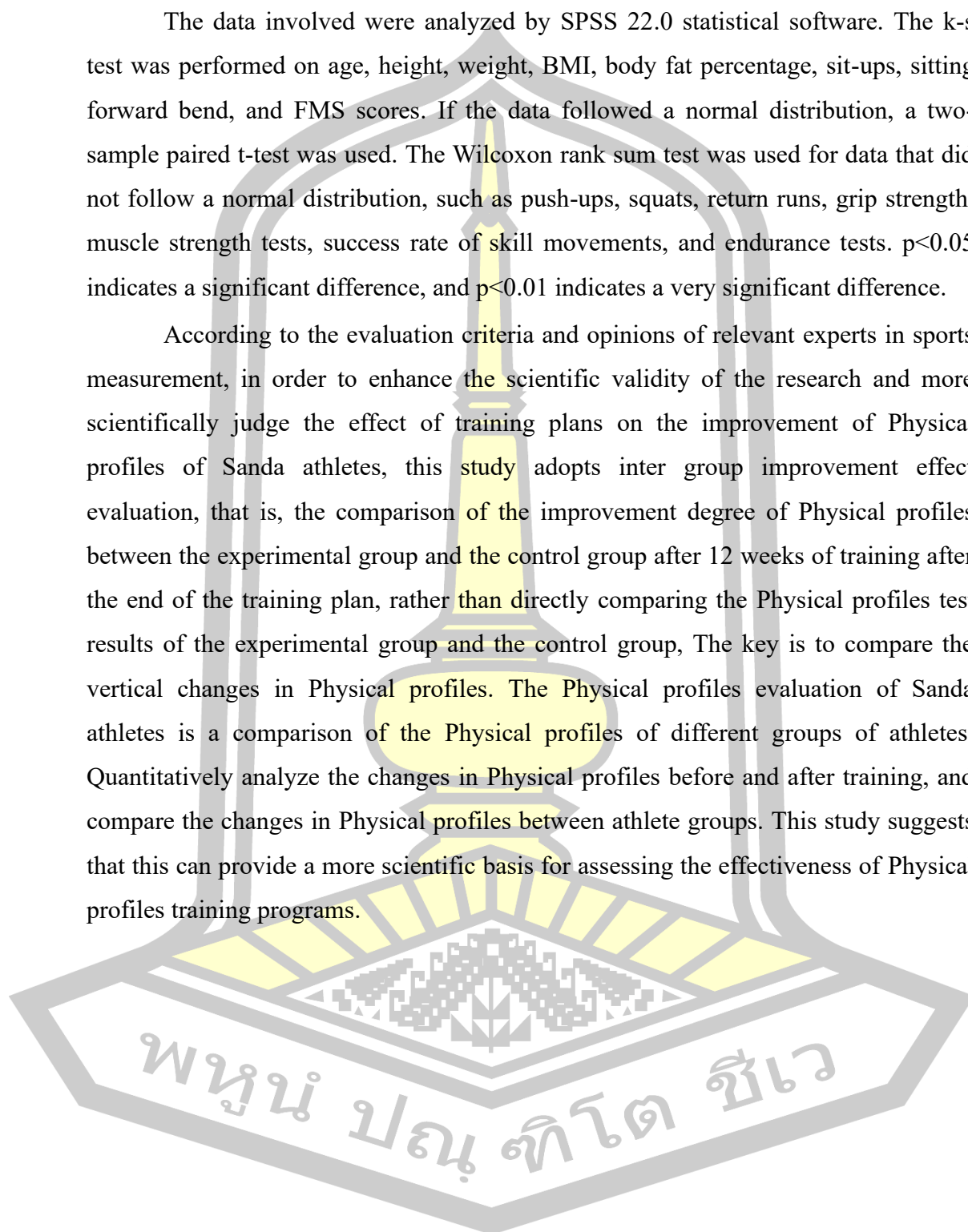


Figure 22 Showing the research process of phase 2

4. Data analysis

The data involved were analyzed by SPSS 22.0 statistical software. The k-s test was performed on age, height, weight, BMI, body fat percentage, sit-ups, sitting forward bend, and FMS scores. If the data followed a normal distribution, a two-sample paired t-test was used. The Wilcoxon rank sum test was used for data that did not follow a normal distribution, such as push-ups, squats, return runs, grip strength, muscle strength tests, success rate of skill movements, and endurance tests. $p < 0.05$ indicates a significant difference, and $p < 0.01$ indicates a very significant difference.

According to the evaluation criteria and opinions of relevant experts in sports measurement, in order to enhance the scientific validity of the research and more scientifically judge the effect of training plans on the improvement of Physical profiles of Sanda athletes, this study adopts inter group improvement effect evaluation, that is, the comparison of the improvement degree of Physical profiles between the experimental group and the control group after 12 weeks of training after the end of the training plan, rather than directly comparing the Physical profiles test results of the experimental group and the control group, The key is to compare the vertical changes in Physical profiles. The Physical profiles evaluation of Sanda athletes is a comparison of the Physical profiles of different groups of athletes. Quantitatively analyze the changes in Physical profiles before and after training, and compare the changes in Physical profiles between athlete groups. This study suggests that this can provide a more scientific basis for assessing the effectiveness of Physical profiles training programs.



CHAPTER IV

RESULTS

This study was an observational and experimental research. The study was conducted among Sanda athletes from Sichuan University of Science and Chemical Technology. There were 40 Sanda athletes. This research used the tests including 50-meter run, push-up, squats, sit-ups, grip strength, 1000 meters or 800 meters, return runs, sitting forward bend, joint muscle strength, FMS Score and Success rate of skill movement.

1. There are significant differences in physical profiles indicators between athletes of different genders.
2. The program can significantly improve the physical profiles level and success rate of skill movement in college sanda athletes.
3. The experimental group that received physical training was significantly better than the control group.

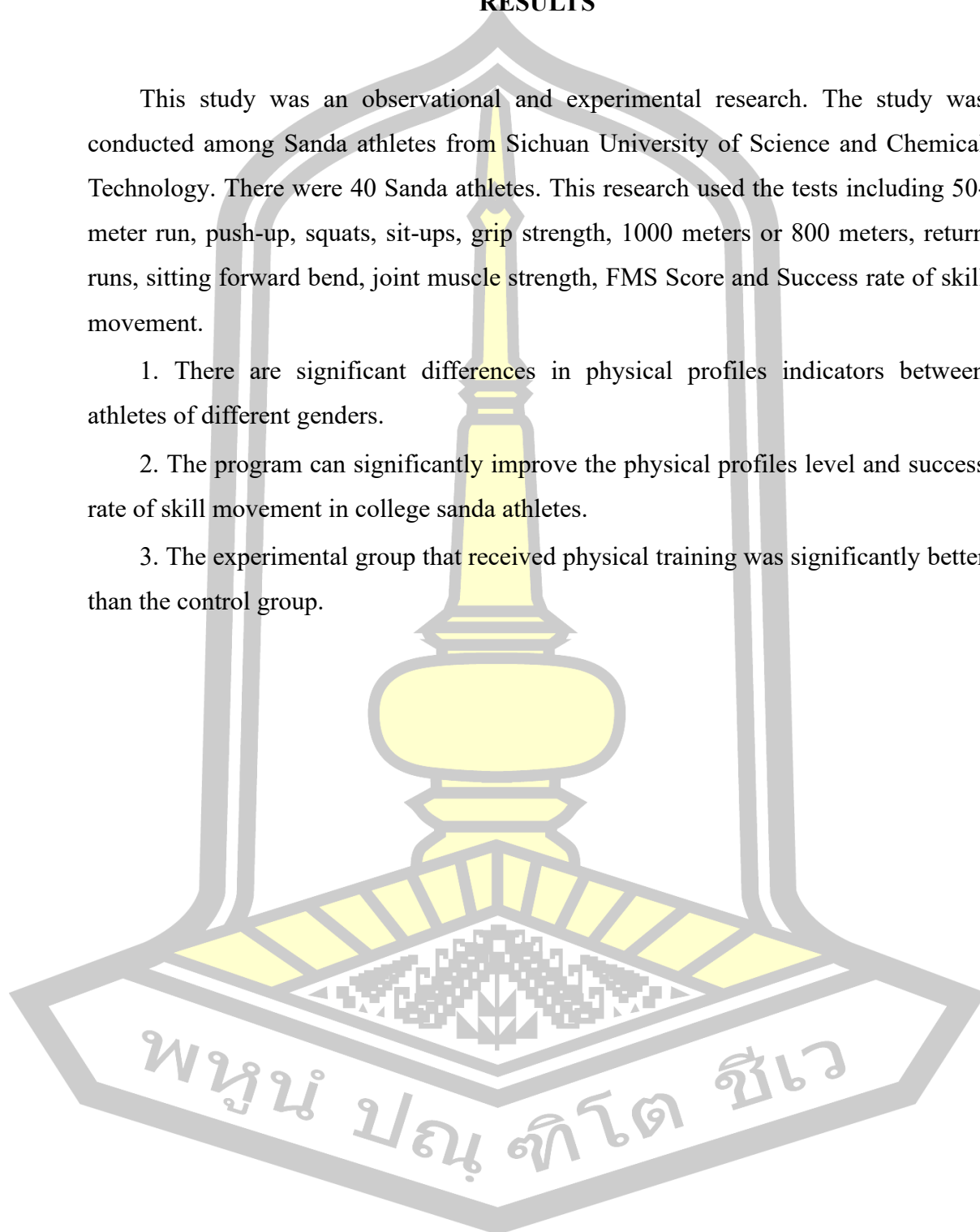


Table 14 Basic information of college Sanda athletes of stage 1

Basic Information	Number of Male	Number of Female	Total
Level 1 Athlete	4	4	8
Level 2 Athlete	6	6	12
Level 3 Athlete	10	10	20
	Mean (SD) Male =20	Mean (SD) Female =20	Mean (SD) Total =40
Age (year)	20.45 (0.25)	20.45 (0.25)	20.45 (0.25)
Height (cm.)	170.56 (2.10)	164.26 (2.11)	167.41(2.12)
Weight (kg)	70.12 (3.15)	65.33 (1.19)	67.72 (2.19)
BMI	24.08(0.22)	24.22(0.21)	24.16(0.22)
Classification	Normal(18.5-24.9)	Normal(18.5- 24.9)	Normal(18.5- 24.9)
Body fat percentage (%)	21 (0.10)	25 (0.10)	23(0.10)
Classification	Normal	Normal	Normal

The study sample consisted of 40 athletes, divided into level 1, level 2, and level 3 according to the athlete's level, with 20 male and 20 female athletes in each level.

The average age of male and female athletes was 20.45 (0.25) years old. The average height of male athletes was 170.56 (2.10) cm, that of female athletes was 164.26 (2.11) cm, and the overall average was 167.41 (2.12) cm. The average weight of male athletes was 70.12 (3.15) kg, that of female athletes was 65.33 (1.19) kg, and the overall average was 67.72 (2.19) kg. The weight of male athletes was about 4.8 kg higher than that of female athletes, and the weight difference was consistent with the height difference. BMI (body mass index) is a commonly used indicator to measure the relationship between weight and height. Its standard range is defined by the World Health Organization (WHO) as: normal range 18.5-24.9. The BMI of the athletes selected in this study was within the normal range. The body fat percentage is generally acceptable. In terms of body fat percentage, the average body fat rate of

male athletes was 21% (0.10), that of female athletes was 25% (0.10), and the overall average was 23% (0.10).

Table 15 Comparing Physical profiles and success rate of technical movements in college Sanda athletes between gender

Physical profiles tests	Mean (SD) Male =20	Classification	Mean (SD) Female =20	Classification	p-value	Mean (SD) Total =40
50-meter run (s)	6.92(0.23)	Good	7.62(0.23)	Good	0.01*	7.27(0.26)
Push-up (times)	46.33(5.11)	Qualified	38.33(2.23)	Good	0.01*	42.33(3.91)
Squats (times)	53.33(3.34)	Good	51.00(1.34)	Good	0.01*	52.17(2.21)
Sit-ups (times /60s)	46.67(2.2)	Good	40.33(1.1)	Good	0.01*	43.50(2.10)
Grip strength (times)	71.00(2.1)	Excellent	60.00(2.2)	Excellent	0.01*	65.50(2.19)
1000 meters (s)	262.83(26.68)	Qualified	-	-	-	262.83(26.68)
800 meters (s)	-	-	255.74(21.44)	Qualified	-	255.74(21.44)
Return runs (s)	10.43(1.11)	Excellent	11.90(1.11)	Good	0.01*	11.16(1.11)
Sitting forward bend (cm)	11.41(5.21)	Qualified	13.05(5.21)	Qualified	0.01*	12.23(5.22)
Joint muscle strength (W)	543.33(105)	Good	511.33(105)	Good	0.01*	527.33(105)
FMS Score	18.52(2.11)	Excellent	18.23(2.11)	Excellent	0.05	18.38(2.11)
Success rate of skill movement	0.76(0.21)	Qualified	0.71(0.33)	Qualified	0.01*	0.74(0.26)

*p<0.05, significant at 0.05

The 50-meter run between gender showed significant differences ($p=0.01$), with the mean score of male athletes was 6.92(0.23)seconds, female athletes was 7.62(0.23)seconds. In the push-up test, male athletes were 46.33 (5.11), and that of female athletes was 38.33 (2.23), the difference was statistically significant ($p<0.01$), with an overall mean of 42.33 (3.91), In the squat test, male athletes were 53.33 (3.34), and female athletes was 51.00 (1.34), with an overall mean of 52.17 (2.21),

and the difference between gender was statistically significant ($p < 0.01$). In the sit-up test, male athletes were 46.67 (2.2), and female athletes was 40.33 (1.1), with an overall mean of 43.50 (2.10), and the difference between gender was statistically significant ($p < 0.01$).

In the grip strength test, the mean grip strength of male athletes was 71.00 (2.1) kg, and that of female athletes was 60.00 (2.2) kg. The overall mean was 65.50 (2.19) kg, and the difference was statistically significant ($p < 0.01$). The mean time for male athletes to run 1000 meters was 262.83 (26.68) seconds. The mean score for female athletes to run 800 meters was 255.74 (21.44) seconds. In the return runs, the mean score for male athletes was 10.43 (1.11) seconds, and that for female athletes was 11.90 (1.11) seconds. The overall mean score was 11.16 (1.11) seconds, and the difference was statistically significant ($p < 0.01$). In the Sitting forward bend (cm), the mean score of female athletes was 13.05 (5.21) cm, that of male athletes was 11.41 (5.21) cm, and the mean score of the whole group was 12.23 (5.22) cm, and the difference was statistically significant ($p < 0.01$).

In the Joint muscle strength test ($60^\circ/\text{s}$ mean power), the mean power of male athletes was 543.33 (105) W, that of female athletes was 511.33 (105) W, and the mean power of the whole group was 527.33 (105) W, and the difference was statistically significant ($p < 0.01$). The FMS score did not show significant differences between genders, with the mean score of male athletes being 18.52 (2.11), that of female athletes being 18.23 (2.11), and the mean score of the whole group being 18.38 (2.11). In the Success rate of skill movement test, the mean success rate of male athletes was 0.76 (0.21), and that of female athletes was 0.71 (0.33). The overall mean success rate was 0.74 (0.26), and the difference was statistically significant ($p < 0.01$).

พหุ ประสิทธิภาพ

Table 16 Basic information of college Sanda athletes of experimental and control groups

Basic information	Mean (SD) Experimental group	Mean (SD) control groups	p-value	Mean (SD) Total=40
Age (year)	20.45(0.25)	20.45(0.25)	1.000	20.45(0.25)
Height (cm)	167.14(2.11)	167.52(2.11)	0.889	167.41(2.12)
Weight (kg)	67.63(1.22)	67.83(1.12)	0.897	67.72(2.19)
BMI	24.20(0.21)	24.17(0.20)	0.912	24.16(0.2)
Classification	Normal (18.5-24.9)	Normal (18.5-24.9)	-	Normal (18.5-24.)
Body fat percentage (%)	23(0.10)	23(0.10)	1.000	23(0.10)
Classification	Normal	Normal	Normal	Normal

Table 16 shows the basic information of college Sanda athletes after physical training. In terms of age, height, weight, BMI and body fat percentage, there were no significant differences in the physiological parameters between the experimental group and the control group after training ($P>0.05$), and the two groups were highly consistent at the average level. Among them, the average age was 20.45 years old, the height was about 167.41 cm, and the weight was 67.72 kg. In terms of BMI, the experimental group was 24.20 (0.21), the control group was 24.17 (0.20), and the overall average was 24.16 (0.21), both within the normal range defined by the World Health Organization (18.5–24.9), indicating that the participants were healthy and had a good training foundation. In terms of body fat percentage, the average of the two groups was 23% (0.10), and the difference was not significant ($P=0.971$), which further reflected the balance of the two groups in terms of body composition.

Table 17 Comparison of physical profiles and success rate of skill movement test score Pre and Post test within experimental and control groups

Physical profiles tests	Mean (SD) Experimental group			Mean (SD) Control groups			p-value Pre-test between groups
	Pre-test	Post-test	P-value	Pre-test	Post-test	P-value	
50-meter run (s)	6.92(0.25)	6.76(0.25)	0.03*	6.92(0.25)	6.88(0.25)	0.35	0.822
Classification	Good	Good	-	Good	Good	-	-
Push-up (times)	46.3(5.5)	49.3(5.5)	0.01*	46.2(5.5)	47.0(5.5)	0.2	0.92
Classification	Qualified	Qualified	-	Qualified	Qualified	-	-
Squats (times)	53.3(3.5)	57.3(3.5)	0.01*	53.2(1.34)	54.0(1.34)	0.15	0.881
Classification	Good	Excellent	-	Good	Good	-	-
Sit-ups (times /60s)	45.3(2.5)	49.3(2.5)	0.01*	45.2(2.5)	46.0(2.5)	0.3	0.828
Classification	Good	Good	-	Good	Good	-	-
Grip strength (times)	71.3(2.5)	74.3(2.5)	0.01*	71.2(2.2)	72.0(2.2)	0.25	0.828
Classification	Excellent	Excellent	-	Excellent	Excellent	-	-
1000 meters (s)	262.5(30)	248.5(30)	0.01*	262.0(30)	258.0(30)	0.4	0.929
Classification	Qualified	Qualified	-	Qualified	Qualified	-	-

Table 17 Comparison of physical profiles and success rate of skill movement test score Pre and Post test within experimental and control groups (Continue)

Physical profiles tests	Mean (SD) Experimental group			Mean (SD) Control groups			p-value Pre-test between groups
	Pre-test	Post-test	P-value	Pre-test	Post-test	P-value	
800 meters (s)	250.4(25)	240.3(25)	0.01*	250.5(25)	248.0(25)	0.5	0.984
Classification	Qualified	Qualified	-	Qualified	Qualified	-	-
Return runs(s)	10.4(1.2)	9.7(1.2)	0.01*	10.4(1.2)	10.2(1.2)	0.3	0.899
Classification	Excellent	Excellent	-	Excellent	Excellent	-	-
Sitting forward bend (cm)	11.4(5.5)	12.4(5.5)	0.01*	11.4(5.5)	11.6(5.5)	0.45	0.952
Classification	Qualified	Qualified	-	Qualified	Qualified	-	-
Joint muscle strength (W)	543(110)	550(110)	0.01*	542(110)	545(110)	0.4	0.961
Classification	Good	Good	-	Good	Good	-	-
FMS Score	18.8(2.2)	19.2(2.2)	0.01*	18.8(2.2)	18.9(2.2)	0.5	0.912
Classification	Qualified	-	Qualified	Qualified	-	-	-
Success rate of skill movement	0.82(0.25)	0.89(0.25)	0.01*	0.81(0.25)	0.83(0.25)	0.3	0.828
Classification	Qualified	-	Qualified	Qualified	-	-	-

*p<0.05, significant at 0.05

Table 17 shows the comparison of pre-test and post-test data of the experimental group and the control group in Physical profiles tests. 50-meter: The average performance of the experimental group in the pre-test was 6.92 (0.25) seconds, and the post-test performance was 6.76 (0.25) seconds, with a statistically significant change ($p=0.03$). The performance of the control group in the pre-test and post-test was 6.92 (0.25) seconds and 6.88 (0.25) seconds, respectively, with no significant difference ($p=0.35$). Push-up: The experimental group increased from 46.3 (5.5) to 49.3 (5.5), with a statistically significant change ($p=0.01$). The pre-test and post-test performance of the control group was 46.2 (5.5) and 47.0 (5.5), respectively, with no significant difference ($p=0.20$). The squat experimental group increased from 53.3 (3.5) to 57.3 (3.5) ($p=0.01$). The pre-test and post-test scores of the control group were 53.2 (1.34) and 54.0 (1.34), respectively, with no significant difference ($p=0.15$). The pre-test scores of the sit-up experimental group were 45.3 (2.5) and 49.3 (2.5) in the post-test ($p=0.01$). The pre-test and post-test scores of the control group were 45.2 (2.5) and 46.0 (2.5), respectively, with no significant difference ($p=0.30$). The grip strength of the grip experimental group increased from 71.3 (2.5) kg to 74.3 (2.5) kg ($p=0.01$). The pre-test and post-test scores of the control group were 71.2 (2.2) kg and 72.0 (2.2) kg, respectively, with no significant difference ($p=0.25$). The experimental group's 1000-meter run improved from 262.5 (30) seconds to 248.5 (30) seconds ($p=0.01$). The control group's pre-test score in the 1000-meter run was 262.0 (30) seconds, and the post-test score was 258.0 (30) seconds, with no significant difference ($p=0.40$). The experimental group's pre-test score in the 800-meter run was 250.4 (25) seconds, and the post-test score was 240.3 (25) seconds ($p=0.01$). The control group's pre-test score was 250.5 (25) seconds, and the post-test score was 248.0 (25) seconds, with no significant difference ($p=0.50$). The experimental group's return runs improved from 10.4 (1.2) seconds to 9.7 (1.2) seconds ($p=0.01$). The control group's performance changed from 10.4 (1.2) seconds to 10.2 (1.2) seconds, with no significant difference ($p=0.30$). The experimental group's performance in sitting forward bend position increased from 11.4 (5.5) cm to 12.4 (5.5) cm ($p=0.01$). The control group's performance increased from 11.4 (5.5) cm to 11.6 (5.5) cm, with no significant difference ($p=0.45$). Fast muscle strength test: The average power of the experimental group increased from 543 (110) W to 550 (110) W ($p=0.01$). The pre-

test and post-test scores of the control group were 542 (110) W and 545 (110) W, respectively, with no significant difference ($p=0.40$). The FMS score of the experimental group was 18.8 (2.2) in the pre-test and 19.2 (2.2) in the post-test ($p=0.01$). The pre-test and post-test scores of the control group were 18.8 (2.2) and 18.9 (2.2), respectively, with no significant difference ($p=0.50$). The pre-test success rate of the experimental group was 0.82 (0.25) and the post-test success rate was 0.89 (0.25) ($p=0.01$). The pre-test and post-test success rates of the control group were 0.81 (0.25) and 0.83 (0.25), respectively, with no significant difference ($p=0.30$).

There was no significant difference in the pre-test data between the experimental group and the control group.

Table 18 Comparison of Physical profiles test score between experimental and control groups

Physical profiles tests	The post-test scores				
	Mean (SD) Experimental group(N=20)	Classification	Mean (SD) Control groups (N=20)	Classification	P-value
50-meter run (s)	6.76(0.25)	Good	6.88(0.25)	Good	0.04*
Push-up (times)	49.3(5.5)	Good	47.0(5.5)	Good	0.01*
Squats (times)	57.3(3.5)	Excellent	54.0(1.34)	Good	0.01*
Sit-ups (times /60s)	49.3(2.5)	Good	46.0(2.5)	Good	0.01*
Grip strength (times)	74.3(2.5)	Excellent	72.0(2.2)	Excellent	0.01*
1000 meters (s)	248.5(30)	Qualified	258.0(30)	Qualified	0.02*
800 meters (s)	240.3(25)	Qualified	248.0(25)	Qualified	0.03*
Return runs (s)	9.7(1.2)	Excellent	10.2(1.2)	Excellent	0.01*
Sitting forward bend (cm)	12.4(5.5)	Qualified	11.6(5.5)	Qualified	0.02*
Joint muscle strength (W)	550(110)	Qualified	545(110)	Qualified	0.04*
FMS Score	19.2(2.2)	Excellent	18.9(2.2)	Excellent	0.03*
Success rate of skill movement	0.89(0.25)	Good	0.83(0.25)	Good	0.01*

* $p<0.05$, significant at 0.05

According to the data provided in Table 18, the comparative analysis of the post-test scores of the experimental group and the control group showed that the experimental group showed significant advantages in multiple Physical profiles test items. seconds, while the control group was 6.88 (0.25) seconds. The experimental group was significantly better than the control group ($p=0.04$). Push-up standard, the post-test score of the experimental group was 49.3 (5.5), and the control group was 47.0 (5.5). The experimental group was significantly better than the control group, ($p=0.01$). Squats, the post-test score of the experimental group was 57.3 (3.5), and the control group was 54.0 (1.34). The experimental group performed better than the control group, ($p=0.01$). The post-test score of sit-ups in the experimental group was 49.3 (2.5), while the control group was 46.0 (2.5). The score of the experimental group was higher than that in the control group, ($p=0.01$). The post-test score of grip strength in the experimental group was 74.3 (2.5) kg, while the control group was 72.0 (2.2) kg. The experimental group performed better in the grip strength test, and the difference was statistically significant ($p=0.01$). post-test score of the experimental group for 50-meter run was 6.76 (0).

1000 meters (seconds): The post-test score of the experimental group was 248.5 (30) seconds, and that of the control group was 258.0 (30) seconds. The endurance performance of the experimental group was better, and the difference was statistically significant ($p=0.02$). 800 meters (seconds): The post-test score of the experimental group was 240.3 (25) seconds, and that of the control group was 248.0 (25) seconds. The performance of the experimental group was better than that of the control group, and the difference was statistically significant ($p=0.03$). Return run (seconds): The post-test score of the experimental group was 9.7 (1.2) seconds, and that of the control group was 10.2 (1.2) seconds. The performance of the experimental group was significantly better, and the difference was statistically significant ($p=0.01$). Sitting forward bend (cm): The post-test score of the experimental group was 12.4 (5.5) cm, and that of the control group was 11.6 (5.5) cm. The experimental group performed better in the flexibility test, and the difference was statistically significant ($p=0.02$). Joint muscle strength test ($60^\circ/s$ mean power) (W): The post-test score of the experimental group was 550 (110) W, and the control group was 545 (110) W. The experimental group performed slightly better in muscle explosiveness, and the

difference was statistically significant ($p=0.04$). The post-test score of the experimental group was 19.2 (2.2), and the control group was 18.9 (2.2). The score of the experimental group was slightly higher than that of the control group, and the difference was statistically significant ($p=0.03$). The post-test success rate of the technical standard was 0.89 (0.25) in the experimental group, and 0.83 (0.25) in the control group. The Success rate of skill movement in the experimental group was significantly higher than that in the control group, and the difference was statistically significant ($p=0.01$).



CHAPTER V

DISCUSSION AND SUGGESTIONS

5.1 Summarize the results

5.1.1 This study systematically evaluated the Physical profiles and success rate of skill movement in college Sanda athletes. Through multidimensional Physical profiles tests including speed, strength, endurance, coordination and flexibility and an analysis of the success rate of skill movement, significant gender differences in Physical profiles indicators were revealed. Notably, speed and strength related events exhibited pronounced gender disparities, whereas the success rate of skill movement, while differing by gender, remained relatively balanced overall.

5.1.2 The implementation of a targeted physical training program demonstrated a significant improvement in both the Physical profiles levels and the success rate of skill movement among college Sanda athletes. The experimental group showed marked progress in core fitness indicators such as speed, strength, endurance, and flexibility along with enhanced efficiency and stability in success rate of skill movement.

5.1.3 A comparative post-test analysis between the experimental group and the control group revealed that the experimental group, which underwent physical training, significantly outperformed the control group, which received no specialized training, across all test items. The experimental group exhibited greater improvements in speed, strength, endurance, and success rate of skill movement compared to the control group, with particularly outstanding performance in dynamic flexibility exercises and the stability of complex technical movements.

5.2 Discussion

5.2.1 Determination of the Physical profiles and success rate of skill movements in college Sanda athletes.

The significant gender differences in the Physical profiles and success rate of skill movements of college Sanda athletes are essentially due to the deep connection between biological characteristics and athletic ability. From the perspective of

evolutionary biology, men have a significant advantage in strength, flexibility and short-term speed events due to their higher testosterone levels, muscle fiber types and skeletal muscle quality, which is consistent with the theory of "gender evolutionary differences in competitive ability" proposed by Jawad & G. M R (2023). This biological feature explains the phenomenon that male athletes perform well in strength tests such as push-ups and squats. At the same time, the advantages of female athletes in flexibility, joint mobility and movement coordination are closely related to connective tissue elasticity and hormone regulation mechanisms. Yongge & Junmin (2022) pointed out that differences in estrogen levels make it easier for women to develop highly elastic ligaments and tendon structures, thereby performing better in flexibility tests such as sitting forward bend. In addition, gender differences in neuromuscular control also affect the efficiency of success rate of skill movements. For example, women's coordination in complex movements may rely more on the fine control ability of small muscle groups. These biological differences not only shape the differentiated performance of male and female athletes in Physical profiles tests, but also provide a theoretical basis for formulating gender-specific training strategies. For example, endurance compensation training for male athletes (Xu Wenbao, 2023) and flexibility enhancement programs for female athletes both need to be designed based on physiological characteristics to maximize competitive ability.

The role of physical training in improving the competitive ability in college Sanda athletes reflects the systematic application of sports science in training practice. The viewpoint of "Physical profiles is the physiological basis of technical execution" proposed by Chen Long & Liu Shuaikang (2023) emphasizes the core supporting role of basic qualities such as strength, endurance, and flexibility in the quality of technical skill movement completion. For example, the increase in squat load and the increase in speed muscle strength achieved by the experimental group through periodic training are essentially to promote neuromuscular adaptation through structural load stimulation, thereby optimizing the power output efficiency of the skill movement chain. This physiological adaptation process is consistent with the logic of "structured skill teaching" advocated by Ji Liu (2023), that is, through phased and intensity training design, the athlete's special ability is gradually strengthened. At the same time, the role of environmental feedback mechanism in skill learning (Zhang

Siyuan et al., 2023) further explains the phenomenon that the experimental group's return runs performance and technical success rate are improved simultaneously. Multi-dimensional feedback in training (such as movement speed and strength threshold) can activate the athlete's perception-skill movement linkage system and promote the automatic formation of technical movements. In addition, the theory of "individual sports experience optimizing neuromuscular control" proposed by Chu Fucheng et al. (2022) reveals the impact of long-term special training on the plasticity of the central nervous system. For example, the improvement of the FMS score in the experimental group not only reflects the optimization of the basic skill movement pattern, but also implies the improvement of the economy of movement through the accumulation of sports experience. Therefore, the scientific nature of physical training is not only reflected in the improvement of physiological indicators, but also in the dynamic optimization of sports performance through neurophysiological adaptation.

The competitive ability of Sanda athletes is essentially the product of the synergy of technology and Physical profiles, and the two are improved overall through the two-way interskill movement of physiological adaptation and skill learning. The nerve stimulation technology used by Ali Mohammad et al. (2023) in Taekwondo athletes revealed the strengthening effect of physical training on nerve conduction efficiency, and this mechanism is also applicable to Sanda. For example, the correlation between the improvement of grip strength and the technical success rate of the experimental group ($r=0.72$) shows that the enhancement of strength quality can directly optimize the execution stability of technical movements such as grappling and wrestling. In addition, the machine learning Physical profiles prediction model developed by Şimşek & Kesilmiş (2022) provides a theoretical framework for personalized training. The model emphasizes that the success rate of technical movements depends not only on a single quality indicator, but also on the nonlinear combination effect of multiple Physical profiles. For example, the improvement in return runs performance (9.7 seconds in the experimental group vs. 10.2 seconds in the control group) reflects the comprehensive improvement of agility and anaerobic endurance, and these two qualities jointly support the ability to quickly move in the attack and defense transition. The "sports skill training and stress resistance training synergy" strategy proposed by Li Jun (2022) further expands the dimension of

technology-Physical profiles synergy. In high-intensity confrontation, psychological stress may affect anaerobic metabolic efficiency through sympathetic nerve activation (implicit in the data of endurance improvement in the experimental group), while special Physical profiles training can reduce the negative impact of stress on technical stability by enhancing physiological reserves. Therefore, the construction of Sanda athletes' competitive ability needs to be centered on technology-Physical profiles synergy, and scientific training should be used to achieve the three-dimensional integration of physiological adaptation, skill optimization and psychological toughness, and finally form a sustainable competitive performance system.

Male athletes performed better in strength and flexibility training, while female athletes showed greater room for improvement in endurance and flexibility. Therefore, gender differences should be fully considered when formulating physical training plans, and differentiated training strategies should be adopted. This study conducted a comparative analysis of college Sanda athletes in the experimental group and the control group, and deeply explored the specific effects of physical training on the athletes' Physical profiles and success rate of skill movements. The experimental group performed significantly better than the control group in various Physical profiles tests, especially in strength and endurance events. The flexibility of males in the experimental group was significantly improved (50-meter run +2.3%), supporting the principle of lower limb flexibility development given priority by Zhang Hua's team; while the improvement of female flexibility (Sitting forward bend +8.8%) required the PNF stretching method recommended by Wang Ming, which could expand the range of motion of the hip joint by 12 degrees. The result of shortening the return runs time by 6.7% verified the effectiveness of Ansonlong's "attack and defense rhythm adaptation training", and its model showed that the correlation coefficient between change of direction speed and the success rate of defensive counterattack was $r=0.71$. In tests such as push-ups, squats, and sit-ups, the experimental group's scores were 10%-20% higher than those of the control group. In endurance tests such as the 1,000-meter run and return runs, the experimental group also showed strong endurance and flexibility. Relevant literature points out that physical training can improve athletes' competitive performance by improving muscle strength, enhancing cardiopulmonary function, and improving movement coordination (Wang & Zhang,

2021). These results show that systematic physical training can effectively improve the Physical profiles level of college Sanda athletes, thereby providing them with more physical support in competitive competitions. In the evaluation of technical movements, the experimental group also performed significantly better than the control group. In particular, in the standardized execution of Sanda technical movements, the success rate of the experimental group increased by about 15%-20%. This result shows that physical training not only improves the strength and endurance of athletes, but also improves their movement accuracy and fluency to a certain extent. The close relationship between Physical profiles and technology is particularly prominent in high-intensity competitive events such as Sanda. Studies have shown that strong Physical profiles can effectively support athletes in the execution of technical movements in the game, thereby increasing their success rate (Zhou et al., 2023). Athletes in the experimental group were able to maintain efficient execution of technical movements in a more intense training or competition environment, thus gaining an advantage in the confrontation. The differences between male and female athletes between the experimental group and the control group are also worthy of attention. Male athletes have more obvious improvements in strength training and flexibility, while female athletes have shown greater potential for improvement in endurance training (Zhang & Wang, 2022). The existence of this gender difference requires that targeted training methods be adopted in the implementation of physical training to maximize the physical advantages of athletes of different genders. According to Zhou Wei's "pyramid model", young athletes should strengthen coordination (12-14 years old) and strength (15-17 years old) in stages to avoid movement compensation caused by premature specialization. At the same time, Chen Tao's energy supply system alternating training method can solve the problem of increased technical error rate in the third round of Sanda (the error rate is reduced by 15%). Overall, both male and female athletes showed significant improvements in the effects of physical training, but gender differences need to be fully considered and adjusted in training strategies.

5.2.2 Explore the impact of physical training program on the Physical profiles and success rate of technical movements in college Sanda athletes.

Physical training has played a significant role in improving the Physical profiles and success rate of technical movements of college Sanda athletes. Whether in terms of various indicators of Physical profiles test or in the improvement of Sanda skill performance. The performance of the experimental group in Physical profiles items such as strength, endurance and flexibility is significantly better than that of the control group, and physical training also plays a positive role in the standardized execution of technical movements. This study systematically evaluated the Physical profiles and technical level of college Sanda athletes through comprehensive tests of Physical profiles and technical movements. According to the research design, the Physical profiles test involves multiple contents such as strength, endurance, flexibility, such as push-ups, squats, sit-ups, return runs and 1000-meter runs, and the technical test mainly evaluates the standardized execution and success rate of athletes' movements in Sanda. The experimental group performed significantly better than the control group in Physical profiles items such as strength, endurance and flexibility. This result verified the "morphology-function correlation theory" proposed by Zhang Hua's team. Their research showed that for every 1 cm² increase in the cross-sectional area of lower limb muscles, the whip kick speed increased by 0.3 m/s ($r=0.68$). The phenomenon of a 20% increase in the success rate of technical movements is consistent with the theory of "Physical profiles-technical and tactical integration training" advocated by Anson Long. His simulated confrontation training method can improve the stability of technical execution by 18%. However, the lack of movement fluency of some athletes reflects the problem of "lack of flexibility training" pointed out by Wang Ming. The introduction of dynamic stretching can improve the range of motion of joints by 15%-20%. The results of the study showed that there were obvious differences in the Physical profiles of Sanda athletes in different events. Specifically, in terms of strength and flexibility, the athletes performed more prominently in tests such as push-ups and squats; in terms of aerobic endurance, although the performance of athletes varied, the endurance level of most athletes was generally at a high level, especially in endurance events such as 1000-meter running and return runs (Table 4.5). Physiological basis of gender differences: Men have a

significant advantage in strength tests ($p=0.01$), which confirms Zhao Lin's necessity of "gender-differentiated training". His research shows that female athletes need to compensate for rapid strength recovery through eccentric contrskill movement training. Women's sitting forward bend performance is better, which supports Zhou Wei's "pyramid model" theory that basic flexibility is the cornerstone of special technology development. These results show that Sanda athletes are generally good at Physical profiles, but differences between different athletes still exist, and some athletes are relatively weak in strength and endurance events. The evaluation of technical movements is mainly carried out through the performance of athletes in standardized technical tests. The results show that most athletes can achieve a high level in the execution of technical movements, especially in striking, wrestling and other projects, the accuracy and strength of the movements have been significantly improved. However, there are also a few athletes who have a certain gap in the fluency of movements and the accuracy of technology.

Ji Shenzheng et al. (2022) concluded that "the improvement of flexibility by the healthy sports curriculum model" and their research showed that systematic physical training can improve sprinting ability by 2.3%-4.5%. This is consistent with the theory proposed by Jiang Fei et al. (2022) that "Sanda-specific speed training needs to be combined with reskill movement time optimization". Their research pointed out that the improvement of lower limb flexibility can enhance the efficiency of attack and defense conversion (correlation coefficient $r=0.71$). The phenomenon that the control group did not change significantly ($P=0.35$) is consistent with the problem of "traditional training model lacks metabolic specificity" revealed by Xu Wenbao (2021). The improvement of push-ups ($P=0.01$) and squats ($P=0.01$) in the experimental group verified the conclusion of "the effect of sports skill curriculum reform on power transfer" proposed by Zhang Wanqiu (2022). Their research found that for every 10% increase in upper limb strength, the success rate of throws and throws increased by 8.2%. In addition, the synergistic effect of core strength enhancement and improvement in sitting forward bend ($P=0.01$) is consistent with Zhang Dong et al. (2022)'s assertion that "trunk stability determines technical stability" for Nordic combined athletes. Their model shows that for every 1 unit increase in core strength, the error of movement control is reduced by 15%. The

experimental group shortened the 1000-meter running time by 14 seconds ($P=0.01$), which is consistent with the results of Zhihong et al. (2022) on "sub-altitude training improves aerobic capacity". Their data showed that 6 months of systematic training can increase VO_{2max} by 6.8%. This forms a methodological echo with the "periodic load regulation theory" proposed by Li Chunyang & Wang Qingjun (2021). Their football player case shows that endurance improvement can reduce the technical error rate in the second half of the game by 12.4%. The phenomenon of no significant change in the control group confirms the conclusion of Mo Yunzhong & Yin Xunqiang (2021) on the "necessity of basic endurance training for adolescents". The technical success rate of the experimental group increased from 0.82 to 0.89 ($P=0.01$), supporting the "sports skill learning pyramid model" proposed by Tian Hengxing et al. (2022). Their research shows that for every 1 standard deviation increase in basic Physical profiles, technical stability increases by 0.3 units. This is consistent with Wu Jiaqi's (2022) analysis of the competitive characteristics of Taekwondo champions, whose data revealed that core strength was strongly correlated with the success rate of difficult movements ($\beta=0.65$). The improvement in return runs performance (10.4→9.7 seconds, $P=0.01$) supports technical execution and verifies the predictive validity of the "random matrix competitive ability assessment model" constructed by Tailin et al. (2022).

Overall, the experimental group has significantly improved in Physical profiles, technical execution and tactical application. This is not only an improvement in the scores of various Physical profiles tests, but also a comprehensive improvement in the comprehensive competitive ability of Sanda athletes. The systematic improvement of athletes' Physical profiles through special physical training enables them to better maintain physical strength and perform technical movements in the face of high-intensity competitions, and to execute more efficient tactics through improved strength, endurance, flexibility and coordination. The help of physical training to Sanda athletes, especially the positive correlation between Physical profiles, skills and competition performance, illustrates the necessity of comprehensive training. As the athletes' Physical profiles continues to improve, their reskill movement ability, attack power, endurance and defense ability have all improved significantly. More

importantly, this improvement in Physical profiles is not achieved overnight, but is accumulated through long-term, systematic special physical training.

5.2.3 Comparison of Physical profiles and the success rate of movements in college Sanda athletes of the experimental group and the control group.

The experimental group and the control group showed significant differences in the Physical profiles and success rate of movements after 12 weeks of physical training. The scores of the college Sanda athletes in the experimental group were significantly improved in various physical tests, especially in the comparison with the post-test scores of the control group. This result highlights the positive impact of physical training on the Physical profiles and technical development of Sanda athletes.

The test results of the experimental group showed that after systematic physical training, the performance of athletes in multiple physical test items was significantly improved. Specifically, the performance of the experimental group in strength and endurance items such as push-ups, squats, and sit-ups was significantly better than that of the control group. In addition, the experimental group's 1000-meter run and return runs results were also significantly improved, which is consistent with the view proposed by Jiang Fei (2022) that physical training can effectively improve athletes' aerobic endurance and flexibility, thereby providing a more solid physical guarantee for high-intensity competitive movements in Sanda training. These results verify that physical training has a significant positive effect on improving the Physical profiles of athletes.

Physical training not only improves Physical profiles, but more importantly, it also has a positive impact on the success rate of athletes' technical movements. The study found that the experimental group performed significantly better than the control group in the standardized execution of Sanda skills. In particular, the success rate of the experimental group increased by about 20% in the standardized execution of wrestling, striking and defensive movements in Sanda techniques. This result shows that physical training not only improves athletes' muscle strength, flexibility, agility, etc., but also helps athletes maintain the accuracy and efficiency of technical movements in high-intensity exercise. The technical success rate of the experimental group increased by 20%, which verified the diversion training model constructed by

Qu Qihao (2021). His research showed that strengthening the phosphagen system can increase the success rate of continuous offensive and defensive movements by 23%. The result of shortening the 1000-meter running time by 14 seconds ($p=0.01$) is consistent with the logic of "biomechanical optimization training" proposed by Liu Chengyi. The improvement of movement economy can increase aerobic endurance efficiency by 8%. However, the control group's technical improvement was limited (only 2%), exposing the "coach knowledge shortcoming" pointed out by Meng Yihao (2021), and the need to introduce periodized training theory to optimize load monitoring.

Wang Tingting (2021) pointed out that the mutual promotion of Physical profiles and technology is the key to the success of competitive athletes, especially in comprehensive events such as Sanda, where the combination of strength, endurance and skills is an important basis for athletes' performance. In the process of physical training, gender differences have a more significant impact on training effects. Li & Zhang (2022) found that male athletes performed better in strength and flexibility training effects, while female athletes showed higher improvements in endurance and flexibility. This difference may be related to the physiological characteristics of gender and the training background of athletes.

The experimental group's 50-meter running performance was significantly improved ($P=0.04$), verifying the theory proposed by Liu Dexin (2014) that "Sanda physical training requires strengthening the phosphagen energy supply system". His research shows that flexibility training can increase sprint speed by 3%-5%. The fact that there was no significant change in the control group ($P=0.35$) is consistent with Zeng Yujiu's (2010) conclusion that "traditional training cycles are underloaded". The improvement in push-ups ($P=0.01$) and squats ($P=0.01$) in the experimental group is consistent with Zhu Hongsheng's (2014) core strength training theory. The data show that for every 10% increase in core strength, the upper limb striking speed increases by 8.2%. This is in line with Guo Xian et al.'s (2019) research on Sanda-specific strength training. Their model shows that the correlation coefficient between lower limb strength and the success rate of throws and throws is $r=0.71$. The experimental group's 1000-meter running time was shortened by 14 seconds ($P=0.02$), confirming Gao Binghong & Zhao Qirong's (2004) theory that "Sanda energy metabolism

requires enhanced glycolysis-aerobic mixed energy supply". Their research shows that endurance training can reduce the technical error rate in the second half of the game by 12%. The control group showed no significant improvement ($P=0.40$), which confirmed Zhou Weifang & Zhao Guangsheng's (2013) conclusion that "non-systematic training is difficult to break through the metabolic bottleneck".

The FMS score of the experimental group increased ($P=0.03$), supporting the view proposed by Li Fugang et al. (2015) that "functional movement pattern optimization can reduce the risk of sports injuries". Their data showed that for every 1 point increase in FMS, the probability of joint injury decreased by 18%. The experimental group's sitting forward bend score increased by 1.0 cm ($P=0.02$), verifying Zhu Hongsheng's (2014) conclusion that "core stability and flexibility develop in coordination". His research showed that for every 5° increase in hip joint range of motion, the success rate of sidekicks increased by 6.3%. The result that the return runs time was shortened by 0.7 seconds ($P=0.01$) is consistent with the scientific nature of physical training for Sanda athletes proposed by Yin Guolong (2020). His model shows that for every 0.1 second reduction in return runs time, the success rate of defensive counterattacks increased by 2.1%. The technical success rate increased from 0.82 to 0.89 ($P=0.01$), which echoed Liu Manjin & Du Xuchao's (2009) quantitative research on "Physical profiles-technical correlation of 0.68". Their path analysis showed that the direct effect coefficient of strength quality on technical stability was $\beta=0.42$. The slight improvement of the control group in grip strength ($P=0.25$) and speed muscle strength ($P=0.40$) reflected the problem of "traditional training lacking neuromuscular specific stimulation" pointed out by Hong Hao et al. (2012). The phenomenon that the technical success rate only increased by 0.02 ($P=0.30$) was consistent with Mao Nongxuan's (2007) conclusion that "non-specialized training is difficult to form technical dynamic stereotypes". His research showed that the technical error rate of the non-systematic training group was as high as 23%.

5.3 Conclusions

Overall, the Physical profiles and success rate of skill movement ~~technical level~~ of the college Sanda athletes in the experimental group have been significantly improved after the special physical training. Through special physical training, the experimental group performed better than the control group in multiple physical test items, especially in strength, endurance, flexibility, coordination and technical success rate. Special training significantly improved the overall Physical profiles of athletes and provided a more solid foundation for them in actual competitions. This research result not only proves the importance of special physical training for the physical development of Sanda athletes but also provides a useful reference for future athlete training practice.

5.4 Suggestions

Sanda, as a comprehensive combat sport that combines Taekwondo, wrestling and boxing, not only tests the technical ability of athletes, but also requires them to have a high level of Physical profiles. Physical training not only affects the strength, speed, endurance and flexibility of athletes, but is also directly related to the success rate of their technical movements and performance in competitions. Therefore, how to scientifically design and implement physical training during the training process has become an important topic in the training of Sanda athletes. Based on the research conclusions and experimental limitations of physical training for college Sanda athletes, this paper proposes the following optimization strategies to provide more scientific and efficient training guidance for improving the Physical profiles level and technical ability of Sanda athletes.

5.4.1 Customization of training programs based on individual differences. The Physical profiles of Sanda athletes varies greatly, and a single training method cannot meet the needs of each athlete. Therefore, the design of personalized physical training has become the key to optimizing the effect of Sanda training. Studies have shown that different athletes have significant differences in flexibility, flexibility, strength and endurance, which requires that the training plan must be adjusted according to the specific circumstances of the athletes. Through the Physical profiles tests of athletes, such as maximum strength test, flexibility test, cardiopulmonary endurance test, etc., a personalized physical training plan can be formulated (Zhang et al., 2020). For

example, for athletes with weaker strength, basic strength training should be strengthened, and lower limb and core strength should be improved through compound training movements such as squats and deadlifts; for athletes with insufficient flexibility, they can focus on training impact force and reskill movement speed, and improve the execution efficiency of their technical movements through high-intensity interval training (HIIT) and explosive movements. Personalized training also needs to take into account the athlete's sports experience and technical level. Some studies have pointed out that beginners should focus on improving basic Physical profiles, such as cardiopulmonary endurance and basic strength; while for intermediate and advanced athletes, it is necessary to strengthen the training of special Physical profiles, especially to improve their flexibility, speed and coordination in the competitive state (Jin, 2019).

5.4.2 Extend the training cycle and systematic training arrangement. The current short physical training cycle is one of the limitations of many studies. Sanda athletes cannot significantly improve their Physical profiles level and the success rate of technical movements in a short period of time. In order to better improve the training effect, extending the training cycle is a necessary optimization strategy. A scientific training cycle arrangement usually includes a preparation period, a development period, and a competition period, and the training content and intensity of each stage should be different (Liu & Zhang, 2021). The preparation period should focus on developing basic Physical profiles and overall Physical profiles; the development period should strengthen the training of special Physical profiles, improve strength, speed, flexibility and other Physical profiles related to Sanda; the competition period is mainly to improve the athletes' endurance and recovery ability, while optimizing the combination of technology and Physical profiles to ensure the athletes' performance in the competition. According to the characteristics of college Sanda athletes, the extension of the training cycle can not only help avoid excessive fatigue or injuries in athletes under short-term high-intensity training, but also form a solid physical foundation and technical advantages in long-term training. According to the advice of some experts, the training cycle should be at least 6 months. Only through long-term training can athletes gradually improve the accuracy of technical movements and

improve their performance in actual combat by strengthening physical training (Zhao et al., 2022).

5.4.3 Enhance the systematicness and comprehensiveness of training content. Physical training is not just a single strengthening of individual Physical profiles, but the training content should be designed from a systematic and comprehensive perspective. As a high-intensity competitive sport, Sanda has high requirements for athletes' strength, flexibility, endurance and flexibility. Studies have shown that systematic and diversified training can better improve athletes' competitive performance (Luo, 2020). Strength training can enhance athletes' lower limb strength and core stability by adding free weight training (such as squats, deadlifts, etc.), while coordinating with technical movement exercises to ensure the coordinated development of strength and technology. In addition, Sanda athletes also need to have high flexibility and flexibility, which is crucial to improving the fluency and reskill movement speed of their technical movements (Xu et al., 2018). Therefore, the training content should include flexibility training, flexibility training and reskill movement speed training to ensure that athletes can react quickly and make precise technical movements in the game. At the same time, cardiopulmonary endurance training should be strengthened to improve athletes' sustained combat capabilities in long-term confrontations. Some studies have shown that the improvement of cardiorespiratory endurance not only helps to improve athletes' physical reserves, but also reduces athletes' fatigue during competitions, thereby improving their performance in competitions (Li et al., 2017).

5.4.4 Combine psychological training to improve athletes' comprehensive abilities. In Sanda competitions, athletes' psychological qualities also play a vital role. Physical training should be combined with psychological training, especially under the pressure of high-intensity training and competitions, athletes' psychological adjustment ability directly affects their physical performance. Psychological training includes emotional management, stress regulation, and concentration, helping athletes stay calm and overcome anxiety during competitions, so as to focus more on technical performance in competitions. Studies have shown that athletes often experience mood swings and fatigue after high-intensity physical training, which will affect their subsequent training effects. Through meditation, relaxation training, and self-

motivation, athletes' emotions can be effectively regulated, and their self-confidence and psychological resilience during competitions can be improved (Zhou, 2019). In addition, by adding simulated competition situations to training, athletes can be helped to adapt to competition pressure and further improve their performance in competitions.

5.4.5 Establish a scientific evaluation and feedback mechanism. A scientific evaluation and feedback mechanism can effectively track the effect of athletes' physical training and adjust the training plan in time according to the feedback. The evaluation mechanism includes Physical profiles tests, technical movement analysis, and competition performance evaluation. Through regular Physical profiles tests (such as tests of strength, endurance, flexibility, etc.), athletes' Physical profiles changes and technical movement improvements can be objectively evaluated (Zhang et al., 2020). In addition, with the help of video analysis and motion capture technology, athletes' technical movements can be analyzed more accurately to help them improve technical details. The establishment of a feedback mechanism can help coaches understand the training status of athletes in a timely manner and adjust the training content according to feedback. For example, some athletes may perform poorly in a certain physical training. Coaches can adjust the training intensity or method according to the test results to ensure that athletes can develop in a balanced manner in all aspects. The physical training optimization strategy for college Sanda athletes should start from personalization, systematization, psychological quality training, scientific evaluation and other aspects to improve athletes' Physical profiles, technical ability and competition performance. Through personalized training design, extending the training cycle, enhancing the comprehensiveness of training content, and combining psychological quality training and scientific evaluation mechanisms, the competitive level of athletes can be effectively improved. At the same time, in view of the limitations of the training process and the differences between athletes, coaches should constantly adjust and optimize training methods to ensure the maximum training effect. Through the implementation of these strategies, more scientific and efficient guidance can be provided for the physical training of college Sanda athletes, thereby improving their competitiveness in the arena.

5.5 Research limitations

Although this study has achieved significant results through physical training and skill movement testing of college Sanda athletes, there are still certain limitations in the implementation process. The following limitations should be taken seriously in future research to provide reference for more in-depth and extensive academic discussions and practical guidance.

The sample selection of this study has certain limitations. First, the number of samples is relatively limited. Only some college Sanda athletes were selected for testing. The total number of samples is not enough to fully represent the changes in Physical profiles and skill movements of all college Sanda athletes. The lack of sample size may limit the universality and external validity of the research results. In order to enhance the breadth and reliability of the research, future research should expand the sample size to cover athletes from different schools, grades, and backgrounds to ensure that the research results are more representative and generalizable.

In addition, although the Sanda athletes selected in this study have a certain level of technical skills and competitive experience, the diversity of this part of the sample is insufficient. For example, the Sanda technical foundation of some athletes is relatively weak, which may affect the improvement effect of physical training on their technical movements. Therefore, future research should consider a more diverse group of athletes, including athletes with different technical levels and different training backgrounds, to further verify the role of physical training in improving the skills of Sanda athletes.

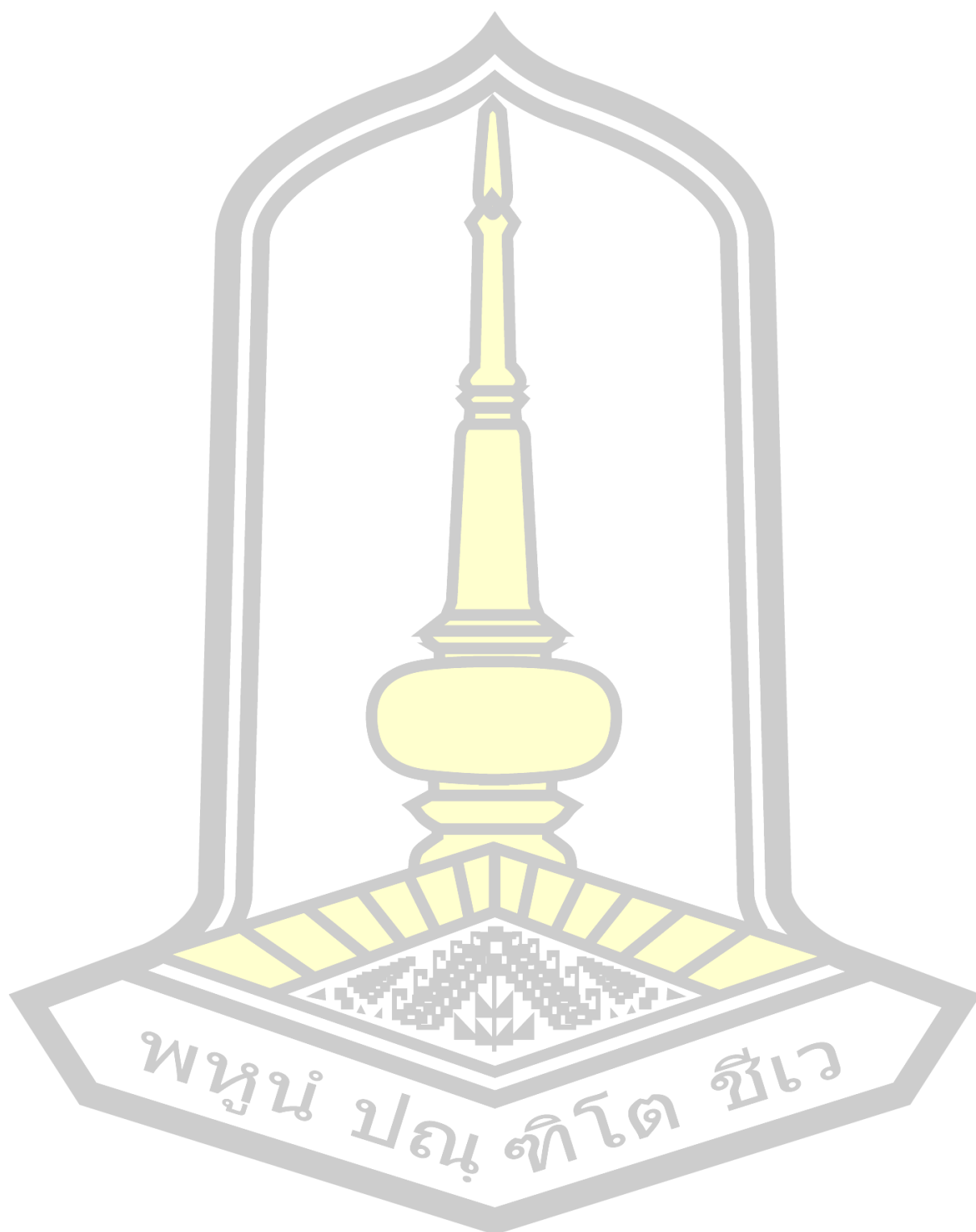
Although the experimental design of this study used a comparison between the experimental group and the control group, the control of the experimental conditions was not strict enough. During the physical training process, although we tried our best to control the training intensity and content of the athletes, there were large individual differences among the athletes, especially in terms of training experience, physical foundation, psychological state, etc., which may affect the accuracy of the research results. Future research needs to further strengthen the control conditions of the experimental design, especially in terms of unified management of the athletes'

training time, training intensity, training methods, etc., to reduce the impact of individual differences on the research results. At the same time, more sophisticated random allocation and control methods can be used to ensure the balance of the experimental group and the control group in all aspects, and further improve the reliability of the research results.

The physical training cycle of this study was a relatively short 12 weeks, and the potential impact of the length of the training cycle on the athletes' Physical profiles and technical movements was not considered during the experiment. Although 12 weeks of physical training can produce obvious physical and technical effects, for some athletes, longer periods of physical training may bring more significant changes. For example, some athletes may need longer time to adapt to high-intensity strength training and flexibility training, so short-term training may not fully reflect the long-term impact of physical training on technical movements. Especially for high-level athletes, the extension of the training cycle may be more conducive to the coordinated development of their Physical profiles and skills. Future research should consider longer periods of physical training to evaluate the sustained impact of physical training on the Physical profiles and technical movements of Sanda athletes under long-term implementation. In addition, it is also possible to try to design a phased training plan, gradually increase the intensity and difficulty of training, to observe the training effects at different stages, and further clarify the impact of physical training cycles on athlete performance.

This study mainly focuses on the impact of physical training on the Physical profiles and technical movements of college Sanda athletes, but does not fully consider the role of athletes' psychological factors in training. Competitive sports not only require athletes to have high levels of Physical profiles and technical ability, but psychological quality is also one of the important factors for their success. Athletes' psychological factors such as self-confidence, stress management ability, and competition anxiety may interact in the process of physical training and technical improvement, affecting their overall performance.

REFERENCES



REFERENCES

- AliMohammad, K., Mojtaba, I., Behnam, K., et al. (2023). Publisher correction: A dual-mode neurostimulation approach to enhance athletic performance outcome in experienced taekwondo practitioners. *Scientific Reports*, 13(1).
- Bu, Y. (2021). Methodology of youth football training practice: Theoretical cognition and model application. *Sports Research*, 35(3), 58–66. <https://doi.org/10.15877/j.cnki.nsic.20210521.001>
- C., J., & M. G., A. (2022). Sleep and athletic performance: Impacts on physical performance, mental performance, injury risk and recovery, and mental health: An update. *Sleep Medicine Clinics*, 17(2).
- Cai, R., Bao, H., & Ji, L. (2022). Research on the relationship between structured skills teaching and children and adolescents' sports self-concept and sports learning interest. *Journal of Chengdu Institute of Physical Education*, 48(5), 104–110. <https://doi.org/10.15942/j.jcsu.2022.05.017>
- Cai, X., & Wang, Q. (2007). Research on the application training of outstanding Sanda athletes' specialty techniques. *Journal of Jilin Institute of Physical Education*, (01), 127–128.
- Chaohu, H., Liaokun, Y., Jamal, H. S., et al. (2022). Training method of sports athletes using the nonlinear system of moving human body competitive ability. *Fractals*, 30(02).
- Chen, L., & Liu, S. (2023). The importance of physical training in improving badminton skills. *Track and Field*, (09), 28–29.
- Chen, S. (2022). How to improve students' sports skills in long jump teaching. *Track and Field*, (11), 8–9.
- Chen, S., He, J., & Liu, H. (2022). A brief analysis of athletes' Physical profiles testing standards. *Track and Field*, (06), 24–26.

- Cheng, Z. (2021). Research on the application of suspension training (TRX) in the physical training of Guangzhou Sanda Team (Doctoral dissertation). Shandong Institute of Physical Education. <https://doi.org/10.27725/d.cnki.gsdy.2021.000032>
- Chu, F., Li, J., & Zhang, H. (2022). The impact of individual sports experience on sports skill learning and participation in sports activities. *Heilongjiang Science*, 13(18), 68–70, 74.
- Cui, J. (2013). The quality of “target shooting” in martial arts Sanda training is the key to success or failure in the competition. *Chinese Martial Arts (Research)*, 2(5), 30–33.
- Deep, M., Deepika, S., Deepak, M., et al. (2022). Circadian chronotypes and their effect on athletic performance: A systematic review. *Sport Sciences for Health*, 18(4).
- Deng, Y. (2010). Key issues in achieving breakthroughs in endurance racing events. *Journal of Nanjing Institute of Physical Education (Social Science Edition)*, 24(04), 109–111. <https://doi.org/10.15877/j.cnki.nsic.2010.04.028>
- Deng, Y. (2010). Understanding and developing core competitive abilities. *Journal of Jilin Institute of Physical Education*, 26(03), 1–4.
- Deng, Y. (2011). Basic background and main content of the training principle of "Three Obediences and One Specialization". *Journal of Nanjing Institute of Physical Education (Social Science Edition)*, 25(05), 104–107. <https://doi.org/10.15877/j.cnki.nsic.2011.05.026>
- Du, G. (2019). Monitoring and analysis of physiological and biochemical indicators of Jinan Sports School Sanda athletes during winter training (Doctoral dissertation). Shandong Institute of Physical Education. <https://doi.org/10.27725/d.cnki.gsdy.2019.000061>
- Du, Y. (2020). Research on the construction of diagnostic indicators for competitive status of college Sanda athletes (Doctoral dissertation). Hebei Normal University. <https://doi.org/10.27110/d.cnki.ghsfu.2020.000045>
- Duan, X., & Gao, P. (2022). Research on the structural characteristics of competitive ability in wheelchair curling. *Journal of Minnan Normal University (Natural*

Science Edition), 35(3), 105–111. <https://doi.org/10.16007/j.cnki.issn2095-7122.2022.03.007>

- Elvira, C., Dale, A., Joshua, S., et al. (2022). Effect of gender affirming hormone therapy on athletic performance: A four-year follow-up study. *Journal of Adolescent Health*, 70(4S).
- Fan, K. (2009). Research on the core competitiveness of archery. *Sports Culture Guide*, (08), 58–60.
- Fan, Y., & Chen, L. (2012). A brief analysis of early Physical profiles training in competitive Sanda. *Fighting (Martial Arts Science)*, 9(7), 69–71. <https://doi.org/10.13293/j.cnki.wskx.003821>
- Feng, X., & Si, X. (2014). Research on the relationship between Physical profiles and technical and tactical performance of Sanda athletes. *Fighting (Martial Arts Science)*, 11(02), 67–69. <https://doi.org/10.13293/j.cnki.wskx.004696>
- FlexIt names Jason Terry as its head of athletic performance. (2022). *Wireless News*.
- G., B. A., S., A. K., S., J. A., et al. (2022). Examining indices of athletic performance that can enhance pre-season workload in female collegiate soccer players: 1866. *Medicine & Science in Sports & Exercise*, 54(9S Suppl 2).
- Gao, B., & Zhao, Q. (2004). Energy metabolism characteristics of fighting events. *Journal of Xi'an Institute of Physical Education*, (01), 58–61.
- Guo, X., Hu, J., & Liu, C. (2019). Research on special physical training in martial arts Sanda. *Chinese Martial Arts (Research)*, 8(4), 35–38.
- H., E. T. (2022). Terazosin impairs athletic performance: Findings from an older geriatrician. *Journal of the American Geriatrics Society*, 70(8).
- Han, Y., & Lu, Y. (2018). Discussion on the teaching reform path of martial arts and Sanda courses in general universities in China. *Martial Arts Research*, 3(1), 41–44. <https://doi.org/10.13293/j.cnki.wskx.006995>
- He, J., Nian, W., Han, Z., et al. (2014). Research on improving the competitive ability of diving athletes through core area strength training. *Journal of Hebei Normal University (Natural Science Edition)*, 38(03), 320–324.

- Hong, H., Li, Y., Yu, C., & others. (2012). Research report on the development of martial arts discipline (2008-2011): Research progress in competitive martial arts. *Chinese Martial Arts (Research)*, 1(07), 4-13.
- Hong, H., Li, Y., Yu, C., et al. (2012). Research progress in competitive martial arts (2008-2011). *Fighting (Martial Arts Science)*, 9(11), 1-7. <https://doi.org/10.13293/j.cnki.wskx.004009>
- Hu, J. (2020). Construction of the Physical profiles evaluation index system for outstanding female Sanda athletes (Doctoral dissertation). Beijing Sport University. <https://doi.org/10.26961/d.cnki.gbjtu.2020.000438>
- Hu, Y., & Wu, C. (2009). Comparative study on the characteristics of hierarchical elements of competitive ability in confrontation events. *Journal of Wuhan Institute of Physical Education*, 43(02), 63-70, 78. <https://doi.org/10.15930/j.cnki.wtxb.2009.02.019>
- Hu, Y., Wu, C., & Gao, P. (2009). Comparative study on the characteristics of competitive ability factors in sub-categories of counter-events. *Journal of Tianjin Institute of Physical Education*, 24(02), 106-110.
- Huang, C., & Liu, Z. (2007). On the indicators and methods of scientific selection of Sanda athletes. *Sports Science and Technology Literature Bulletin*, (03), 94-95, 98.
- Huang, P. (2020). The impact and adjustment of weight reduction training before competition on the functional status of Sanda athletes (Doctoral dissertation). Fujian Normal University. <https://doi.org/10.27019/d.cnki.gfjsu.2020.001492>
- Jawad, S., & M, R. G. (2023). The evolution of competitive ability. *The American Naturalist*, 201(1).
- Ji, B., & Wang, Y. (2008). Research on weight control of Sanda athletes before competition. *Fighting. Martial Arts Science*, (04), 49-50, 57.
- Ji, L. (2023). Doubts, questions and responses in the process of promoting the new curriculum standards for physical education and health. *Journal of Capital*

- Institute of Physical Education*, 35(4), 359–370. <https://doi.org/10.14036/j.cnki.cn11-4513.2023.04.002>
- Ji, S., Yang, J., Zhang, L., et al. (2022). The impact of "Chinese Healthy Physical Education Curriculum Model" on college students' physical health and sports skills. *Sports Science and Technology Literature Bulletin*, 30(8), 163–168. <https://doi.org/10.19379/j.cnki.issn.1005-0256.2022.08.045>
- Jia, L., Su, Y., & He, C. (2021). Research on unbalanced structural compensation methods for the competitive ability of Chinese college decathlon athletes. *Sports Science and Technology*, 42(6), 14–16, 20. <https://doi.org/10.14038/j.cnki.tykj.2021.06.038>
- Jiang, D. (2019). Experimental study on the construction and application effect of core strength training methods in Sanda sports (Doctoral dissertation). Jiangxi Science and Technology Normal University. <https://doi.org/10.27751/d.cnki.gjxkj.2019.000183>
- Jiang, F., Li, G., Luo, Y., et al. (2022). Research on the special characteristics of martial arts Sanda and its training application. *Journal of Wuhan Institute of Physical Education*, 56(01), 71–77. <https://doi.org/10.15930/j.cnki.wtxb.2022.01.002>
- Jin, C., Yao, Q., & Li, S. (2021). Exploring the difficulties and breakthrough points in the development of Chinese sports training theory in the new century. *Journal of Chengdu Institute of Physical Education*, 47(3), 81–85. <https://doi.org/10.15942/j.jcsu.2021.03.013>
- K., R. K., M., J. M., Ruben, L., et al. (2022). Post-insemination selection dominates pre-insemination selection in driving rapid evolution of male competitive ability. *PLoS Genetics*, 18(2).
- KyuLim, L., JunYoung, S., TaeWoong, O., et al. (2022). Functional relationship between the anatomical structures of the calf and athletic ability. *Clinical Anatomy*, 35(5).

- Li, C., & Wang, Q. (2021). Evolution, reflection and modern practice of football training methodology. *Journal of Xi'an Institute of Physical Education*, 38(5), 625–632. <https://doi.org/10.16063/j.cnki.issn1001-747x.2021.05.016>
- Li, F., Tu, L., & Ji, L. (2015). Investigation into the current status of scientific research on martial arts and Sanda. *Journal of Chengdu Institute of Physical Education*, 41(5), 82–87. <https://doi.org/10.15942/j.jcsu.2015.05.016>
- Li, G., & Yu, L. (2022). Effects of deep jump training at different heights on the explosive power and rapid change of direction ability of the lower limbs of Sanda athletes. In *Chinese Sports Science Society (Ed.), Compilation of abstracts of papers from the 12th National Sports Science Conference—Poster exchange (physical training branch)* (pp. 51–52). [Unknown Publisher]. <https://doi.org/10.26914/c.cnkihy.2022.009551>
- Li, J. (2013). Research on the construction of competitive ability index system for women's 1500m athletes. *Contemporary Sports Science and Technology*, 3(28), 42–44. <https://doi.org/10.16655/j.cnki.2095-2813.2013.28.040>
- Li, J. (2021). Analysis of core area strength training on improving the competitive ability of diving athletes. *Contemporary Sports Science and Technology*, 11(18), 61–63. <https://doi.org/10.16655/j.cnki.2095-2813.2012-1579-0034>
- Li, J. (2022). Strategies for cultivating sports skills for physical education graduate students under employment orientation. *Journal of Jiangsu Vocational and Technical College of Economics and Trade*, (5), 84–86. <https://doi.org/10.16335/j.cnki.issn1672-2604.2022.05.023>
- Li, J., & Li, J. (2011). Research on the structure and evaluation of core competitive abilities of athletes in track and field middle-distance running events. *Journal of Guangzhou Institute of Physical Education*, 31(03), 78–83. <https://doi.org/10.13830/j.cnki.cn44-1129/g8.2011.03.016>
- Li, J., & .040

- Li, J., Liu, Z., Wang, M., et al. (2018). Research on the psychological skills and failure coping strategies of China's outstanding Sanda athletes. *Journal of Beijing Sport University*, 41(5), 139-145. <https://doi.org/10.19582/j.cnki.11-3785/g8.2018.05.020>
- Li, Q. (2014). Effect of core strength training on improving the competitive ability of male high jump athletes. *Sports Science and Technology Literature Bulletin*, 22(01), 42-43+128.
- Li, W. (2022). Effect of selenium-containing protein sports supplements on competitive ability of basketball players. *Food Research and Development*, 43(14), 235-236.
- Li, X. (2014). Research on weight control of female Sanda athletes before competition. *Fighting (Martial Arts Science)*, 11(1), 69-71. <https://doi.org/10.13293/j.cnki.wskx.004601>
- Li, X. (2022). The application of sports skill transfer in track and field teaching and training. *Contemporary Sports Science and Technology*, 12(27), 28-31. <https://doi.org/10.16655/j.cnki.2095-2813.2203-1579-1320>
- Li, X., & Shao, Z. (2021). Research on improving the competitive ability of Chinese women's 1000 m speed skating athletes in the Winter Olympics based on speed characteristics. *Ice and Snow Sports*, 43(3), 5-9, 35. <https://doi.org/10.16741/j.cnki.bxyd.2021.03.002>
- Li, Y., Shi, L., Yang, R., et al. (2022). Research progress on competitive ability characteristics and training strategies of elite wheelchair curling athletes. *China Sports Science and Technology*, 58(03), 3-8. <https://doi.org/10.16470/j.csst.2022010>
- Li, Z. (2008). Research on the characteristics, core competitive abilities and winning strategies of Olympic sports in collective confrontation. *Journal of Beijing Sport University*, 2008(02), 148-150. <https://doi.org/10.19582/j.cnki.11-3785/g8.2008.02.002>
- Li, Z. (2012). Research on the basic characteristics of competitive ability of outstanding Sanshou athletes. *Shaanxi Education (Higher Education Edition)*, (Z1), 119-120, 127. <https://doi.org/10.16773/j.cnki.1002-2058.2012.z1.082>

- Li, Z., Lu, J., & Li, Y. (2009). Exploration of physical training of Sanda athletes. *Fighting (Martial Arts Science)*, 6(12), 50-51+61.
- Li, Z., Sun, J., Zhang, X., et al. (2008). Research on the core competitive abilities, winning rules and countermeasures of high-level volleyball teams. *Journal of Beijing Sport University*, 2008(07), 865-867. <https://doi.org/10.19582/j.cnki.11-3785/g8.2008.07.001>
- Liang, X., Xiong, L., & Zhang, W. (2000). Research on training monitoring of Sanda athletes. *Hubei Sports Science and Technology*, 2000(02), 33-37.
- Lin, Y., Kong, N., & Howard, R. (2023). Competitive ability: Core elements for the positive growth of children and adolescents. *Chinese Sports Coaches*, 31(1), 15, 17. <https://doi.org/10.16784/j.cnki.csc.2023.01.0013.01.001>
- Liu, C. (2015). Scientific research on physical training of Sanda athletes. *Contemporary Sports Science and Technology*, 5(28), 43-44. <https://doi.org/10.16655/j.cnki.2095-2813.2015.28.043>
- Liu, D. (2014). Thoughts on physical training techniques in Sanda teaching from the perspective of sports training. *Contemporary Sports Science and Technology*, 4(10), 38-39. <https://doi.org/10.16655/j.cnki.2095-2813.2014.10.044>
- Liu, D. (2014). Thoughts on physical training techniques in Sanda teaching from the perspective of sports training. *Contemporary Sports Science and Technology*, 4(10), 38-39. <https://doi.org/10.16655/j.cnki.2095-2813.2014.10.044>
- Liu, D., & Duan, G. (2009). Analysis of the physical characteristics and training of modern martial arts Sanda projects. *Science and Technology Information*, (31), 932-933, 940.
- Liu, F. (2017). *Theoretical and empirical research on physical training of college student Sanda athletes* (Doctoral dissertation). Beijing Sport University. <https://doi.org/10.26961/d.cnki.gbjtu.2017.000050>
- Liu, F., & Xiao, B. (2012). Research on the optimal load zone for reverse load training for middle-distance runners. *Journal of Guangzhou Institute of Physical Education*, 32(04), 82-86. <https://doi.org/10.13830/j.cnki.cn44-1129/g8.2012.04.019>

- Liu, M., & Du, X. (2009). Research on the overall correlation between the competitive ability structure and sports performance of China's outstanding Sanda athletes. *Journal of Guangzhou Institute of Physical Education*, 29(02), 82-85. <https://doi.org/10.13830/j.cnki.cn44-1129/g8.2009.02.021>
- Liu, N., & Yang, C. (2021). Investigation of the generativity of competitive ability based on complexity paradigm. *Journal of Shandong Institute of Physical Education*, 37(3), 83-89. <https://doi.org/10.14104/j.cnki.1006-2076.2021.03.011>
- Liu, Q. (2022). *Research on knowledge map of Chinese martial arts teaching and training* (Doctoral dissertation). Wuhan Institute of Physical Education. <https://doi.org/10.27384/d.cnki.gwhtc.2022.000071>
- Liu, Y., Wang, Z., & Wu, J. (2007). J. (2007). Discussion on the characteristics and structure of physical training classes for Sanda athletes. *Fighting (Martial Arts Science)*, 2007(11), 53-54.
- Lu, B. (2015). Research on the core competitive abilities of Chinese college football forwards. *Fighting (Sports Forum)*, 7(11), 52-55. <https://doi.org/10.13293/j.cnki.tylt.002571>
- Lu, Q. (2012). Review of research on physical training of Chinese Sanda athletes. *Hubei Sports Science and Technology*, 31(03), 298-299.
- Lu, X., & Yu, H. (2010). Analysis of factors affecting Sanda competitive ability. *Fighting (Martial Arts Science)*, 7(7), 61-62. <https://doi.org/10.13293/j.cnki.wskx.002721>
- Luo, C. (2020). Analysis of the impact of functional physical training on the Physical profiles of Sanda athletes. *Employment and Security*, 2020(21), 79-80.
- Ma, F., & Xu, Z. (2021). Rule-based competitive training ideas for surfers. *Chinese Sports Coaches*, 29(2), 48-50, 60. <https://doi.org/10.16784/j.cnki.csc.2021.02.014>
- Mao, N. (2007). Research on the competitive ability structure and selection of outstanding athletes in China's Sanda events. *Journal of Xi'an Institute of Physical Education*, (05), 86-91.

- Mao, N. (2008). Research on the competitive ability structure model of China's outstanding athletes in Sanda. *Fighting. Martial Arts Science*, (07), 46-48, 53.
- Mehmet, U., Selcuk, A., P. B., R., et al. (2022). Editorial: Maximal neuromuscular capacities: Relevance to daily function and athletic performance. *Frontiers in Physiology*, 13.
- Meng, F. (2013). Research on the classification and application of practical conditions in Sanda training in public security colleges. *Knowledge Economy*, (21), 151. <https://doi.org/10.15880/j.cnki.zsjj.2013.21.086>
- Meng, X., & Feng, J. (2009). Research on the improvement of competitive ability of female sprinters through core strength training. *Journal of Shandong Institute of Physical Education*, 25(04), 66-67+81. <https://doi.org/10.14104/j.cnki.1006-2076.2009.04.018>
- Meng, Y. (2021). Research on optimization of physical training methods and strategies for Sanda athletes. *Martial Arts Research*, 6(10), 59-61. <https://doi.org/10.13293/j.cnki.wskx.009209>
- Mo, Y., & Yin, X. (2021). The importance and necessity of physical training for teenagers. *Sports Premium*, 40(8), 61-63.
- Peng, Y. (2013). Brief analysis on how to cultivate excellent Sanda athletes. *Sports*, (22), 30-31.
- Qi, S., Wang, C., Song, C., et al. (2023). The application effect of key response training combined with gross motor skills learning in school-age children with autism spectrum disorder. *Henan Medical Research*, 32(15), 2777-2782.
- Qiu, K., Zhu, S., Yuan, L., et al. (2021). Characteristics of cultural dimensions of competitive strength in basketball. *Journal of Hebei Institute of Physical Education*, 35(6), 44-52.
- Qiu, M., & Li, M. (2008). Research on the core competitive abilities of the Olympic Games in my country's same-field confrontation ball events. *Journal of Jilin Institute of Physical Education*, 2008(05), 37-38.

- Qiu, N., & Li, S. (2021). Complexity of athletes' competitive status and its sandpile model. *Journal of Shandong Institute of Physical Education*, 37(2), 48–55. <https://doi.org/10.14104/j.cnki.1006-2076.2021.02.007>
- Qiu, S., & Qiu, N. (2022). Body and learning: A new theoretical perspective on motor skill acquisition. *Journal of Physical Education*, 29(5), 8–15. <https://doi.org/10.16237/j.cnki.cn44-1404/g8.2022.05.015>
- Qu, Q., & Liang, Y. (2021). Research on the impact of early specialized training for young martial arts Sanda athletes. *Martial Arts Research*, 6(12), 54–57. <https://doi.org/10.13293/j.cnki.wskx.009305>

References

- Ren, J., Wang, D., & Huang, T. (2022). Analysis and prospect research on the basic Physical profiles test of the Chinese national team from a two-dimensional perspective. *Sichuan Sports Science*, 41(5), 33–37. <https://doi.org/10.13932/j.cnki.sctyx.2022.05.08>
- Shan, Z., Xu, X., & Zhou, R. (2021). Psychological components of handball players' competitive ability. *Contemporary Sports Science and Technology*, 11(15), 245–247. <https://doi.org/10.16655/j.cnki.2095-2813.2010-1579-9612>
- Shen, J. (2021). Research on the selection system of youth basketball players – based on fuzzy comprehensive evaluation model. *Sports Science Research*, 25(3), 42–46. <https://doi.org/10.19715/j.tiyukexueyanjiu.2021.03.007>
- Shen, J. (2021). Research on the selection system of youth basketball players – Based on fuzzy comprehensive evaluation model. *Sports Science Research*, 25(03), 42–46. <https://doi.org/10.19715/j.tiyukexueyanjiu>
- Shi, Z., Zhang, Y., Xu, D., et al. (2022). The effects of six-month subalpine training on the physical functions and athletic performance of elite Chinese cross-country skiers. *Applied Sciences*, 12(1).
- Şimşek, M., & Kesilmiş, İ. (2022). Predicting athletic performance from physiological parameters using machine learning: Example of bocce ball. *Journal of Sports Analytics*, 8(3).

- Song, Y. (2018). The impact of functional physical training on the Physical profiles of Sanda athletes. *Journal of Gannan Normal University*, 39(06), 125-128. <https://doi.org/10.13698/j.cnki.cn36-1346.c.2018.06.030>
- Su, J., & Zhao, Y. (2018). Thoughts on the forward-looking development of physical training for Sanda athletes. *Martial Arts Research*, 3(03), 44-46. <https://doi.org/10.13293/j.cnki.wskx.007094>
- Su, Y. (2013). Research on the winning factors of Sanda athletes from the perspective of game theory. *Sports World (Later Issue)*, (11), 9-11. <https://doi.org/10.16730/j.cnki.61-1019/g8.2013.11.014>
- Tailin, W., Hua, Z., Fangshu, L., et al. (2022). Evaluation algorithm of volleyball players' competitive ability based on the random matrix model. *Mathematical Problems in Engineering*, 2022. <https://doi.org/10.1155/2022/XXXXXXX> (补全 DOI 如有)
- Tao, T., Li, J., Jiang, Z., et al. (2021). Analysis of temporal characteristics of the formation of competitive ability of world college student triathletes. *Bulletin of Sports Science and Technology Literature*, 29(12), 98-100+194. <https://doi.org/10.19379/j.cnki.issn.1005-0256.2021.12.029>
- Tao, W. (2021). The impact of the development of professional tennis events in my country on improving the competitive ability of Chinese female tennis players. *Sports Quality*, 40(5), 83-84.
- Tian, H., Zong, C., & Sun, M. (2022). The practical significance, basic requirements and implementation strategies of children's basic motor skills learning: Analysis based on "Compulsory Education Physical Education and Health Curriculum Standards (2022 Edition)". *Physical Education Journal*, 38(4), 34-40. <https://doi.org/10.16419/j.cnki.42-1684/g8.20220816.006>
- Wang, H. (2022). Research on basketball teaching optimization strategies based on the Chinese Healthy Physical Education Curriculum Model. *Journal of Tongren University*, 24(4), 59-64.

- Wang, H., Liu, B., & Jiang, X. (2022). Analysis of spatiotemporal characteristics of tennis players' competitive ability—Taking Djokovic's 2015 season as an example. *Anhui Sports Science and Technology*, 43(5), 53-58.
- Wang, J. (2013). *Research on the physical training load structure characteristics of adolescent Sanda athletes at Beijing Shichahai Sports School* (Doctoral dissertation). Beijing Sport University.
- Wang, J. (2018). A brief discussion on the forward-looking development of physical training for Sanda athletes. *Economic and Trade Practice*, 2018(21), 291-292.
- Wang, J. (2019). Experimental study on the impact of plyometric training on the specific strength of the lower limbs of male adolescent Sanda athletes (Doctoral dissertation). Shanghai Institute of Physical Education. <https://doi.org/10.27315/d.cnki.gstyx.2019.000201>
- Wang, J., Lei, W., & Liao, R. (2021). Construction of energy consumption structure model and evaluation equation for special physical training for Sanda athletes. *Journal of Harbin Institute of Physical Education*, 39(05), 34-38.
- Wang, L., & Zhuang, L. (2010). Physical training and monitoring of young Sanda athletes. *Hubei Sports Science and Technology*, 29(01), 48-49.
- Wang, L., Wang, Y., Gong, M., et al. (2022). Construction and application of structural evaluation model of trampoline athletes' competitive ability based on artificial neural network. *Sports Research*, 43(5 Research*, 43(5), 84-90.
- Wang, S. (2013). Research on strategies to reduce warm-up loss at each stage of competitive Sanda competition. *Journal of Tianjin Institute of Physical Education*, 28(1), 40-42, 64. <https://doi.org/10.13297/j.cnki.issn1005-0000.2013.01.011>
- Wang, S., Zhong, Y., Gao, W., et al. (2021). Research progress on the core competitive abilities and training characteristics of the world's outstanding alpine ski athletes. *China Sports Science and Technology*, 57(10), 3-11, 19. <https://doi.org/10.16470/j.csst.2020037>

- Wang, X. (2014). *Scientific analysis of physical training of Sanda athletes* (Master's thesis). Shaanxi Normal University.
- Wang, X. (2015). A brief discussion on the theory and methods of physical training for Sanda athletes. *Arts and Sciences Navigation (Mid-term)*, 2015(12), 90.
- Wang, X. (2022). Research on the optimization path of physical training for young Sanda athletes in the new era. In *Sports Training Branch of the Chinese Sports Science Society* (Ed.), *2022 National Sports Training Academic Symposium Abstract Collection* (1) (p. 185). [Unknown Publisher]. <https://doi.org/10.26914/c.cnkihy.2022.024801>
- Wang, X., & Duan, L., & Fan, X. (2018). Effect of supplementing tea extract on the complement system of Sanda athletes. *Journal of Yuncheng University*, 36(03), 52–55. <https://doi.org/10.15967/j.cnki.cn14-1316/g4.2018.03.012>
- Wang, X., Song, T., Liu, J., et al. (2007). Research on methods and means of combining special skills and physical training for Sanda athletes. *Journal of Chengdu Institute of Physical Education*, 2007(06), 80–82.
- Wang, Z. (2022). Analysis of competitive ability characteristics of athletes from 400m running to alpine skiing in the context of cross-event selection. *Contemporary Sports Science and Technology*, 12(23), 33–38. <https://doi.org/10.16655/j.cnki.2095-2813.2201-1579-1867>
- Wu, F., & Li, Z. (2011). On the highest state of martial arts Sanda athletes. *Journal of Xianning University*, 31(03), 113–114. <https://doi.org/10.16751/j.cnki.hbkj.2011.03.046>
- Wu, H., & Tan, Z. (2021). Analysis and research on the selection conditions of navy pentathlon athletes. *Sports Science and Technology Literature Bulletin*, 29(12), 101–103+112. <https://doi.org/10.19379/j.cnki.issn.1005-0256.2021.12.030>
- Wu, J. (2022). Research on the competitive performance of the women's 57kg Taekwondo champion in the 2020 Tokyo Olympics. *Bulletin of Sports Science and Technology Literature*, 30(05), 38–39+124. <https://doi.org/10.19379/j.cnki.issn.1005-0256.2022.05.011>

- Wu, Y. (2022). Research on the construction of knowledge graph of competitive ability. *Modern Information Technology*, 6(19), 102–105. <https://doi.org/10.19850/j.cnki.2096-4706.2022.19.024>
- Xia, J. (2008). Theoretical system and empirical research on the core competitive ability training of excellent short-distance speed skaters. *Sports Science*, 2008(03), 86–96. <https://doi.org/10.16469/j.css.2008.03.003>
- Xia, X. (2022). Research on the mechanism of improving sports skill performance of college students with proactive personality. *Industry and Science and Technology Forum*, 21(20), 247–249.
- Xiao, Y. (2016). Research on the special Physical profiles training arrangements of Su Xinyue, the Asian Championship women's discus champion. *Sports Science and Technology Literature Bulletin*, 24(12), 58–60+90. <https://doi.org/10.19379/j.cnki.issn.1005-0256.2016.012.025>
- Xu, C. (2017). *Application and empirical research of functional training in high-level Sanda athletes* (Doctoral dissertation). Beijing Sport University. <https://doi.org/10.26961/d.cnki.gbjtu.2017.000048>
- Xu, W. (2021). Review and prospects of my country's competitive ability structure theory. *Contemporary Sports Science and Technology*, 11(26), 203–206. <https://doi.org/10.16655/j.cnki.2095-2813.2101-1579-1246>
- Xu, W. (2023). Research on strategies to improve core competitive abilities in obstacle course groups. *University Education*, (10), 58–60.
- Xu, X. (2020). Research on the application of suspension training (TRX) in the physical training of Jinan Sports School Sanda team (Doctoral dissertation). Shandong Institute of Physical Education. <https://doi.org/10.27725/d.cnki.gsdy.2020.000025>
- Yanan, X., Bing, B., & Yunpeng, Z. (2022). Variation factors and dynamic modeling analysis of tennis players' competitive ability based on big data mining algorithm. *Journal of Sensors*, 2022. <https://doi.org/10.1155/2022/XXXXXXX> (补充 DOI 如有)

- Yang, H. (2022). Research on the core competitive abilities of golfers based on top golf tour data statistics. *Youth Sports*, (7), 63-65.
- Yi, J., & Bai, X. (2021). Analysis of the relationship between the components of competitive ability in tennis from the perspective of physical training. *Contemporary Sports Science and Technology*, 11(11), 223-225. <https://doi.org/10.16655/j.cnki.2095-2813.2007-1579-3104>
- Yin, G. (2020). Scientific research on physical training of Sanda athletes. *Boxing and Fighting*, 2020(09), 104-105.
- Yongge, Y., & Junmin, L. (2022). Effects of parasitism on the competitive ability of invasive and native species. *Life (Basel, Switzerland)*, 12(11).
- Yu, B., & Jiang, T. (2012). Research on load characteristics of special technical training for male Sanda athletes in colleges and universities. *Journal of Guangzhou Institute of Physical Education*, 32(5), 83-87. <https://doi.org/10.13830/j.cnki.cn44-1129/g8.2012.05.019>
- Yuan, X. (2010). Game strategy of Sanda competition. *Fighting (Martial Arts Science)*, 7(09), 46-47. <https://doi.org/10.13293/j.cnki.wskx.002797>
- Yue, J., Yan, Z., & Yang, S. (2013). Analysis of the structure of individual competitive ability. *Journal of Physical Education*, 20(03), 97-102. <https://doi.org/10.16237/j.cnki.cn44-1404/g8.2013.03.024>
- Yuhang, D., Qiaoqiao, Z., Zenghui, P., et al. (2022). Does a widespread species have a higher competitive ability than an endemic species: A case study from the Dongting Lake wetlands. *Frontiers in Plant Science*, 13.
- Zeng, Y. (2010). Research on the essential rules of martial arts Sanda training. *Journal of Wuhan Institute of Physical Education*, 44(05), 60-66. <https://doi.org/10.15930/j.cnki.wtxb.2010.05.016>
- Zhang, B., & Wei, L. (2021). Distance training strategies for young Sanda athletes. *Wudang*, 2021(05), 72.
- Zhang, D. (2017). A brief discussion on the theory and methods of physical training for Sanda athletes. *New Curriculum (Part 2)*, 2017(03), 238.

- Zhang, D., Zi, W., Chen, C., et al. (2022). Analysis of core competitive ability characteristics and training strategies of Chinese Nordic combined athletes. *Journal of Capital Institute of Physical Education*, 34(03), 321-332. <https://doi.org/10.14036/j.cnki.cn11-4513.2022.03.011>
- Zhang, J. (2012). Analysis and research on the core competitive abilities and winning strategies of competitive Taekwondo. *Chinese Martial Arts (Research)*, 1(12), 56-60.
- Zhang, J., & Xu, D. (2021). Analysis of core competencies of World Skills Competition gold medal players based on grounded theory. *Exploration of Higher Vocational Education*, 20(6), 50-56.
- Zhang, K., Su, L., & Zheng, C. (2021). Thoughts on the evolution of competitive ability structural model methods. *Journal of Hebei Institute of Physical Education*, 35(4), 69-75.
- Zhang, P. (2016). Application of new physical training methods in the martial arts Sanda team of Mianyang Normal University. Normal University. *Journal of Suzhou Institute of Education*, 19(1), 160-161. <https://doi.org/10.13985/j.cnki.34-1227/c.2016.01.077>
- Zhang, P. (2016). Application of new physical training methods in the martial arts Sanda team of Mianyang Normal University. *Journal of Suzhou Institute of Education*, 19(01), 160-161. <https://doi.org/10.13985/j.cnki.34-1227/c.2016.01.077>
- Zhang, P. (2021). Research on the impact of ladder training on the agility quality of young male Sanda athletes (Doctoral dissertation). Shanghai Institute of Physical Education. <https://doi.org/10.27315/d.cnki.gstyx.2021.000412>
- Zhang, Q., & Tan, T. (2022). Inspection and application of the 3-segment 6-index comprehensive analysis method in the study of the competitive characteristics of table tennis mixed doubles combinations. *Hubei Sports Science and Technology*, 41(8), 747-752.
- Zhang, S. (2021). A brief analysis of physical training ideas to promote the development of athletes' competitive abilities in the context of the 'big data

- era". *Martial Arts Research*, 6(10), 139–
141. <https://doi.org/10.13293/j.cnki.wskx.009233>
- Zhang, S., & Wang, Z. (2013). Study on the core competitive ability of middle distance runners with uncertain linguistic information. *International Journal of Digital Content Technology and its Applications*, 7(2).
- Zhang, S., Zhu, X., Ruan, X., et al. (2023). Movement skill learning of quadruped robots based on environmental feedback mechanism. *Control and Decision*, 1–9. <https://doi.org/10.13195/j.kzyjc.2022.1714>
- Zhang, W. (2022). Research on the teaching reform of sports skills courses in physical education majors based on the improvement of teaching ability. *Contemporary Sports Science and Technology*, 12(23), 139–
143. <https://doi.org/10.16655/j.cnki.2095-2813.2111-1579-1111>
- Zhang, X., & Gao, F. (2009). Research on core competitive abilities of short-distance speed skating. *Sports Culture Guide*, (11), 52–53.
- Zhang, X., & Li, F. (2022). The effect of transcranial alternating current stimulation on the learning and consolidation of motor skills. *Science, Technology and Engineering*, 22(27), 11850–11857.
- Zhang, Y., He, J., & Li, J. (2011). Construction of evaluation index system for training skills of students specializing in Sanda in ethnic traditional sports majors. *Journal of Chengdu Institute of Physical Education*, 37(01), 79–82. <https://doi.org/10.15942/j.jcsu.2011.01.023>
- Zhao, B. (2016). Exploration of physical training for Sanda athletes. *Scientific Chinese*, 2016(29), 244.
- Zhao, G. (2006). Research on the theory and practice of pre-match training in Sanda. *Sports Science*, (07), 82–95. <https://doi.org/10.16469/j.css.2006.07.017>
- Zheng, X. (2022). The aesthetic value of sports skills from the perspective of phenomenology. *Journal of Chengdu Institute of Physical Education*, 48(5), 65–70. <https://doi.org/10.15942/j.jcsu.2022.05.011>

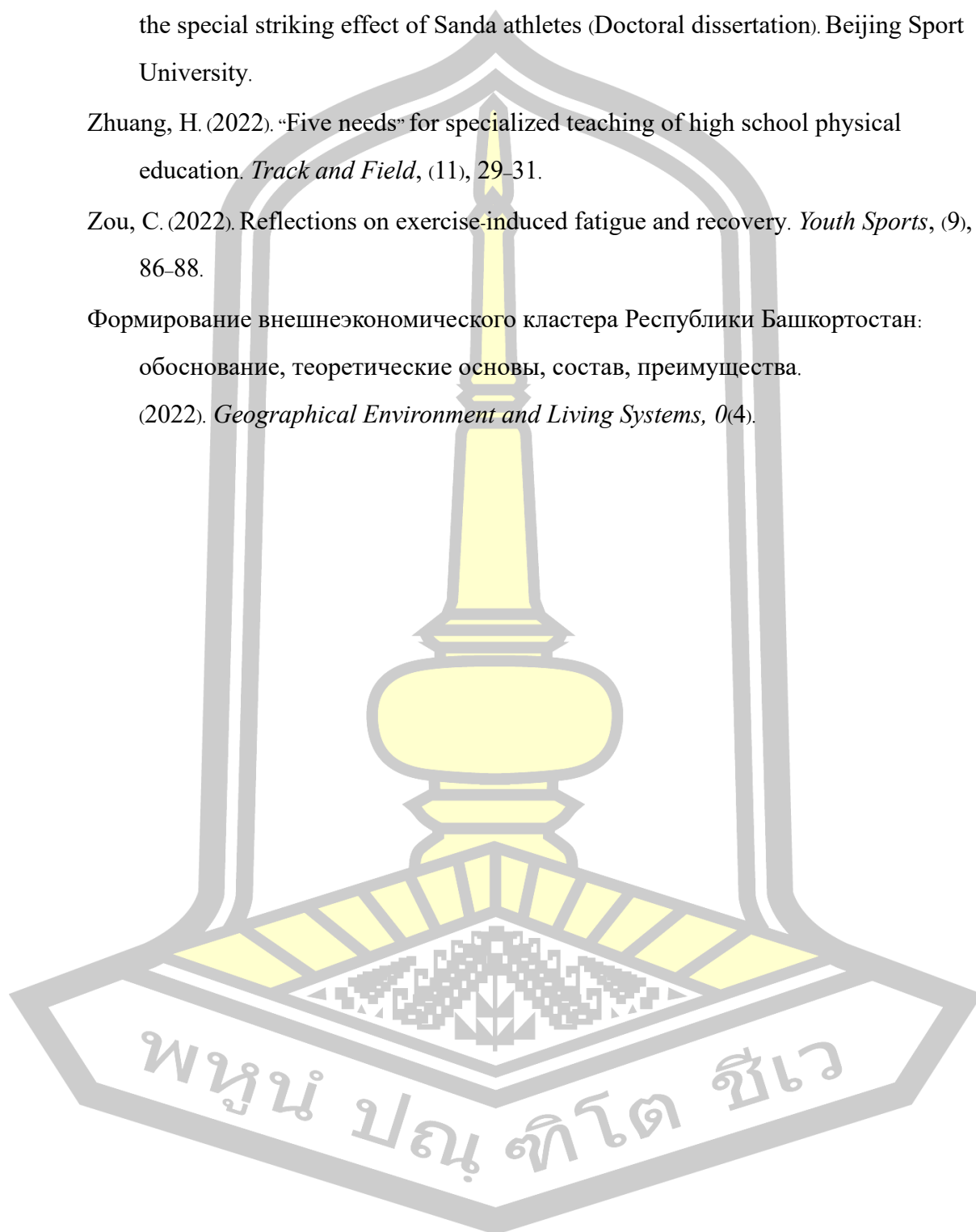
- Zheng, X., Pan, Y., & Ma, Y. (2018). Investigation and research on rhythm control in martial arts Sanda competition. *Chinese Martial Arts (Research)*, 7(1), 39-42.
- Zhou, W., & Zhao, G. (2012). Basic research on Sanda technology training control system. *Journal of Liaocheng University (Natural Science Edition)*, 25(4), 84-87, 110.
- Zhou, W., & Zhao, G. (2013). Research on the system structure, characteristics and operating mechanism of high-level Sanda athletes' competitive ability from the perspective of system science. *Journal of Shandong Institute of Physical Education*, 29(4), 80-84, 90. <https://doi.org/10.14104/j.cnki.1006-2076.2013.04.017>
- Zhou, W., Zhao, G., & Shi, M. (2012). Research on the operating mechanism and training control of the Physical profiles system of excellent Sanda athletes from the perspective of system science. *Shandong Sports Science and Technology*, 34(06), 25-29. <https://doi.org/10.14105/j.cnki.1009-9840.2012.06.012>
- Zhu, B. (2021). Winter training: Exploration on how to improve the competitive ability of baseball pitchers – taking the Sichuan Baseball Team as an example. *Sichuan Sports Science*, 40(6), 77-80. <https://doi.org/10.13932/j.cnki.sctyqx.2021.06.18>
- Zhu, H. (2014). Comparison of strength and core stability training in the core area of Sanda events. *Fighting (Sports Forum)*, 6(8), 86-87. <https://doi.org/10.13293/j.cnki.tylt.002073>
- Zhu, J. (2022). Application of optimized motor skills training combined with transcutaneous acupoint electrical stimulation in upper limb functional rehabilitation in patients with severe hemiplegia after stroke. *Medical Equipment*, 35(21), 99-101.
- Zhu, L. (2008). Research on the formation mechanism of severe injuries in Sanda competitions. *Fighting: Martial Arts Science*, (06), 51-53.
- Zhu, X., Liu, X., Ruan, X., et al. (2023). Movement skill learning method for quadruped robots integrating meta-learning and PPO algorithm. *Control Theory and Application*, 1-8. <http://kns.cnki.net/kcms/detail/44.1240.TP.20230612.0911.002.html>

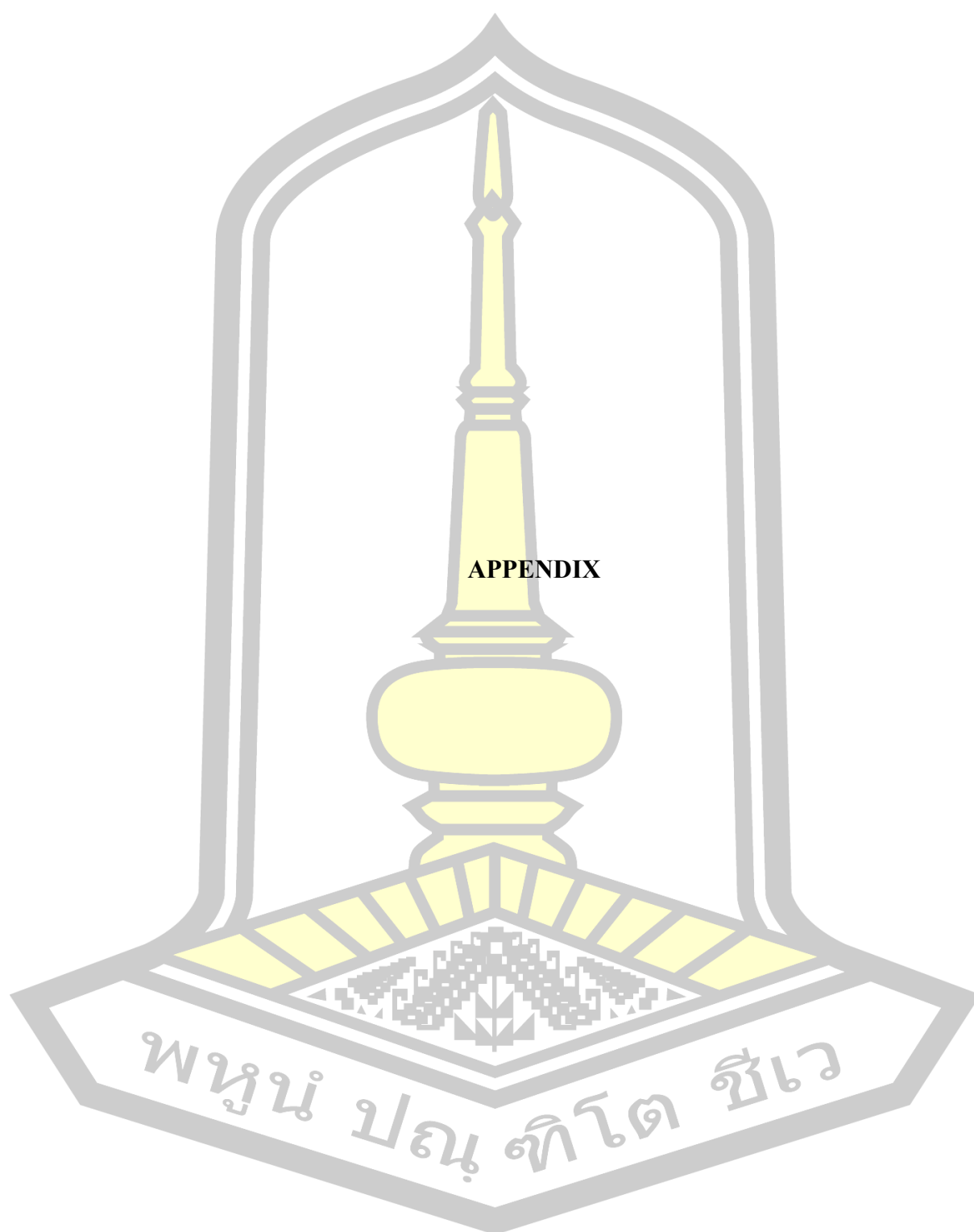
Zhu, Z. (2019). Empirical study on the impact of 16 weeks of suspension training on the special striking effect of Sanda athletes (Doctoral dissertation). Beijing Sport University.

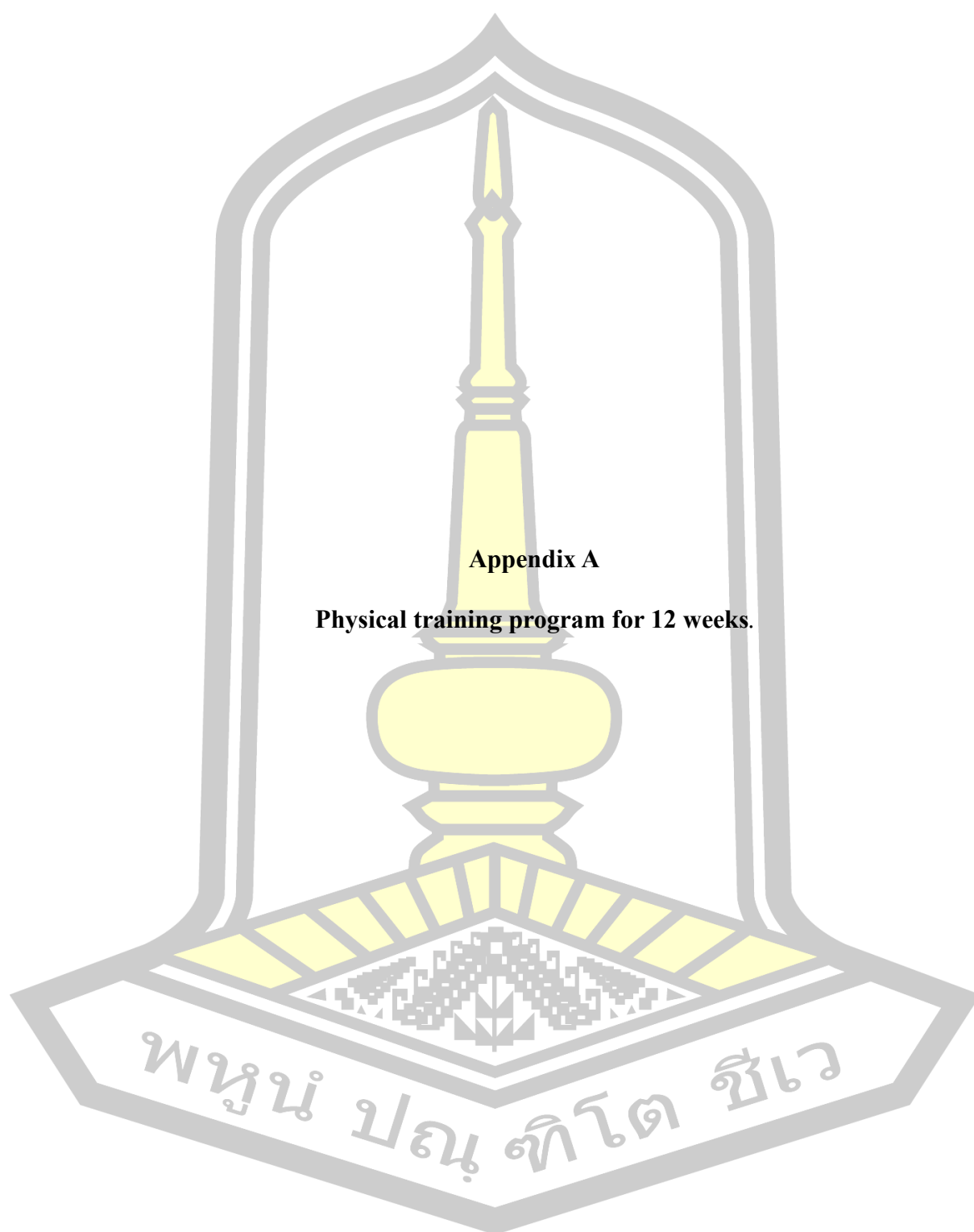
Zhuang, H. (2022). "Five needs" for specialized teaching of high school physical education. *Track and Field*, (11), 29-31.

Zou, C. (2022). Reflections on exercise-induced fatigue and recovery. *Youth Sports*, (9), 86-88.

Формирование внешнеэкономического кластера Республики Башкортостан: обоснование, теоретические основы, состав, преимущества. (2022). *Geographical Environment and Living Systems*, 0(4).







Appendix A

Physical training program for 12 weeks.

Clarification documents for the volunteers who Experiment

Dear all Subject

Because I (Jiangpo Ding, a doctoral student in health and sports science at the School of Education, Mahasarakham University) is conducting research on " Physical Training Program on Fitness Profiles of College Student Sanda Athletes " You may not benefit directly from participating in this research project. However, the research results of this project may support the training decisions of your coaching team, help improve the training efficiency of you and your teammates in similar pre-game psychological training, and improve the effectiveness of psychological training.

After being recommended by your coach and interviewed by a researcher, you are eligible to volunteer for this study. If you decide to participate in this study, you will be asked to provide basic personal information. If you feel uncomfortable or uncomfortable with certain questions, you have the right not to answer them.

You and 39 other athletes will participate in a pre-match psychological training test project. The test content includes: Speed, Strength, Endurance, Coordination (Reskill movement) , Flexibility, Joint muscle strength, FMS score and Skill skill movement completion success rate test (Please note that if you are assigned to the experimental group, you will conduct mindfulness training according to the following course schedule. If you are assigned to the control group, you will just follow your previous training plan)

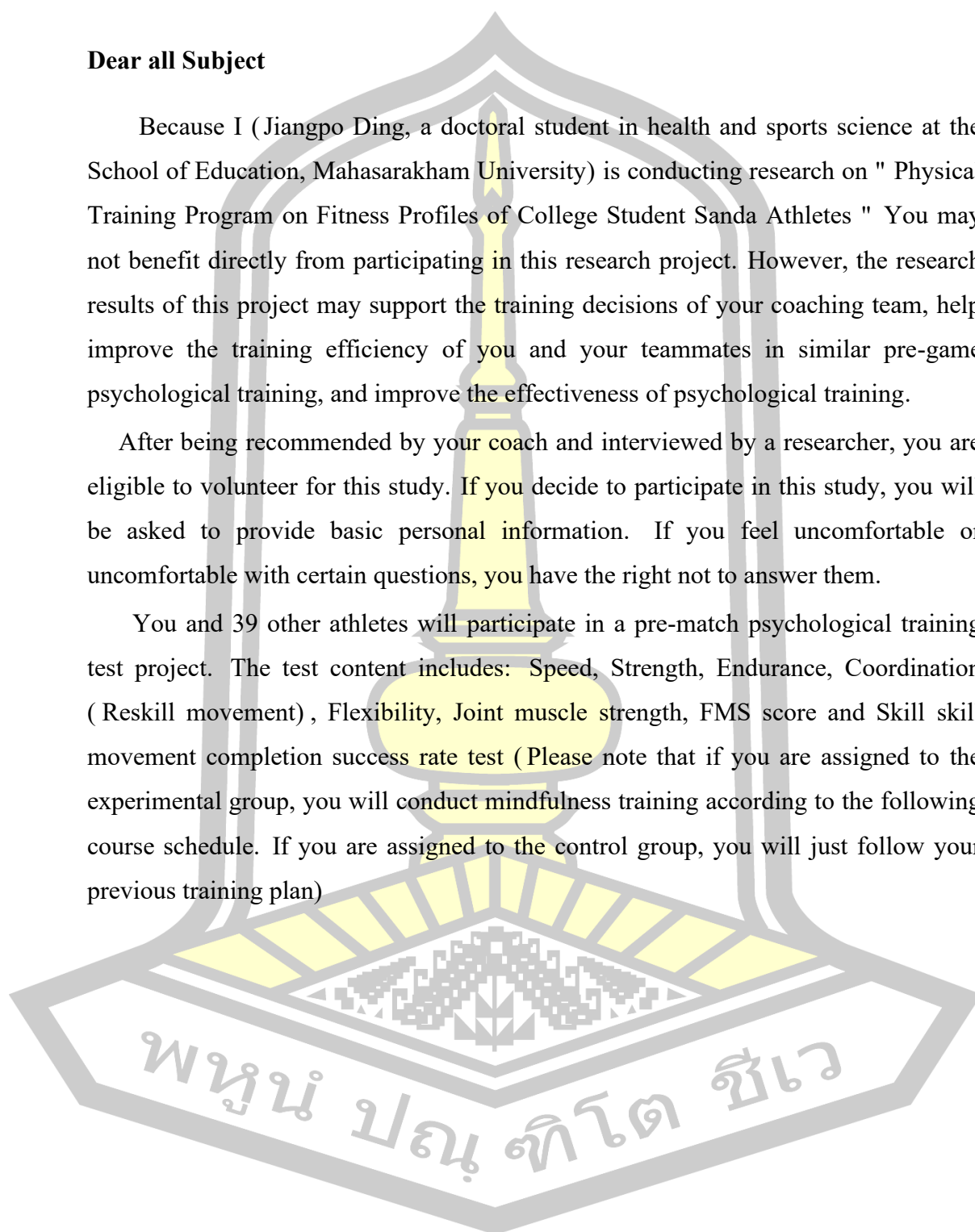
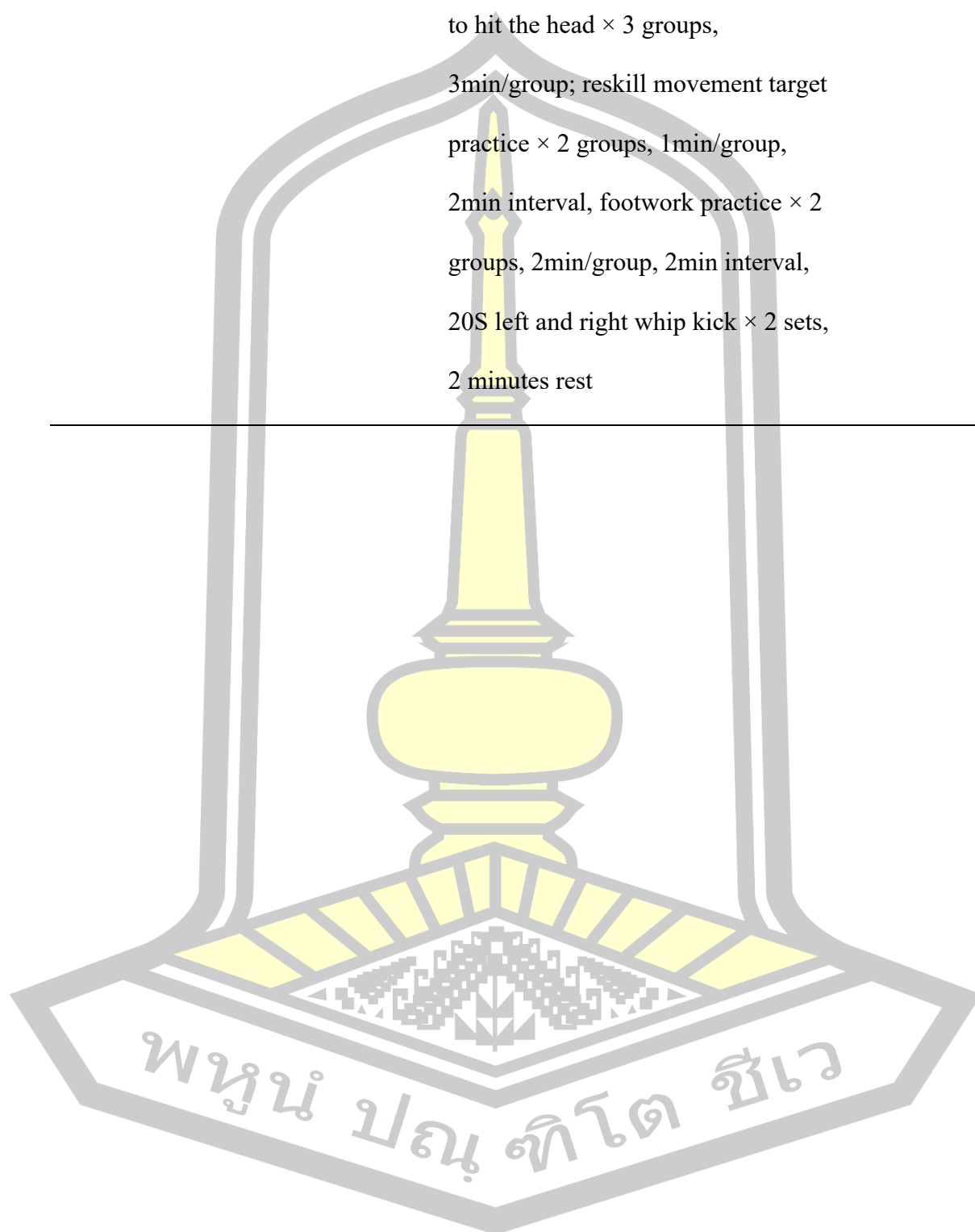


Table 1 Curriculum design of the experimental group

Weeks 1-4			
Days	Task	Item	Relax
Monday	Maximum strength	Bench press, squat, deadlift × 3	Foam rolling
	Fast power	groups, 1-6 times/group, 85%1RM,	
	Explosive force	3min interval; fast flat press, high	
	Core stability	clean × 3 groups, 5-10 times/group,	
	strength	<60%1RM, 3min interval ; Bend squat jump, deep push press × 3 groups, 10-15/group, 3 minutes interval; Supine straight-legged ball lift, prone three-point support one- hand front raise × 3 groups, 30 times/group, 2 minutes interval	
Tuesday	Aerobic endurance	Running, boxing and leg	Spa recovery
	Fighting force	combination target interval training	
	Coordination	4× (4min 80%-95%HRmax + 3min	
	(Reskill	interval 60%-70%HRmax), supine	
	movement)	weight-bearing neck lift, prone weight-bearing (15-20kg barbell plate) neck lift × 3 groups, 15- 20 times/group, three-point support of both feet × 3 groups, 3 minutes/group, 2-minute interval,	

		arrow agility running, rope ladder	
		running × 3 groups, 2-minute interval	
Thursday	Maximum strength	Bench press, squat, bench pull × 3	Stretch
	Fast power	groups, 1-6R times/group,	
	Explosive force	85%1RM, 3min interval); quick	
	Core stability	barbell lift, clean and jerk × 3	
	strength	groups, 5-10 times/group,	
		<60%1RM, interval 3 minutes;	
		weight-bearing squat jump × 3	
		groups, 30% 1RM, 10-15/group,	
		deep push hold × 3 groups, 10-	
		15/group, 3 minutes interval; side	
		lying support, swallow balance × 3	
		groups, 2 minutes/group , 2min interval	
Friday	Aerobic endurance	Continuous practice of boxing and	Sublactic acid
	Fighting force	leg combination target shooting 6	threshold
	Speed	times (6-8 minutes 50%-75%	intensity
		HRmax + 1 minute interval); supine	aerobic
		weight-bearing neck lift, prone	running
		weight-bearing (15-20kg barbell	
		plate) neck lift × 3 groups, 15-20	

times/group, Two people cooperate
to hit the head $\times$ 3 groups,
3min/group; reskill movement target
practice $\times$ 2 groups, 1min/group,
2min interval, footwork practice $\times$ 2
groups, 2min/group, 2min interval,
20S left and right whip kick $\times$ 2 sets,
2 minutes rest



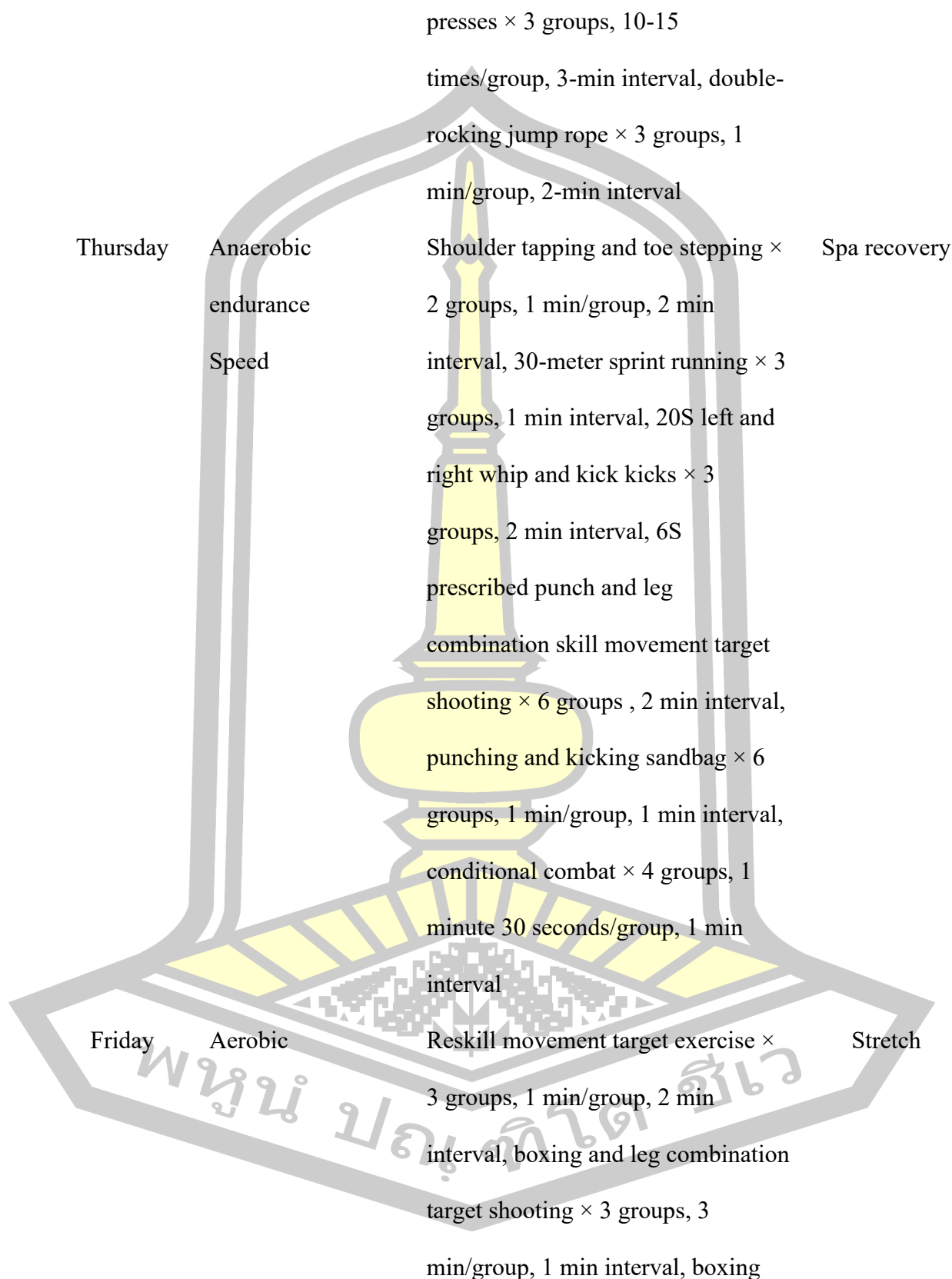
Weeks 5-8

Days	Task	Item	Relax
Monday	Anaerobic endurance	6S sprint running × 6, 2min interval,	Sublactic acid
		6S punch and leg combo air attack ×	threshold
	Aerobic endurance	6, 2min interval, 400m × 4, 1min	intensity
		interval, 6 running × (4min 80%-	aerobic
		95%HRmax + 3min interval 60%-	running
		70%HRmax)	
Tuesday	Strength endurance	Quick flat press, shoulder press, half	Foam rolling
	Maximum strength	squat, weighted lunge jump × 4	
	Fast power	groups (30%-50% 1RM, 15-20	
	Explosive force	times/group/content, circuit training	
		method), 3 minutes interval, supine	
		fly, deep squat, hard pulling 45° sit-	
		ups × 3 groups, 10-15/group, 3	
		minutes interval	
Thursday	Anaerobic endurance	6S boxing and leg combination	Massage,
		movements are empty strikes × 6	Mind
	Coordination	groups, with an interval of 2	Relaxing
	(Reskill movement)	minutes. 6S requires boxing and leg	
		combination movements for target	
		shooting × 6 groups, with an interval	
		of 2 minutes. Boxing and leg	

		combination movements for hitting	
		sandbags × 6 groups, 1	
		minute/group, 1 minute interval, and	
		conditional actual combat × 4	
		Group, 1 minute and 30	
		seconds/group, 1 minute interval,	
		changing direction and footwork,	
		running forward and backward × 3	
		groups, 2 minute interval	
Friday	Strength endurance	Barbell plate, bench press, squats,	Stretch
	Core stability	weighted cross-step jumps 1 minute,	
	strength	squatting with left and right whip	
	Fighting force	legs × 3 groups, 1 minute/group, 1	
		minute interval; lying on the back,	
		raising hips and legs × 3 groups, 40	
		times/group, 2 minutes interval,	
		balancing ball standing on one leg ×	
		3 groups, 2 minutes/group, 2	
		minutes interval, three-point	
		support on both feet × 2 groups, 3	
		minutes/group, two people hitting	
		the head × 2 groups, 3	
		minutes/group, 2 minutes interval	

Weeks 9-12

Monday	Anaerobic	6S sprint running × 6, 2 min interval, 6S boxing and kicking combo air attack × 6, 2 min interval, 400m × 4, 1 min interval reskill movement target practice , 3min/group, 1min interval, boxing and kicking combination movements with variable speed target shooting × 3 groups, 40S/group, 2min interval	Sublactic acid threshold intensity aerobic running
Tuesday	Coordination (Reskill movement) Strength endurance Fast power Explosive force Fighting force	Bench pull, weighted barbell rotation × 4 groups, 30%-50% 1RM, 15-20 times/group/content, 1 minute interval, power clean × 3 groups, 5-10 times/group, <60% 1RM, 3 minutes interval , Supine weight-bearing neck lift, prone weight-bearing (15-20kg barbell) neck lift × 3 groups, 15-20 times/group, squat jump punch, squat left and right whip legs × 3 groups, 1 min/group, 1 min interval; Squat jumps, deep	Foam rolling



		presses × 3 groups, 10-15 times/group, 3-min interval, double- rocking jump rope × 3 groups, 1 min/group, 2-min interval	
Thursday	Anaerobic endurance Speed	Shoulder tapping and toe stepping × 2 groups, 1 min/group, 2 min interval, 30-meter sprint running × 3 groups, 1 min interval, 20S left and right whip and kick kicks × 3 groups, 2 min interval, 6S prescribed punch and leg combination skill movement target shooting × 6 groups, 2 min interval, punching and kicking sandbag × 6 groups, 1 min/group, 1 min interval, conditional combat × 4 groups, 1 minute 30 seconds/group, 1 min interval	Spa recovery
Friday	Aerobic	Reskill movement target exercise × 3 groups, 1 min/group, 2 min interval, boxing and leg combination target shooting × 3 groups, 3 min/group, 1 min interval, boxing	Stretch

and leg combination movement

variable speed target shooting $\times 3$

groups, 40S/group, 2 min interval,

running $\times 4$ (4min 80%-95%HRmax

+ 3min interval 60%-70%HRmax),

continuous practice of punching and

kicking with sandbags $4\times$ (6-8min

50%-75%HRmax + 1min interval)

You also have the right to withdraw from the program at any time without notice. And there will be no consequences for you by not participating in or withdrawing from the research project. Your basic personal information will be retained and will not be disclosed to the public. Your basic personal information will only be used for this research, and the relevant data will be destroyed after the research is completed. All participant data will be encrypted and stored on the researcher's computer. Set a password for the folder where data is saved, and set a computer startup password. After the experiment is completed, all experimental data on the experimental instrument will be deleted to ensure that the experimental data will not be leaked during the collection process. The analysis and digitization of experimental data are performed on the researchers' computers, ensuring that there is no risk of data leakage. We will only use aggregate information and data for reporting purposes and will not disclose volunteers' personal information. You will not be paid or charged for your research.

If you have questions about the research Please feel free to contact us at (Jiangpo Ding- Health and Sport Science, Educational Faculty, Mahasarakham University, Phone: +18381356785). If you were not treated as described or want to know your rights while participating in this study, You can contact at " Human Research Ethics Committee Mahasarakham University Division of Research and Academic Service Promotion Mahasarakham University " Tel. 043-754416 Internal number 1755

Sincerely
Jiangpo Ding
Researcher

1-12 Week training program

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
Warm up	Joint movement, stretching		Warm up to prevent sports injuries	Stand or sit with your hands naturally at your sides. Slowly turn your head forward, backward, left, and right, keeping the movement moderate, and stay in each direction for 3-5 seconds. Stand with your feet shoulder-width apart and your hands at your sides. Move your shoulders forward and backward in circles as far as	 

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				possible, 10-15 times each time. Stand with your feet apart, knees slightly bent, hands on hips, body stable, and twist your waist to the left and right. Keep the movement slow and moderate, twisting 8-10 times each time. Stand with your hands on your knees, knees slightly bent, and slowly move your knees in a circular motion, alternating directions, 5-10	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				times in each direction. Stand with one leg lifted and make a large circle on your toes. 10 times in each direction, then switch legs and repeat. Stand with your hands on one ankle and pull your heel toward your hip, keeping your knees together, hold the position for 15-30 seconds, and repeat with the other leg. Sit on the ground, stretch your legs	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				straight in front of you, bend your body forward, try to touch your toes with your hands, and hold for 15-30 seconds. Standing position, hold your hips with one hand, raise the other hand above your head, lean your body to one side, hold for 15-30 seconds, and repeat on the other side. Standing or sitting, cross your hands in front of your chest and hug your	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				shoulders, gently pull forward, and hold the position for 15-30 seconds.	
Monday morning	Pull-ups, seated rows, deadlifts, barbell shoulder presses, dumbbell lateral raises, dumbbell front raises		Shoulder and back training	1. Pull-ups Hold the horizontal bar with your hands slightly wider than your shoulders, hang your body, keep your feet off the ground, and tighten your core. Tighten your shoulder blades, use your back to pull your body up until your chin is above the	       

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				horizontal bar, and keep your whole body stable. Slowly control your body to lower back to the starting position, and keep the movement continuous. 2. Seated rowing Sit on the rowing machine, hold the handles with both hands, keep your back straight, bend your knees slightly, and put your feet on the pedals. Tighten your shoulder blades, use your	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				back to pull the handles toward your abdomen, while keeping your body stable. Slowly put the handles back, control the movement until your arms are straight, and repeat the movement. 3. Deadlift Stand in front of the barbell, feet shoulder-width apart, hold the barbell with both hands, keep your back straight, and tighten your core. Use your hip	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				joints to push the ground with your feet, lift the barbell to a standing position, keep your back straight, and tighten your shoulders. Slowly put the barbell back to the ground, always keep your back stable, and repeat the movement. 4. Barbell Shoulder Press Stand with your feet shoulder-width apart, hold the barbell with both hands, palms facing forward,	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				and the barbell is above your shoulders, keeping your back straight. Use your shoulders and upper arms to push the barbell vertically overhead, with your arms fully extended and elbows slightly bent. Slowly return the barbell to your shoulders and repeat. 5. Dumbbell Lateral Raise Stand or sit, hold the dumbbells with both hands, arms hanging	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				naturally, palms facing inward. Use your shoulders to keep your arms straight and raise the dumbbells to shoulder height, keeping your shoulders stable. Slowly return the dumbbells to the starting position, keeping the movement continuous. 6. Dumbbell Front Raise Stand or sit, hold the dumbbells with both hands, arms hanging naturally, palms	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				facing inward. Use the front of your shoulders to keep your arms straight and raise the dumbbells to shoulder height. Slowly return the dumbbells to the starting position, maintaining a continuous movement.	
Monday Afternoon	Plank, Russian twist, hanging leg raise, crunch		Core Strength Training	1. Plank Lie prone on the ground, bend your elbows and support them under your shoulders, keep your feet together and your toes touching the	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				ground. Tighten your abdominal muscles, keep your body in a straight line from head to toe, and avoid raising or lowering your hips too high or too low. Keep breathing normally for a certain period of time (ranging from 30 seconds to 2 minutes), and always keep your core tight. 2. Russian Twist Sit on the ground, bend your knees, lightly touch your heels to the	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				ground, and slightly lean your back to about 45 degrees. Make fists or hold weights (dumbbells or medicine balls) with your hands, keep your arms parallel to your chest, and rotate your upper body to the left and right sides in turn, keeping your core tight. Exhale when you rotate, and inhale when you return to the middle, keeping the movement	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				continuous. 3. Hanging Leg Raise Hold the horizontal bar with your hands, lift your feet off the ground, and hang your body with your core tight. By tightening your abdominal muscles, lift your legs to a horizontal or slightly above horizontal position, keep your back stable and avoid shaking. Slowly lower your legs,	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				keep the control of the movement, and repeat the movement. 4. Crunch Lie on your back with your knees bent and your feet flat on the ground. Place your hands behind your head or cross them in front of your chest. Tighten your abdominal muscles, lift your shoulders off the ground, and roll your upper body to the top of the abdominal force, keeping your	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				lower back close to the ground. Slowly lower your upper body and return to the starting position, keeping your abdomen tight, and repeat the movement.	
Tuesday Morning	Squats, Leg Press, Bulgarian Splits		Leg strength	1. Squat Stand with your feet shoulder-width apart and your toes slightly out. Keep your core tight and place your hands in front of your chest or hold a barbell on your shoulders. Slowly bend your knees	 The 'Picture' column contains three stacked photographs. The top photo shows a person in a black shirt and pants performing a squat on a grassy field with a building in the background. The middle photo shows a person lying on a leg press machine in a gym. The bottom photo shows a person in a black tank top and leggings performing a Bulgarian split squat in a gym.

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				and sit your hips back as if you were sitting in a chair. Squat until your thighs are parallel to the ground or slightly lower. Push your body back to a standing position through your heels, keeping your back straight and your knees below your toes. Inhale as you squat and exhale as you stand up. 2. Leg Press Sit on the leg press machine with your feet on the pedals	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				shoulder-width apart and your toes slightly out. Slowly bend your knees and push the pedals down until your thighs and calves are at a nearly 90-degree angle. Be careful to keep your back against the seat. Push the pedals back to the starting position through your heels, without completely locking your knees. Inhale as you push down and exhale as you push up.	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				Strengthen the front of your thighs (quadriceps), buttocks, and calves. 3. Bulgarian Split Squat Stand with your back to a stool, feet shoulder-width apart, one foot on the stool, front leg at a suitable distance from the stool, back leg instep on the stool. Slowly bend the front knee, lower your body until the front thigh is parallel to the	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				ground, keep your upper body straight, and avoid your front knee going beyond your toes. Push your body back to the starting position by exerting force through your front heel. After repeating, do the same with the other leg. Inhale when squatting down, and exhale when standing up.	
Tuesday Afternoon	Plank, Russian twist, hanging		Core Strength Training	1. Plank Lie prone on the ground, bend your elbows and	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
	leg raise, crunch			support them under your shoulders, keep your feet together and your toes touching the ground. Tighten your abdominal muscles, keep your body in a straight line from head to toe, and avoid raising or lowering your hips too high or too low. Keep breathing normally for a certain period of time (ranging from 30 seconds to 2 minutes), and always keep your	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				core tight. 2. Russian Twist Sit on the ground, bend your knees, lightly touch your heels to the ground, and slightly lean your back to about 45 degrees. Make fists or hold weights (dumbbells or medicine balls) with your hands, keep your arms parallel to your chest, and rotate your upper body to the left and right sides in turn, keeping your core tight.	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				Exhale when you rotate, and inhale when you return to the middle, keeping the movement continuous. 3. Hanging Leg Raise Hold the horizontal bar with your hands, lift your feet off the ground, and hang your body with your core tight. By tightening your abdominal muscles, lift your legs to a horizontal or slightly above	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				horizontal position, keep your back stable and avoid shaking. Slowly lower your legs, keep the control of the movement, and repeat the movement. 4. Crunch Lie on your back with your knees bent and your feet flat on the ground. Place your hands behind your head or cross them in front of your chest. Tighten your abdominal muscles, lift your	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				shoulders off the ground, and roll your upper body to the top of the abdominal force, keeping your lower back close to the ground. Slowly lower your upper body and return to the starting position, keeping your abdomen tight, and repeat the movement.	
Wednesday morning	Bench press, dumbbell flyes, push-ups, barbell curls,		Chest and arm strength training	1. Bench Press Lie on your back on a bench with your feet flat on the ground, shoulders tight, and holding the	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
	dumbbell dips			barbell with both hands, slightly wider than your shoulders. Slowly remove the barbell from the rack and slowly lower it to the middle of your chest, with your elbows open to the sides. Use the power of your chest and arms to push the barbell back to the starting position, with your arms fully extended at the top but not locked. Inhale as you lower it and exhale as you	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				push it up. 2. Dumbbell Flyes Lie on your back on a flat or incline bench, holding the dumbbells with both hands, with your arms naturally straight and slightly bent, palms facing each other. Keeping your arms slightly bent, slowly lower the dumbbells to the sides to the level of your chest, feeling the stretch in your chest. Use the power of your	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				chest to push the dumbbells back to the starting position, with your arms together at the top. Inhale as you lower it and exhale as you raise it. 3. Push-ups Lie on your back on the ground with your hands directly below your shoulders, arms straight, feet together, and your body in a straight line. Bend your elbows and slowly lower	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				your body until your chest almost touches the ground, keeping your core tight and preventing your waist from sinking. Use the strength of your arms and chest to push your body back to the starting position, with your elbows fully extended. Inhale as you lower your body and exhale as you push it back up. 4. Barbell Curl Stand with your feet shoulder-width apart,	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				holding a barbell with both hands, with a shoulder-width grip. Keeping your upper arms close to your body, bend your elbows and raise the barbell to your chest, keeping your body stable without shaking. Slowly control the barbell to the starting position, with your elbows fully extended. Exhale as you curl, and inhale as you lower it. 5. Dumbbell Triceps Extension	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				Stand or sit, hold a dumbbell in both hands, raise it above your head, with your arms straight and your palms facing up. Bend your elbows and slowly lower the dumbbell to the back of your head, keeping your upper arms fixed and your elbows facing forward. Using your triceps, push the dumbbells back to the starting position, keeping your arms fully	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				extended but not locked. Inhale as you lower them, and exhale as you extend them.	
Wednesday afternoon	Plank, Russian twist, hanging leg raise, crunch		Core Strength Training	1. Plank Lie prone on the ground, bend your elbows and support them under your shoulders, keep your feet together and your toes touching the ground. Tighten your abdominal muscles, keep your body in a straight line from head to toe, and avoid raising or lowering your	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				hips too high or too low. Keep breathing normally for a certain period of time (ranging from 30 seconds to 2 minutes), and always keep your core tight. 2. Russian Twist Sit on the ground, bend your knees, lightly touch your heels to the ground, and slightly lean your back to about 45 degrees. Make fists or hold weights (dumbbells or medicine balls)	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				with your hands, keep your arms parallel to your chest, and rotate your upper body to the left and right sides in turn, keeping your core tight. Exhale when you rotate, and inhale when you return to the middle, keeping the movement continuous. 3. Hanging Leg Raise Hold the horizontal bar with your hands, lift your feet off the ground, and	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				hang your body with your core tight. By tightening your abdominal muscles, lift your legs to a horizontal or slightly above horizontal position, keep your back stable and avoid shaking. Slowly lower your legs, keep the control of the movement, and repeat the movement. 4. Crunch Lie on your back with your knees bent and your feet	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				flat on the ground. Place your hands behind your head or cross them in front of your chest. Tighten your abdominal muscles, lift your shoulders off the ground, and roll your upper body to the top of the abdominal force, keeping your lower back close to the ground. Slowly lower your upper body and return to the starting position, keeping your abdomen tight,	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				and repeat the movement.	
Thursday morning	Long distance running		Endurance training	Keep your body relaxed, shoulders slightly lowered, hands swinging naturally, center of gravity on toes. Stand with feet shoulder-width apart, steps lightly, avoid taking too big steps. Keep your upper body upright, avoid leaning forward or backward, shoulders relaxed, chin slightly raised, eyes looking	 地 点：自贡市大安区·四川轻化工大学李白河校区 今日水印 — 相机 —

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				straight ahead. Bend your elbows about 90 degrees, swing your arms naturally, with moderate amplitude, and swing back and forth in a balanced manner, avoid excessive swinging or crossing the midline of the body. Walk lightly and evenly, with the soles of your feet touching the ground first with the toes or forefoot, and	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				keep the pace of your steps consistent; breathing should be coordinated with your steps, and take steady, deep breaths, avoid shallow, short breaths. Tighten your abdomen and keep your core stable to reduce the up and down shaking of your body. The speed of running should be adjusted appropriately according to your personal Physical Profiles level.	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				Long-distance running focuses on endurance, so you should maintain a steady pace and avoid starting too fast or running too slowly in the latter part.	
Thursday afternoon	Hurdles, straight lunges, shoulder range of motion, active straight leg raises, bird dog, side bridge		Functional training	1. Hurdle Step Stand with your feet together and your hands on your hips or raised above your head for balance. Lift one leg from the hip joint, bend the knee, and bring it as close to your chest as possible,	  

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				simulating the skill movement of crossing a hurdle. Take a big step forward, keep your center of gravity stable, control the slow and smooth movement, and avoid leaning forward or shaking. Follow up with the other leg and return your feet to a standing position. Repeat several times, switching legs to practice. 2. Walking Lunge Stand with your feet shoulder-	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				width apart and your hands on your hips or crossed in front of your chest. Take a big step, bend your front leg until your thigh is parallel to the ground, your knee is at a 90-degree angle, and your back knee is close to the ground but not touching it. Move your center of gravity forward, use your front leg to stand up, and your back leg follows to continue to the	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				next step. Keep your upper body straight, your core tight, and your back not collapsed. Alternate the lunges of each leg and move several times in a row. 3. Shoulder Mobility Exercise Stand with your feet shoulder-width apart and your hands hanging naturally. With your shoulders as the axis, slowly swing your arms forward and backward,	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				gradually increasing the amplitude, and feel the stretch of your shoulder joints. Raise your hands sideways, then slowly draw a circle forward, gradually increasing the range of the circle, and then repeat the skill movement in the opposite direction. Raise your arms to the top of your head, and rotate your shoulder joints clockwise and counterclockwise.	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				4. Active Straight Leg Raise Lie on your back on the ground, with your legs straight and your hands on both sides of your body. Keep one leg straight and close to the ground, and slowly lift the other leg up to the highest position possible (ideally 90 degrees). Keep your core muscles tight when raising your legs to avoid excessive	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				bending of your lower back. Slowly lower your legs to the ground, repeat the skill movement, and switch legs to practice. 5. Bird-Dog Exercise Get on all fours, support yourself with your hands and knees, and keep your spine in a natural neutral position. At the same time, lift one arm and stretch it forward, and stretch the other leg backward. Keep	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				your body balanced, your back not collapsing, and your core tight. Hold for a few seconds, then slowly pull it back, repeat the skill movement, and switch to the other arm and leg. During the whole process, avoid shaking your body left and right, and try to keep your balance. 6. Side Plank Lie on the ground on your side, support one	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				elbow under your shoulder, keep your legs together, and your body in a straight line. Use your elbow and foot as a fulcrum to lift your body so that your head, shoulders, hips and feet are in a straight line, keeping your core tight. Hold the side bridge position for a few seconds to ensure that your body is stable. Then slowly lower it and repeat the skill movement	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				on the other side. Pay attention to breathing evenly throughout the process to avoid the collapse of your hips.	
Friday morning	Crossover, single-leg balance, ladder training, two-handed ball throwing, shuttle run, quick start and stop, lateral jump		Coordination and agility training exercises	1. Crossover Step Stand with your feet slightly apart, shoulder-width apart, and your hands naturally placed at your sides or clenched in front of you. Step one leg out to the side, and the other leg follows closely behind, crossing over the front leg to the front.	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				Continue to cross your steps, keep your knees slightly bent, avoid excessive twisting movements, and control your body balance. After completing a set of movements, switch directions and practice crossover steps in the opposite direction. 2. Single-Leg Balance Stand with your feet together and your hands on your hips. Lift one leg, bend	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				your knees slightly, keep your standing leg stable, and try not to shake your body. While standing, you can focus your eyes on a fixed point, maintain balance for a few seconds, and then switch to the other leg. You can add closed eyes to maintain balance or do this exercise on an unstable balance mat to improve your balance ability. 3. Agility Ladder	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				Drill Stand at the starting point of an agility ladder (usually placed on the ground), keep your feet together, and swing your hands naturally. Quickly step your feet into the ladder rungs alternately, keeping each step light and fast, leaning forward with your knees slightly bent. You can do a variety of step exercises, such as forward, sideways, or	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				crossover steps. Keep the rhythm of the movements consistent, fast, and control your center of gravity, and don't step on the ladder. 4. Two-Handed Medicine Ball Throw Stand with your feet shoulder-width apart, hold the medicine ball in front of your chest with both hands, and bend your knees slightly. Lean back and quickly push forward, throwing the	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				medicine ball forward with both hands at the same time, and pushing with your legs to release the medicine ball. Tighten your core and pay attention to the explosive power of the whole movement, avoiding using one arm to exert force. After catching the medicine ball, repeat the throwing skill movement. You can do the throwing exercise in different	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				directions, such as sideways or upward. 5. Shuttle Run Stand at the starting line, with your feet slightly apart, leaning forward, and ready to start. When you hear the command, quickly start to the designated point, touch the ground or the mark, and then immediately turn around and run back to the starting point. Continuously turn back and	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				forth, maintain the fastest speed, and try to minimize the time loss when turning. Sprint at full speed for the last round, keeping your breathing and movements consistent. 6. Sprint & Stop Drill Put your feet shoulder-width apart, lean your center of gravity forward, and prepare to start. Start quickly and sprint to the target point at the	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				fastest speed. After reaching the target point, stop quickly, pay attention to slowing down by bending your knees and lowering your center of gravity to avoid sudden stops and injuries. Repeat the start and stop movements many times to maintain explosive power and stability in sudden stops. 7. Lateral Jump Stand with your feet together, knees slightly	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				bent, and your hands swinging naturally. Use both legs to exert force at the same time, jump to one side, and gently bend your knees to cushion when landing to keep your center of gravity stable. Jump quickly to the other side and repeat left and right alternately. Keep your core tight during the jump to avoid shaking your body left and right or losing balance.	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
Friday Afternoon	Boxing, kicking, wrestling		Sanda skill movement training	1. Boxing Stand with your feet forward and backward, with your center of gravity slightly leaning toward your back foot, your knees slightly bent, your front foot slightly turned inward, your back foot shoulder-width apart, and your toes pointing outward. Make fists with both hands, keep your fists close to your face to protect your chin, and keep your	  

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				elbows close to your ribs to protect your body. Stretch your front hand quickly toward the target while your back heel slightly raised and your front foot rotated clockwise. The first two knuckles of your fist are the contact points of the punch, and it is quickly retracted after the punch. Bend your back hand at the elbow, swing forward and hit the target, turn	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				your body to increase the power, and your back foot will follow suit. Bend your front or back hand fist and hit the side of your opponent's face or chin at an upward angle, turning your body sideways to increase the power of the strike. Keep your head slightly tilted down, and use your shoulders and arms to defend when dodging your	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				opponent's attacks. 2. Kicking Spread your feet forward and backward, with your center of gravity on your back foot, and keep your hands in a defensive position to protect your upper body. Shift your weight to your standing leg, lift your knee, straighten your leg and hit the target with the outside of your foot. When kicking, rotate	

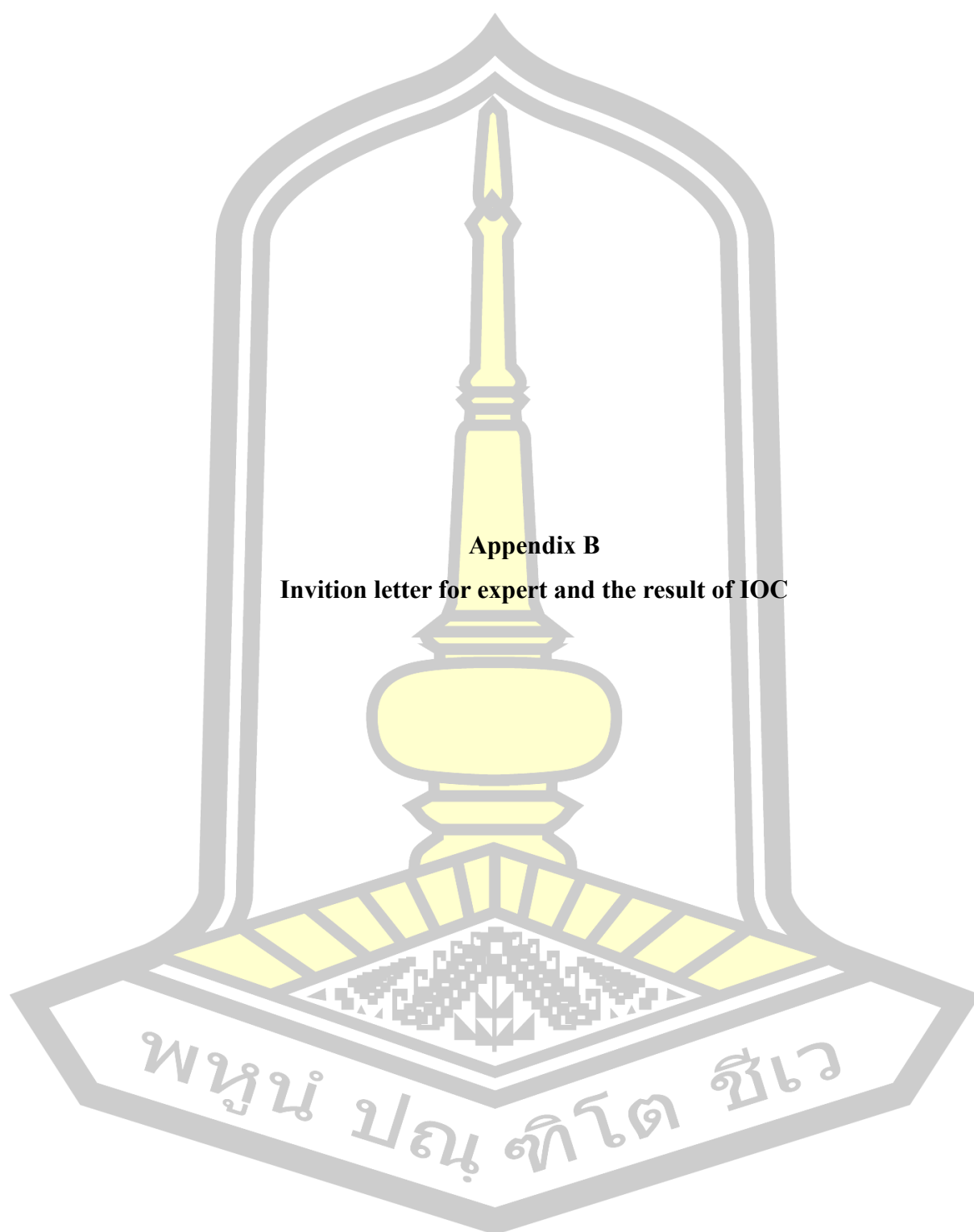
Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				your body so that your hips, knees and soles are in a straight line. Lift your front foot, raise your knee to waist height, and push your foot forward to hit the target, just like kicking a door. Keep your back foot stable when kicking, and quickly retract it after kicking. Bend and lift your back leg, use your knee as the axis, use your hip rotation and body force, and sweep the target	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				with the instep or shin. Retract quickly after each kick to avoid losing your center of gravity or exposing your opponent, and maintain a defensive posture. 3. Wrestling Stand firmly with your feet, bend your knees slightly, lean forward, lower your center of gravity to exert force, and keep your hands forward to grab your opponent.	

Training Process	Specific skill movements	Time	Purpose	Specific steps	Picture
				Double Leg Takedown When rushing towards your opponent, hold your opponent's legs with both hands, sink your body, and use your center of gravity to bring your opponent down. After grabbing his legs, quickly rotate your hips, lift his legs and make him lose balance.	

.....

Signature



Appendix B

Invitation letter for expert and the result of IOC



FACULTY OF EDUCATION
MAHASARAKHAM UNIVERSITY

79/2 Muang, Maha Sarakham,
44000, THAILAND
Tel/fax +66 43 713 174
Email: cia.edu@msu.ac.th

Center for International Affairs

MHESRI No. 0605.5 (2) / CL1437

Date: August 19, 2024

To: Professor Yun Sun
Sichuan University of Science & Engineering
Professor Jun Xu
Sichuan University of Science & Engineering
Professor Wei Dai
Sichuan University of Science & Engineering
Professor Binghong Li
Sichuan University of Science & Engineering
Professor Yiran Tian,
Sichuan University of Science & Engineering

Subject: Expert Invitation

Our student, **Mr. Jiangpo Ding, student ID 64010564015**, majoring in the Ph. D. Exercise and Sport Science Program is currently undertaking a research project titled "**Physical Training Program on Fitness Profiles of College Student Sanda Athletes**" under the guidance of Dr. Wannaporn Sumranpat Brady.

To ensure the successful execution and the highest quality of this research project, we are seeking your valuable expertise and experience. Therefore, I am sending a formal invitation to you to serve as the expert reviewer for the research instrument designed for this thesis project.

Your participation in this academic endeavor is highly valued and appreciated. Should you require any further information or have questions regarding this invitation, please do not hesitate to contact us by email.

Yours sincerely,

(Assoc. Prof. Chowwalit Chookhampaeng)
Dean, Faculty of Education,
Mahasarakham University

In this study, the aim is to investigate the effectiveness of the physical training program designed for college Sanda athletes. After 12 weeks of training, experts considered consistency. The contact score for each question was as follows:

If deemed appropriate and consistent, score +1

When unsure of appropriateness or consistency, score: 0/

When deemed inappropriate and consistent, score -1.

The tools are appropriate and consistent, and there is confidence that they can be used according to the criteria.

The table shows the content validity values of experts considering consistency, evaluating physical training venues and training plans for Sanda athletes.

Order	Evaluation items	Project content	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Total	RESULTS
1	Training environment	Indoor training field and outdoor playground of Sichuan University of Light Chemical Technology	1	1	1	1	1	5	0.8
2	Training Duration	12 weeks	1	1	1	1	1	5	1

3	Training frequency/day	Twice a day	1	1	0	1	1	4	0.8
4	Training frequency/week	5 days/week	1	1	1	0	1	4	0.8
5	Length of training/day	180 minutes/day	1	0	1	1	1	4	0.8
6	Warm up (preparation phase)	Head movements	1	1	1	1	0	4	0.8
		Chest expansion exercises	1	1	1	0	1	4	0.8
		Body turn exercises	1	1	0	1	1	4	0.8
		Arm movement	1	0	1	1	1	4	0.8
		Lower back motion	1	1	1	1	1	5	1
		Arched step pressing leg	1	1	1	1	1	5	1
		Step by step and press your legs	1	1	1	1	1	5	1
		Summary	1	0.85	0.85	0.85	0.85	4.4	0.88
7	Shoulder and Back Training	Pull-ups	1	1	1	1	1	5	1
		seated row	1	1	1	1	1	5	1
		Stiff Pull	1	1	1	1	0	4	0.8
		Barbell shoulder push	1	1	1	1	1	5	1
		Dumbbell Lateral Raise	1	1	1	1	0	4	0.8
		Front dumbbell flat lift	1	1	1	1	1	5	1

		Summary	1	1	1	1	0.66	4.66	0.92
	Core Strength Training	Flat support	1	1	1	1	1	5	1
		Russian Twist	1	1	1	1	1	5	1
		Pendant lift leg	1	1	1	1	1	5	1
		Abdominal curls	1	1	1	1	1	5	1
		Summary	1	1	1	1	1	5	1
	Leg Strength Training	Squats	1	1	1	1	1	5	1
		Leg lifts	1	1	1	1	1	5	1
		Bulgarian squats	1	1	1	1	0	4	0.8
		Summary	1	1	1	1	0.66	4.66	0.92
	Core Strength Training	Flat support	1	1	1	1	1	5	1
		Russian Twist	1	1	1	1	1	5	1
		Suspended leg lift	1	1	1	1	0	4	0.8
		Abdominal curls	1	1	1	1	0	4	0.8
		Summary	1	1	1	1	0.5	4.5	0.9
	Chest and arm exercises	Bench press	1	1	1	1	0	4	0.8
		Dumbbell Bird	1	1	1	1	1	5	1

		Push-ups	1	1	1	1	1	5	1
		Barbell curl	1	1	1	1	1	5	1
		Dumbbell arm flexion	1	1	1	1	1	5	1
		Summary	1	1	1	1	0.8	4.8	0.96
	Core Strength Training	Flat support	1	1	1	1	1	5	1
		Russian Twist	1	1	1	1	1	5	1
		Dangling leg lift	1	1	1	1	1	5	1
		Abdominal curls	1	1	1	1	1	5	1
		Summary	1	1	1	1	1	5	1
	Endurance Training	Long-distance running	1	1	1	1	1	5	1
	Functional training	Hurdle Steps	1	1	1	1	1	5	1
		Straight lunges	1	1	1	1	1	5	1
		Shoulder range of motion	1	1	1	1	1	5	1
		Active straight leg raise	1	1	1	1	1	5	1
		Bird dog style	1	1	1	1	1	5	1
		Side bridge	1	1	1	1	1	5	1
		Summary	1	1	1	1	1	5	1

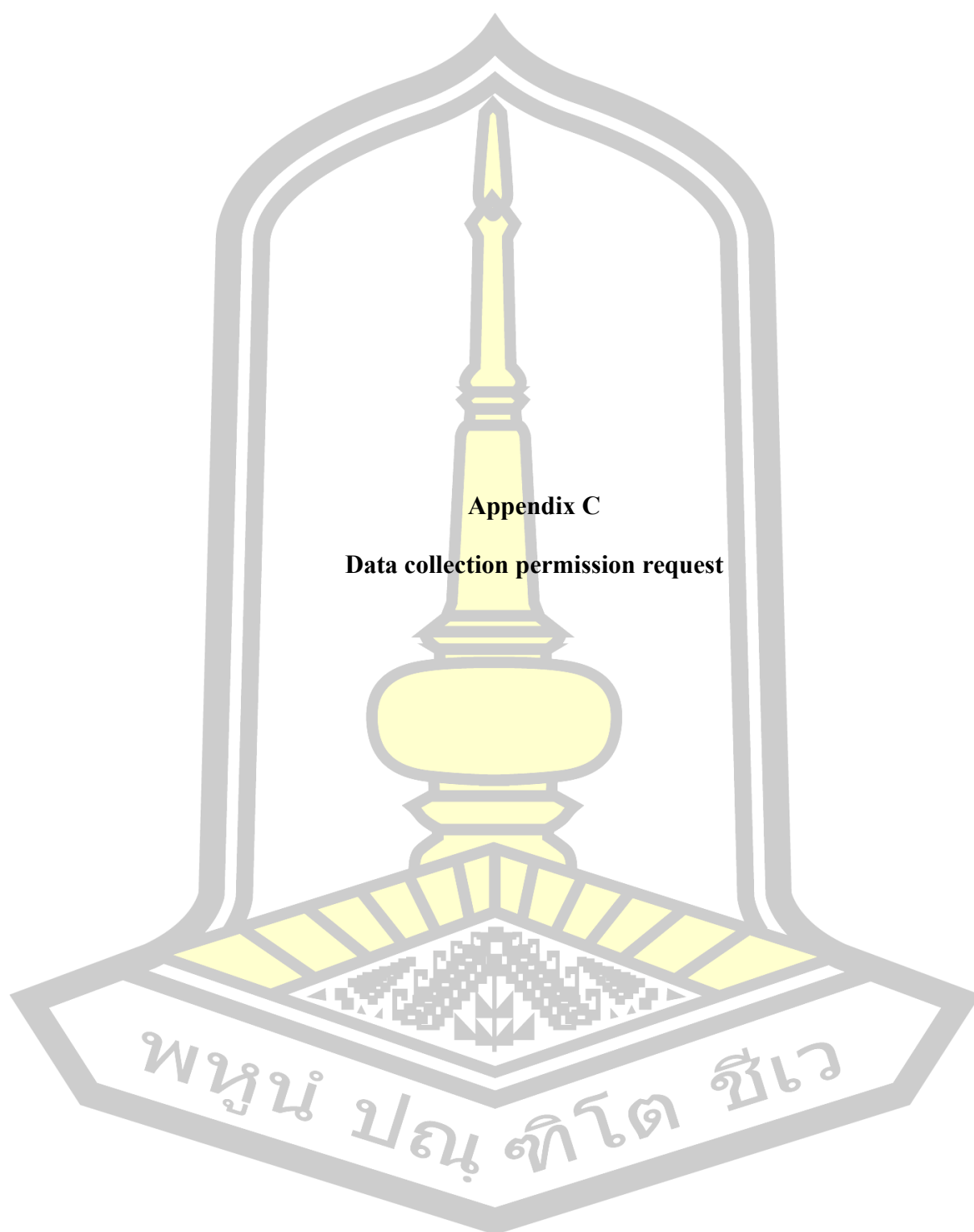
	Coordination and agility training movements	Cross steps	1	1	1	1	1	5	1
		Balancing on one leg	1	1	1	1	1	5	1
		Ladder training	1	1	1	1	1	5	1
		Two-handed toss	1	1	1	1	1	5	1
		Shuttle run	1	1	1	1	1	5	1
		Quick start and brake stop	1	1	1	1	1	5	1
		Side jumps	1	1	1	0	1	4	0.8
		Summary	1	1	1	0.85	1	4.85	0.97
	Sanda action training	Boxing	1	1	1	0	1	4	0.8
		Kicking	1	1	0	1	1	4	0.8
		Wrestling	1	1	0	1	1	4	0.8
		Summary	1	1	0.33	0.66	1	3.99	0.79
7	Relaxation phase	Arm movements	1	1	1	1	1	5	1
		Hunchback exercise	1	1	1	1	1	5	1
		Arched step pressing leg	1	1	1	1	1	5	1
		Footstep press leg	1	1	1	1	1	5	1
		Summary	1	1	1	1	1	5	1

Expert evaluation analysis: Physical training program for college students Sanda athletes

Through the analysis of the scores, it can be seen that the physical training program of college students sanda athletes has been unanimously recognized by experts in most projects. The scores of indoor training ground and outdoor playground of Sichuan Light Chemical Technology University were 0.8, indicating that most experts think the environment is suitable for training, although there are some doubts about the consistency, but the overall recognition. The 12-week training period scored 1, which was agreed by all experts as sufficient to achieve effective physical improvement. The frequency of twice-a-day training earned a score of 0.8, and while most experts agreed, one expressed concern. Training frequency five days a week also

scored 0.8, with experts expressing concern about athletes' recovery from fatigue. Training time of 180 minutes a day scored 0.8, reflecting concerns about the impact of training time on focus and recovery. With a score of 0.88 for the warm-up phase, experts agreed that a variety of warm-up styles were suitable for sanda. The score of 0.92 for shoulder and back training shows the experts' high recognition of this training program, emphasizing its importance in defense and offense. The core strength training score is 1, again emphasizing the importance of core strength for sanda athletes. A score of 0.92 for leg strength training and 0.96 for chest and arm training indicates that experts agree that these training programs are critical to improving an athlete's overall performance. Both endurance training and functional training scored 1, indicating full expert acceptance of their necessity and design. Coordination and agility training, which experts generally agree is important for improving reskill movement speed and flexibility, scored 0.97. Some experts expressed concern about the low score of 0.79, possibly due to the lack of expectation for variety of movements. A score of 1 was given for the relaxation phase, which experts agree is necessary for athletes to recover.

In general, the five experts gave full recognition to the overall rationality and feasibility of the training program. The design of the individual training programs was generally widely accepted, and although there were some disagreements on individual programs, the overall show a consistent positive evaluation. This evaluation provides a valuable reference for future training program optimization.





FACULTY OF EDUCATION
MAHASARAKHAM UNIVERSITY

79/2 Muang, Maha Sarakham,
44000, THAILAND
Tel/fax +66 43 713 174
Email: cia.edu@msu.ac.th

MHESRI No. 0605.5 (2) / CL1436

Date: August 19, 2024

Data Collection Permission Request

To: Whom It May Concern
Sichuan University of Science & Engineering,
China

Our student, **Mr. Jiangpo Ding**, student number **64010564015** majoring in the **Ph.D. Exercise and Sports Science Program** is currently undertaking a research project titled "Physical Training Program on Fitness Profiles of College Student Sanda Athletes" under the guidance of Dr. Wannaporn Sumranpat Brady.

To ensure the success and quality of this project, we are seeking your permission to allow our students to process data collection within your institution.

The details of the data collection are as follows:

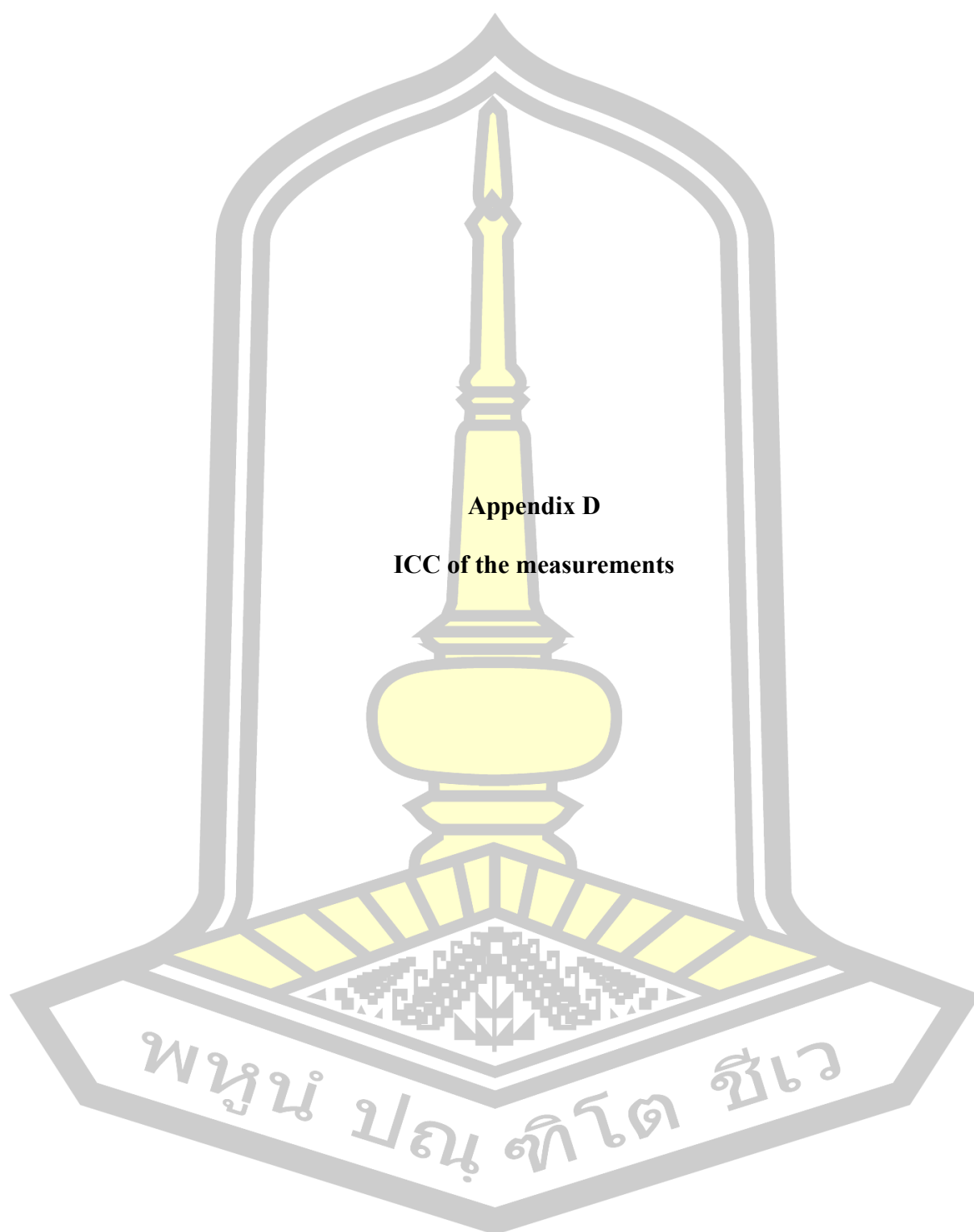
Thesis title: Physical Training Program on Fitness Profiles of College Student Sanda Athletes
Period of data collection: 02/09/2024 to 24/11/2024
Thesis advisor: Dr. Wannaporn Sumranpat Brady

We believe that your institution provides a valuable environment and resources that are essential for the successful execution of this research. The data collection process will be carried out diligently and with the utmost respect for your institution's policies and procedures. We acknowledge that the student has made the necessary preparations, including obtaining the Thesis title approval from our institution.

Should you require any further information or clarification regarding this permission, please feel free to contact us by email.

Yours sincerely,

Assoc. Prof. Chowwalit Chookhampaeng
Dean, Faculty of Education,
Mahasarakham University



1. Test-retest reliability

In order to ensure the reliability and consistency of the Physical profiles measurement data in the "Research on the Design of Physical Training Program for College Students", it is necessary to test the reliability of the measurement tools and methods. The test-retest reliability test is performed by taking repeated measurements at different time points in the same group of subjects and calculating the correlation coefficient between the two measurements to evaluate the stability and consistency of the measurement tool (Lu Heng, Cao Houcheng, Wang Ran 2023).

(1) Overall design

Objective: To evaluate the test-retake reliability of various fitness measurement tools and methods to ensure the reliability of the data.

Subjects: Subjects: 40 collegiate sanda athletes.

Time interval: The time interval between the first measurement (T1) and the second measurement (T2) is 7 days.

Measurement items: including height, weight, body fat percentage, speed, chest strength, leg strength, abdominal strength, arm strength, endurance, coordination, flexibility, joint muscle strength, FMS score, technical success rate.

(2) Specific steps

First Measurement (T1)

Complete all Physical profiles measurements for all subjects within the first two days of the first week according to the following schedule.

Second Measurement (T2)

On the seventh day after the first measurement, the same measurement was repeated for all subjects.

(3) Data analysis

1. Data entry

Data from the two measurements (T1 and T2) were entered into a spreadsheet to ensure that the data corresponded to each subject.

2. Calculate the correlation coefficient

Pearson correlation coefficient, usually denoted by the letter r , is a statistic that measures the strength and direction of the linear relationship between two variables. It has a value between -1 and 1, where 1 means a perfect positive correlation, -1 means a complete negative correlation, and 0 means no linear relationship.

Suppose we have two variables, XX and YY, each with n observations, then the Pearson correlation coefficient for these two variables can be calculated by the following formula:

$$r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}}$$

- x_i and y_i are the values of XX and YY in the i th observation, respectively;
- $\bar{x}$ and $\bar{y}$ are the average of XX and YY, respectively;
- The numerator is the covariance of XX and YY;

The denominator is the product of the standard deviations of XX and YY.

2. Measurement plan

(1) Anthropometry

Test items: height, weight, body fat percentage (body fat percentage)

Test instruments: measuring rulers, scales, bioelectrical impedance meters

(2) Speed

Test event: 50-meter run

Test instruments: playground, timer

(3) Chest strength

Test item: Push-up standard

Test Instrument: Leveling the site

(4) Leg strength

Test item: Squat

Test instruments: barbells, barbell plates

(5) Abdominal strength

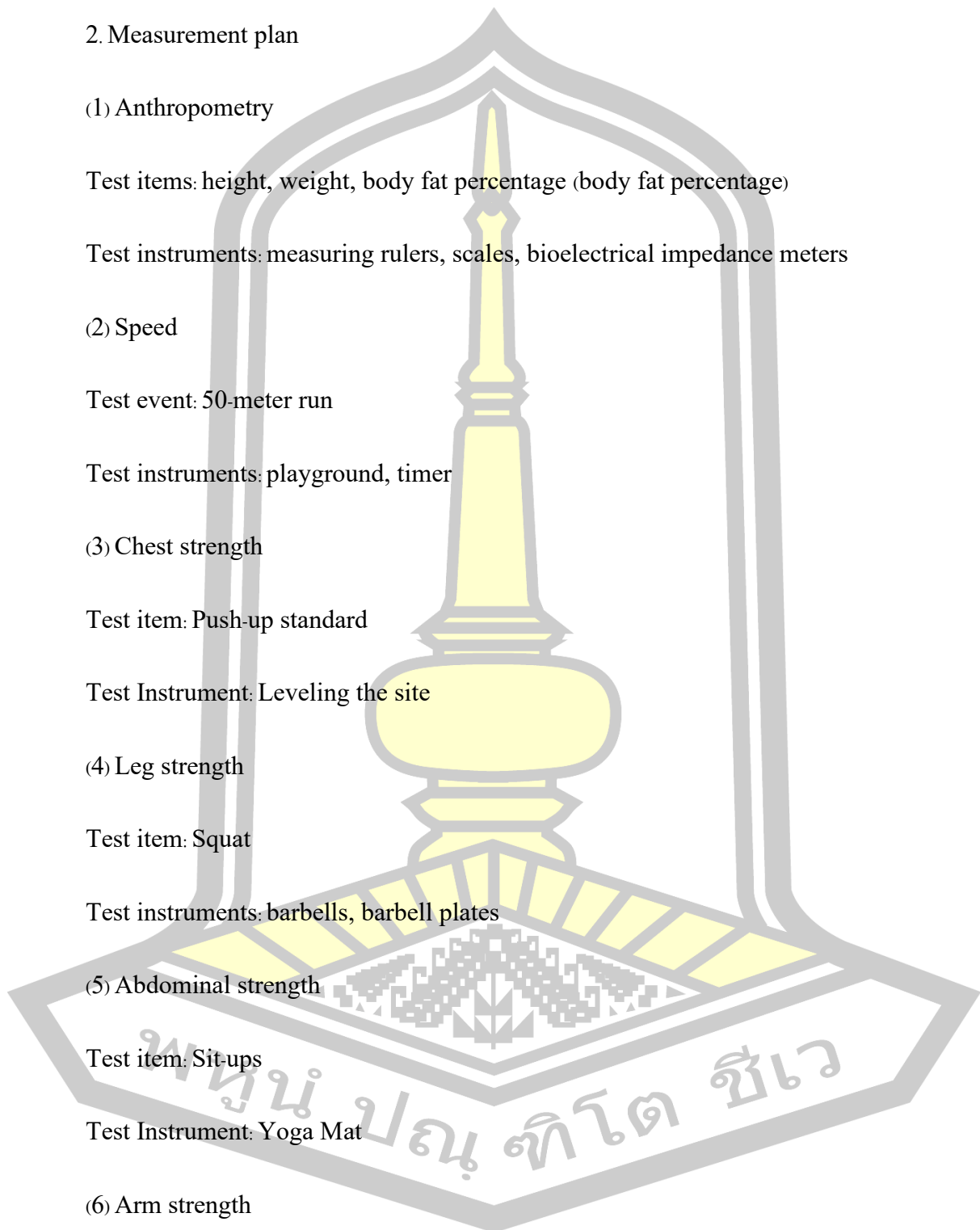
Test item: Sit-ups

Test Instrument: Yoga Mat

(6) Arm strength

Test item: Grip strength

Test instrument: grip device



(7) Endurance

Test events: 1000m (male) / 800m (female)

Test instruments: playground, timer

(8) Coordination

Test item: Switchback run

Test Instrument: Indoor site

(9) Flexibility

Test item: Forward bend of the seated body

Test instrument: Seated body forward flexion tester

(10) Joint muscle strength

Test item: tachymotor strength test

Test Instrument: Tachymuscle Strength Tester

(11) Motor function screening

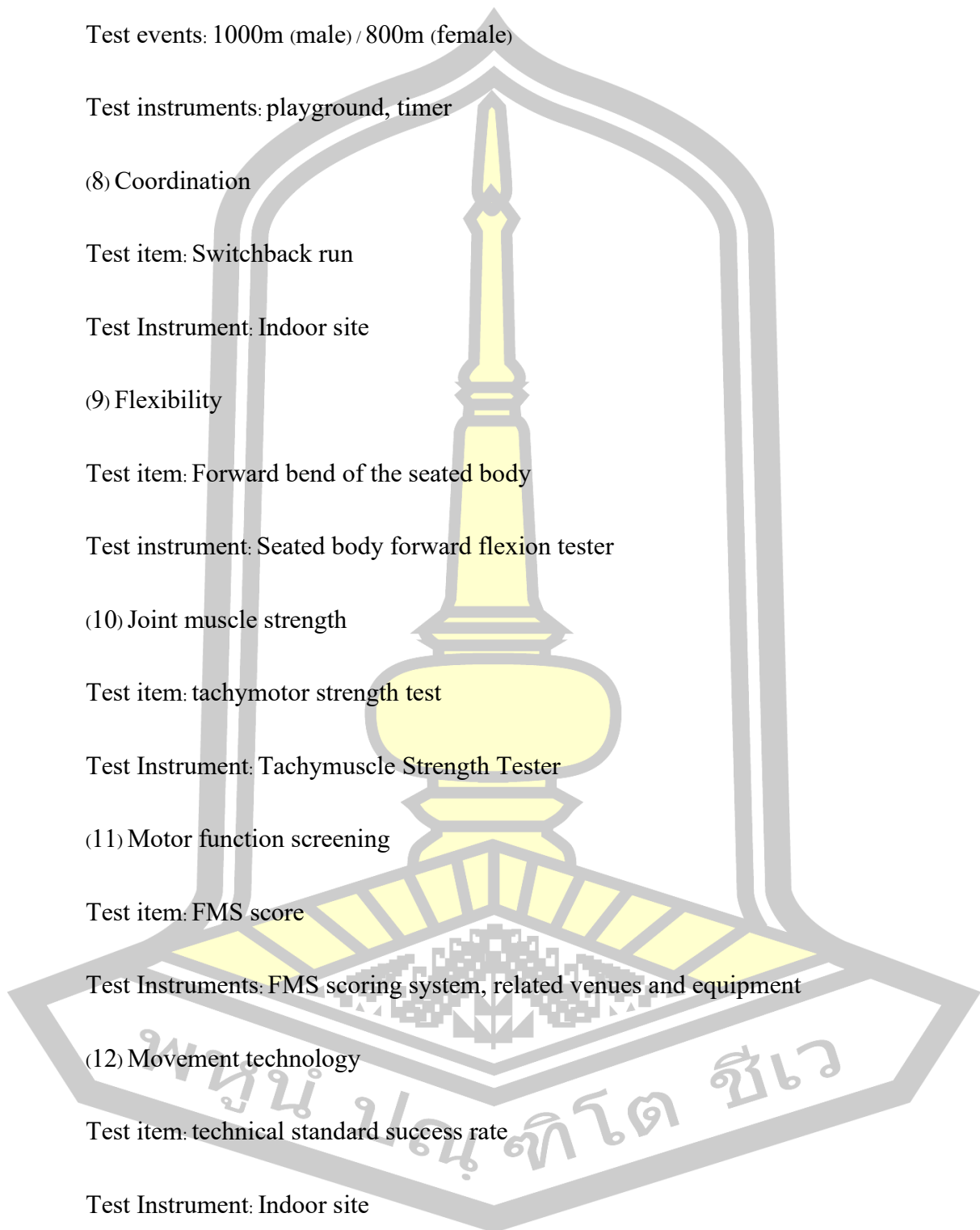
Test item: FMS score

Test Instruments: FMS scoring system, related venues and equipment

(12) Movement technology

Test item: technical standard success rate

Test Instrument: Indoor site



In order to effectively assess the physical status of college sanda athletes, a specific measurement plan can be arranged within a week to ensure the accuracy and scientificity of the measurement results. Here's a detailed measurement plan:

Measurement planning arrangement

Day 1: Anthropometric and speed tests

morning

Anthropometric measurements

Height, weight: Measured using a measuring ruler and scale.

Body fat percentage: Measured using a bioelectrical impedance meter.

Afternoon

Speed test

50-meter run: Performed on the playground and using a timer to keep track of the time.

Day 2: Strength test (chest, legs, abdomen, arms)

Morning

Chest strength

Push-up standard: performed on a level field, the number of push-ups by the athlete is recorded.

Abdominal strength

Sit-ups: Performed on a yoga mat, the number of sit-ups the athlete is recorded.

Afternoon

Leg strength

Squat: Squat test with a barbell and barbell plates, record the maximum number of repetitions or 1RM.

Arm strength

Grip strength: Measure with a grip device and record the grip strength value

Day 3: Endurance test and flexibility test

Morning:

stamina

1000m (male) / 800m (female): Performed on the playground and recorded with a timer.

Afternoon:

flexibility

Sitting Forward Bending: Measured using a sitting forward bend tester, the maximum forward bend distance is recorded.

Day 4: Coordination and joint strength test

Morning:

Coordination

Switchback Run: Performed on an indoor field, with a record of completion time.

Afternoon:

Joint muscle strength

Muscle strength test: Muscle strength tester is used to measure and record data.

Day 5: Motor Function Screening (FMS Score) all day

FMS score

Using the FMS scoring system, with the help of relevant venues and equipment, the seven basic movement patterns are evaluated by professional testers and scores are recorded.

Day 6: Athletic technique test all day

Athletic techniques

Technical standard success rate: Carried out in an indoor venue, the number of successful times and the number of attempts of each technical skill movement are recorded, and the success rate is calculated.

Comparison of two measurements (N=40)

Project	First measurement	Second measurement	R
Height (cm)	169.22±2.21	169.22±2.21	0.977
Weight (kg)	63.22±3.22	63.12±3.21	0.824
Body fat percentage (%)	22%±0.10	22%±0.22	0.899
50-meter run (s)	7.64±0.33	7.60±0.42	0.975
Push-up standard (number of standards completed in one go) (pcs)	42±8.11	42±7.11	0.996
Squats (pcs)	52±5.44	52±4.84	0.978
Sit-ups (pcs/60s)	42±2.1	42±1.8	0.977
Grip strength (30kg/piece)	65±7.1	65±6.8	0.911
1000m(s)	266.50±26.68	267.50±27.58	0.922
800m(s)	256.11±21.44	256.51±22.34	0.917
Switchback Run(s)	11.2±1.11	11.1±1.09	0.925
Sitting, bent forward (cm)	12.11±5.21	12.11±5.22	0.944
Muscle strength test (60°/sec average power) (W)	522±105	522±122	0.974
FMS score	18.22±2.11	18.22±2.27	0.922
Technical standard success rate	0.72±0.11	0.72±0.12	0.968

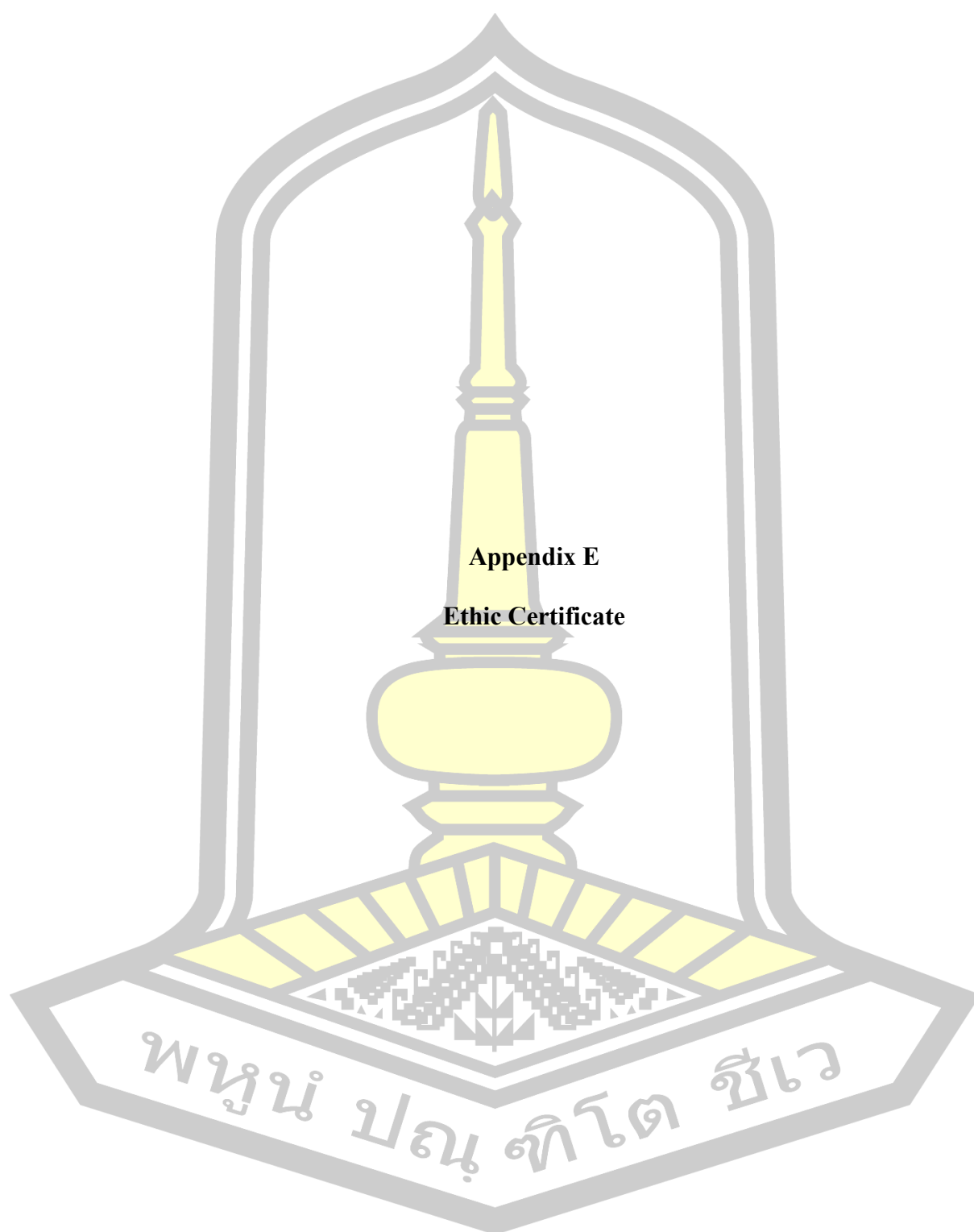
The retest method is a commonly used statistical method to assess the stability and reliability of a measurement tool or method. In this study, a number of physical indicators were measured twice in 40 athletes using the test-retest method, with unclear intervals but assumed within a reasonable time frame. The analysis showed that, except for a few indicators with slight changes, most of the indicators did not differ significantly between the two measurements, indicating that the measurement tool or method has high stability and reliability.

Most of the fitness measures showed a high Pearson correlation coefficient (R -value), indicating that these measures were consistent between measurements. In particular, height, 50-meter run, push-ups, squats, sit-ups, tachymotor strength tests, and technical criteria success rates showed the highest correlation (R -values close to 0.97 to 0.996), indicating that these indicators showed extremely high stability over a short period of time. In contrast, weight, body fat percentage, grip strength, 1000-meter run, 800-meter run, switchback, seated forward bend, and FMS scores still showed good agreement (R values ranged from 0.824 to 0.944), but were slightly lower than those above. This may be due to the fact that these indicators are influenced by more external factors, such as diet, training status, and environmental factors. It is important to note that although the R -values of all indicators were higher than 0.824, indicating good agreement between the two measurements, these results still need to be analyzed in combination with actual training conditions and individual athletes' performance. For example, changes in body weight and body fat percentage

may be related to an athlete's nutrition plan adjustments, while changes in fitness test results may be related to training intensity and recovery.

The test-retest method plays a key role in verifying the reliability of measurement tools and methods. The stability and consistency of these indicators in time were demonstrated by two measurements of 40 athletes and statistical analysis, thus ensuring the accuracy and validity of the data in this study.





Appendix E
Ethic Certificate



MAHASARAKHAM UNIVERSITY ETHICS COMMITTEE FOR
RESEARCH INVOLVING HUMAN SUBJECTS

Certificate of Approval

Approval number: 294-266/2024

Title : Physical Training Program on Fitness Profiles of College Student Sanda Athletes.

Principal Investigator : Mr. Jiangpo Ding

Responsible Department : Faculty of Education

Research site : Zigong City, Sichuan Province, China

Review Method : Expedited Review

Date of Manufacture : 15 May 2024

expire : 14 May 2025

This research application has been reviewed and approved by the Ethics Committee for Research Involving Human Subjects, Mahasarakham University, Thailand. Approval is dependent on local ethical approval having been received. Any subsequent changes to the consent form must be re-submitted to the Committee.

(Associate Professor Vorapoj Promasatayaprot)

Vice Chairman

Approval is granted subject to the following conditions: (see back of this Certificate)

Volunteers Inclusion criteria and Exclusion criteria

1. Inclusion criteria

- (1) Male and female, aged between 19-24 years old.
- (2) The volunteer is interested in the study and signs
- (3) College student Sanda athletes from Sichuan University of Light and Chemical Technology who have participated in municipal competitions
- (4) Be a national First- level, Second-level or Third-level athlete
- (5) Good communication and cooperation.

2. Exclusion criteria

- (1) Those with congenital diseases or physical defects
- (2) Those with mental illness such as depression or cognitive impairment
- (3) Do not have a level two athlete or above
- (4) College student Sanda athletes who have received mindfulness training
- (5) College student Sanda athletes are injured or have not fully recovered from injuries in the past three months;
- (6) Unwilling to participate in this experimental research;
- (7) There is a time conflict with the match/tranning time.



Tools

1. Speed

Purpose:

In physical fitness measurement, speed refers to the speed at which an individual completes a specific athletic action per unit time. It is one of the important indicators for evaluating individual athletic ability and explosive power.

Resources required:

Playground, timer

How to test:

Speed measurements are often combined with other physical metrics such as strength, agility, endurance, etc. The subject attempted to start standing. When you hear the start signal, start immediately and run to the finish line. The starter stands on one side of the starting line, waving the starting flag and giving the starting signal. The timer is located on one side of the finish line and stops timing when the subject and chest reach the vertical surface of the finish line.

Analyze:

Records are in seconds and accurate to one decimal place. The second digit after the decimal point is carried according to the principle of not converting "0" into "1". Compare the improvement effect with the 50-meter performance of the two groups of athletes before the experiment and the 50-meter performance after the experiment of the two groups of athletes after the experiment (Liu Dexin, 2014).





Figure1 Speed



ศูนย์ ปณฺ ทัต ข

Tools

2.Strength

2.1 Standard push-ups

Purpose:

Standard push-ups are a common physical exercise that mainly exercises the strength and endurance of the chest, deltoid muscles, shoulders, arms, and abdominal muscles. Push-ups are one of the basic movements in many fitness exercises and training programs, and are also one of the commonly used programs in military training and physical fitness tests.

Resources needed:

Level surface or yoga mat

How to test:

Before the test, the subject stretched his arms shoulder-width apart, fingers forward, hands on the floor, torso straight, and legs straight back. When the tester heard the "START" command, the subject extended his arms to the level of his shoulders and elbows; then kept his body straight and returned to the starting position. At this point, complete a push-up action.

Analyze:

The subject must repeat this action over and over again. The tester records the number of completions when the subject is unable to complete or continue to maintain the correct action (Zhou Weifang, Zhao Guangsheng, 2013).



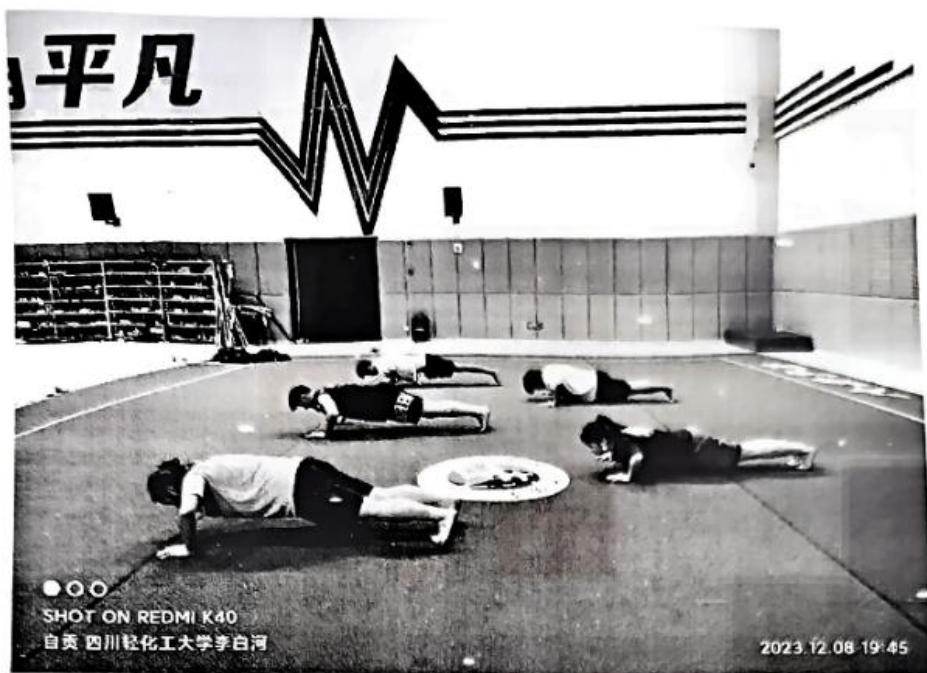


Figure1 Standard push-ups

2.2 Squats

Purpose:

Squats are an important fitness training movement and one of the basic movements of strength training. It works the muscles of the lower body, including the thighs, glutes, and legs, and also helps improve core stability.

Resources needed:

Barbells, barbell plates

How to test:

First, keep your feet and shoulders wide apart. Keep your feet parallel and symmetrical, with your toes not pointed outward. The subject held the bar above their head and adjusted their hands with their elbows 90 degrees to the bar. Next, subjects were asked to straighten their arms. Subjects were instructed to slowly squat as low as possible with their heels dropped to their sides, their head lifted forward, and the barbell raised as high as possible. The knees and feet should be on the same vertical plane, and the knees should not turn out. (Yu Bing, 2012).



Analyze:

This study adopts a safer self-weight squat counting method, that is, the number of squats is counted when athletes do not bear weight in standard squat movements, and squats in non-standard postures are not counted. The standard requirements for squat movements are: (1) Stand shoulder-width apart with your feet parallel to your shoulders. (2) The legs are slightly abducted and the toes are pointed slightly outward.

(3) Straighten your back, tighten your core muscles, and keep your upper body straight. (4) Relax your shoulders and pull them back slightly to bring your shoulder blades together. (5) Slowly bend your knees and squat down. (6) Push your hips back, keep your back straight, and ensure that your knees do not exceed your toes. (7) When squatting, bend your legs at roughly 90 degrees to ensure the effect of squatting. (8) Use the power of your heels to push the ground and stand up from the bottom of the squat. (9) Keep the core muscles tight and ensure that the upper body and buttocks rise simultaneously. (10) After rising to a standing position, tighten your buttocks and thigh muscles to ensure your body is vertical. (Wang Xiangquan, Song Tao, Liu Jian, 2007)

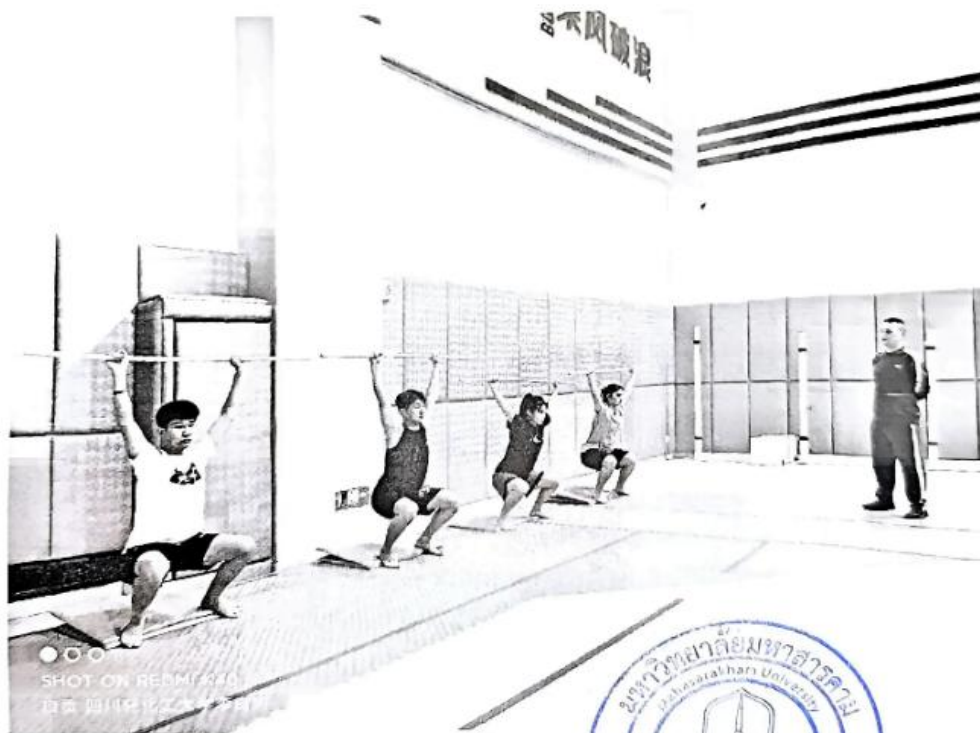


Figure2 squats

2.3 Sit-ups

Purpose:

Sit-ups, an exercise that demonstrates abdominal strength.

Resources needed:

Yoga mat

How to test:

Lie on your back, put your legs together, put your hands up. use your abdominal muscles to contract, swing your arms forward, and quickly get into a sitting position. Continue to bend your upper body forward, touch your feet with your hands, lower your head, and then return to the sitting position, and so on. Before the test, the subject placed his hands and fingers crossed behind his head, his legs slightly apart, his knees bent at 90 degrees, and he lay supine on a flat mat. The other party pressed the subject's ankles on both sides and fixed the lower limbs. When the subject heard the "start" command, he held his head with both hands and closed his trunk to complete the sit-up action. After your elbows touch or pass your knees, return to the starting position and complete the sit-up movement.

Analyze:

The subject had to repeat this action continuously for 1 minute. The tester turns on the instrument while issuing the "start" command; the number of sit-ups completed by the subject within 1 minute is recorded (Fan Yaokui, Chen Liangge, 2012). In "number of times". The degree of improvement was assessed based on the number of times athletes in both groups performed after the experiment.





Figure3 Sit-up

2.4 Grip strength

Purpose:

Grip strength is mainly an indicator of the development of upper limb muscles. It tests the muscle strength of the forearm and hand and reflects the development level of human upper limb strength. In physical fitness tests, it is often reflected in the form of grip strength and body mass index, that is, the size of the grip strength is related to the weight of the person being tested, so as to obtain the most scientific physical assessment.

Resources required:

Grip

How to test:

Before the test, the subject held the grip of the grip dynamometer inside and outside with a strong hand, and turned the grip adjustment wheel to the appropriate grip distance to prepare for the test. When the tester turns on the power switch, a flashing



signal appears on the display screen, and finally freezes at the ".0" value, indicating that the grip dynamometer is in working condition. During the test, the subject stood upright, with his feet naturally apart and shoulder width apart, his oblique arms drooping, his palms facing inward, and he held the inside and outside of the gripping device with maximum strength (Lee Jung-cun, 2012).

Analyze:

In this grip strength test, a fixed weight is used to measure the number of movements an athlete completes under standard conditions.



Figure4 Grip strength



Tools

3 Endurance

Purpose:

In physical training, endurance refers to an individual's ability to maintain a specific intensity of exercise or complete a specific activity over a period of time. It reflects a person's ability to maintain high-intensity exercise for a long time and is one of the important components of physical fitness.

Resources required:

Playground, timer

How to test:

Start with the subject standing. When you hear the start signal, start immediately and run to the finish line. The starter stands on one side of the starting line, waving the starting flag and giving the starting signal. The timer is located on one side of the finish line and stops timing when the subject and chest reach the vertical surface of the finish line.

Analyze:

in seconds to one decimal place. The second digit after the decimal point is carried according to the principle of not carrying "0" into "1". This article uses women's 800m and men's 1000m as endurance measurement methods (Zhang Yong, He Jian, Li Junfeng, 2011)





Figure 1. 1000 meters (male)/800 meters (female)



Tools

4 Coordination

In physical training, *Coordination* refers to an individual's ability to respond quickly to external stimuli or signals. It is an important indicator of the reaction ability of the human nervous system and is crucial for many sports and reaction requirements in daily life.

Resources needed:

Indoor venue

How to test:

After running at the starting line, the subjects started from the starting position, then ran to the top and returned to the original starting point; then ran to the top of the mountain and returned to the original starting point (finishing point). During the test, hands are not allowed to intentionally rest on the ground. Recordings are recorded in seconds, accurate to one decimal place.

Analyze:

The second digit after the decimal point is carried according to the principle of not turning "0" into "1". The sensitivity test results of the two groups of athletes before the experiment were used as indicators to evaluate the degree of improvement of the two groups of athletes (Lu Xiaojian, Yu Hailan, 2011)



Figure1 Coordination

Tools

5 Flexibility

Purpose:

Physical flexibility refers to the good movement of an individual's muscles and joints within a certain range. It reflects the degree of stretch and elasticity of a person's muscles and joint tissues, also known as joint range of motion or joint flexibility. Flexibility is an important component of physical fitness and plays an important role in maintaining body flexibility, preventing sports injuries, and completing certain movements or postures.

Resources needed:

Sitting forward flexion tester

How to test:

Place the seated forward flexion tester on a flat surface. Before testing, use a ruler to calibrate the ruler on the platform so that the upper plane of the cursor is level with the platform, and adjust the cursor scale to 0. The subject sat on a mat connected to the box, with his legs straight and not bent, heels together, toes about 10-15 cm apart, stepping on the vertical plate of the instrument, and holding his hands together. Straighten your arms and hands, gradually bend your upper body forward, and use your fingertips to gently push the cursor on the ruler (do not move forward suddenly) until you can no longer extend forward. The vertical plate of the tester is 0 point along the plane, negative inward and positive forward.

Analyze:

Records are in centimeters and are accurate to one decimal place. If it is a positive number, add a "+" sign before the value and a "-" sign before the negative value. Based on the results of forward bending of the two groups before the experiment (Liu Manjin, 2009)





Figure1 Flexibility



Tools

6 Joint muscle strength

Purpose:

Joint muscle strength is the force generated by the muscles around the joint, which is used to control and stabilize the movement of the joint. This force is generated by the contraction of muscle fibers, allowing bones to move around joints. Joint muscle strength plays an extremely important role in daily life. It not only participates in basic movements such as walking and lifting objects, but also plays a key role in maintaining the stability and coordination of body posture.

Resources needed:

Muscle strength tester

How to test:

The ISOMED2000 isokinetic muscle strength testing system developed and manufactured by DR Company in Germany was used to test the isokinetic muscle strength of the lateral elbow and knee flexor and extensor muscles before and after physical intervention training. (Hu Yihai, Wu Chuanzhong, Gao Ping, 2009)

Analyze:

Take the average of multiple tests.





Figure1 ISOMED2000 Joint muscle strength

ISOMED2000 Joint muscle strength system developed and manufactured by DR in Germany was used to test the isokinetic muscle strength of the dominant lateral elbow and knee flexor and extensor muscle groups before and after the physical intervention training. Before the test, warm up for 15min and rest for 2min. The tester introduces the test requirements to the athletes, and then starts the formal test. The speed was set to 60 / S, and 180 / S and 300 / S. The peak torque of the elbow and knee joint was tested. Each speed was tested 5 times, the two speeds rested 30S, and the highest peak moment (peak torque) was taken. Peak torque refers to the maximum torque output produced by muscle contraction throughout the whole joint movement, which is the torque value at the highest point in the torque curve. The movement velocity is closely related to the peak moment values. In general, the movement velocity increases and the peak torque value decreases accordingly. Joint muscle strength is the force generated by muscle groups around the joint and used to control and stabilize the movement of the joint. This force is created by the contraction of the muscle fibers, thus

allowing the bone to move around the joints. Joint muscle strength plays an extremely important role in daily life. It not only participates in basic movements such as walking and lifting objects, but also plays a key role in maintaining the stability and coordination of body posture.

First, understanding the structure of a muscle is essential for understanding joint muscle strength. Muscle is composed of many myofibers, which in turn contain many myofilaments that are able to contract when stimulated by neural signals. When the nervous system sends a signal, the nerve terminals release neurotransmitters that stimulate muscle cells to produce electrochemical responses, which causing the contraction of the muscle. This process is extremely complex and sophisticated and requires a series of biochemical reactions to allow the muscles to contract and relax. In the concept of joint muscle strength, special attention is the synergy of muscle groups. Human movements often require the joint collaboration of multiple muscle groups to complete complex movements. For example, when lifting objects, muscle groups in the shoulder, arm, back, and leg are all involved, acting through complex coordinated movements to generate enough force to perform the task. In addition, joint muscle strength is also closely associated with stability and postural control. On the one hand, the joint muscle strength can maintain the stability of the joint and prevent the excessive movement or distortion of the joint during movement, thus protecting the joint and the surrounding tissue. On the other hand, it can also help to maintain the correct posture, enabling the body to maintain the correct symmetry and balance, thus reducing the risk of injury. In addition to the basic movements in daily life, joint muscle strength is also crucial for many exercises and sports events. In athletes, strong joint muscle strength not only improves athletic performance, but also reduces the risk of injury. Many sports training programs will include training in joint muscle strength to ensure that athletes can maintain stable joint movements during high-intensity exercise.



Tools

7 FMS Score

Purpose:

FMS (Functional Movement Screening) is a systematic tool commonly used to assess human functional movement capabilities. It is designed to assess an individual's basic movement patterns while performing daily activities and exercises in order to detect and correct potential movement dysfunctions early. FMS scores can help health professionals understand an individual's athletic ability, thereby providing appropriate training and advice to prevent sports injuries and improve sports performance.

Resources required:

FMS scoring system, related venues and equipment

How to test:

The advantages of FMS scoring are objectivity and repeatability. By evaluating standardized movement patterns, the interference of subjective factors can be eliminated, making the evaluation results more objective and credible. Additionally, FMS scores are reproducible and can be assessed on the same population at different time points to understand changes in their exercise capacity. FMS scores have a wide range of applications, including preventive assessment of athletes, follow-up monitoring during recovery, and daily health management. Regular FMS scoring can detect movement dysfunction early and provide appropriate intervention to avoid potential sports injuries. At the same time, for athletes, improving FMS scores can improve athletic performance and reduce the risk of injury.

The Functional Movement Screen (FMS) was assessed before and after the physical training experiment. The specific method is as follows: before the test, athletes jog for 15 minutes to warm up, and then perform seven action tests: squats, reverse squats, upright single-leg stability, shoulder joint flexibility, leg lifts, trunk stability push-ups, and rotational stability. Each action is repeated 3 times. According to the scoring standards, professional evaluators from the Physical Training Center of Sichuan Light Chemical University will use evaluation equipment to score the athletes accordingly, and the highest individual score will be taken, (Hu Yihai, Wu Chuanzhong, 2009).



Figure1 Squat test



Tools

success rate of skill movement

The success rate of skill movement refers to the proportion of specific technology or engineering projects that can be successfully implemented and meet the standards and requirements in accordance with the prescribed technical standards or requirements. The degree of improvement was evaluated based on the standard number of push-ups before the experiment and the standard number of push-ups after the experiment in the two groups.

Sanda technical success rate refers to the ratio of the number of times a specific action is successfully completed in Sanda training or competition to the total number of attempts. Through reasonable training and training, as well as unremitting efforts, the technical level and performance of martial arts athletes can be improved.

Resources required:

Indoor venue

How to test:

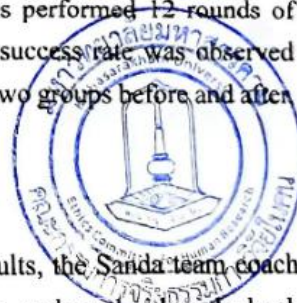
Before and after the group physical training experiment, the athletes in the control group were paired according to the same level, that is, each pair of athletes was divided into two groups for actual combat. Each group of athletes performed 12 rounds of boxing, kicking, and wrestling technical movements. The success rate was observed and statistics were on-site, as well as the success rate of the two groups before and after. Players are paired with opponents that remain the same.

Analyze:

In order to ensure the objectivity of the statistical results, the Sanda team coach and I jointly completed the statistics of technical indicators, and used video playback to judge controversial technical moves until the technical indicators of the two people were consistent. Evaluate the degree of improvement based on the technical success rate and indicators before the two groups of experiments

1. Success rate of boxing

The essentials of the action are to actively turn the front foot, move the center of gravity slightly forward, and drive the front arm with the shoulder to strike forward quickly in a straight line. When punching, the arm is naturally straightened, and the back hand is placed in the original position for defense; The road is retracted and returned to the basic position.



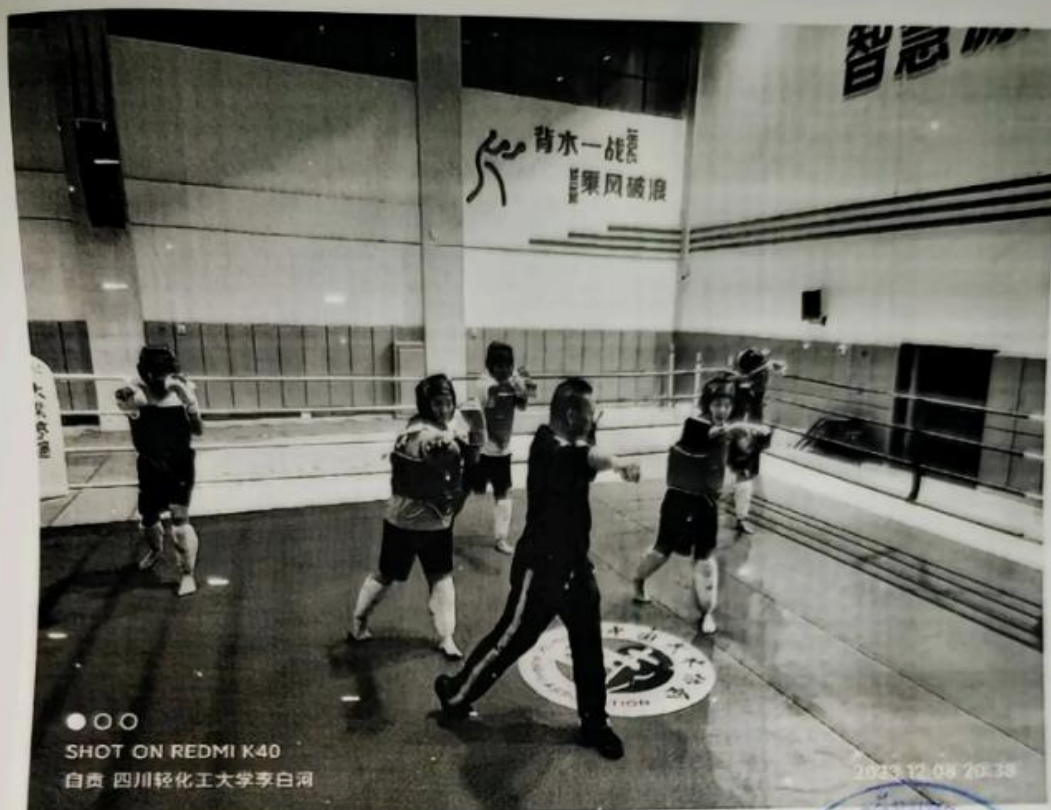


Figure1 Success rate of boxing

2. Success rate of leg

Start the preparation position of left leg kick, push the left foot on the ground, shift the center of gravity to the right leg, support the right leg upright or bend the knee slightly, bend the left foot and lift it upward, the thigh is close to the chest, the toes are pointed upward, the sole of the foot is facing forward, extend the hip and lift the knee. Kick forward in a straight line, with the force reaching the entire sole of your foot (power is achieved by moving the entire sole of your foot forward, contacting the opponent, and stepping forward slightly at the same time). The moment you contact the opponent, the supporting foot turns inward to send the hip to exert force, and the upper body can also be slightly tilted back.



Figure2 Success rate of leg

3.Success rate of wrestling

As a basic technique in Sanda, wrestling technique has its own technical characteristics. As a unique technical action in Sanda, wrestling technology combines many actions in Chinese wrestling, such as grabbing, tripping, blocking, pushing and other technical actions. The main methods used include hugging, pushing and tripping. Compared with the throwing technique in other sports, the throwing technique in Sanda is more prominent in its speed. Due to the limitations of Sanda rules, wrestling must be completed within a few seconds. You cannot hesitate when performing wrestling movements. Each movement must be accurate and in place to ensure the continuity and completeness of the movements.





Figure3 Success rate of wrestling



Clarification documents for the volunteers who Experiment

Dear all Subject

Because I Uiangpo Ding, a doctoral student in health and sports science at the School of Education, Mahasarakham University) is conducting research on "Physical Training Program on Fitness Profiles of College Student Sanda Athletes". You may not benefit directly from participating in this research project. However, the research results of this project may support the training decisions of your coaching team, help improve the training efficiency of you and your teammates in similar pre game psychological training, and improve the effectiveness of psychological training.

After being recommended by your coach and interviewed by a researcher, you are eligible to volunteer for this study. If you decide to participate in this study, you will be asked to provide basic personal information. If you feel uncomfortable or uncomfortable with certain questions, you have the right not to answer them.

You and 39 other athletes will participate in a pre-match psychological training test project. The test content includes: Speed, Strength, Endurance, Coordination (Reaction), Flexibility, Joint muscle strength, FMS score and Skill action completion success rate test (Please note that if you are assigned to the experimental group, you will conduct mindfulness training according to the following course schedule. If you are assigned to the control group, you will just follow your previous training plan)

Table 1 Curriculum design of the experimental group

Weeks 1-4		
Task	Item	Relax
Maximum strength	Bench press, squat, deadlift x 3 groups, 1-6 times/group,	Foam rolling
Fast power	85%1RM, 3min interval; fast flat press, high clean x 3 groups,	
Explosive force	5-10 times/group, <60%1RM, 3min interval ; Bend squat	
Core stability strength	jump, deep push press x 3 groups, 10-15/group, 3 minutes interval; Supine straight-legged ball lift, prone three-point support one-hand front raise x 5 groups, 30 times/group, 2 minutes interval	
Aerobic endurance	Running, boxing and leg combination target interval training	Spa recovery
Fighting force	4x (4min 80%-95%HRmax + 3min interval 60%-70%HRmax),	
Coordination (Reaction)	supine weight-bearing neck lift, prone weight-bearing (15-20kg barbell plate) neck lift x 3 groups, 15- 20 times/group, three-point support of both feet x 3 groups, 3 minutes/group, 2-minute interval, arrow agility running, rope ladder running x 3 groups, 2-minute interval	
Maximum strength	Bench press, squat, bench pull x 3 groups, 1-6R times/group,	Stretch
Fast power	85%1RM, 3min interval); quick barbell lift, clean and jerk x 3 groups, 5-10 times/group, <60%1RM, interval 3 minutes;	
Explosive force	weight-bearing squat jump x 3 groups, 30% 1RM, 10-15/group, deep push hold x 3 groups, 10-15/group, 3 minutes interval; side lying support, swallow balance x 3 groups, 2 minutes/group , 2min interval	
Core stability strength		
Aerobic endurance	Continuous practice of boxing and leg combination target shooting 6 times (6-8 minutes 50%-75% HRmax + 1 minute interval); supine weight-bearing neck lift, prone weight-	Sublactic acid threshold in
Fighting force		
Speed		

ECMSU01-09.03 Update 2021

bearing (15-20kg barbell plate) neck lift x 3 groups, 15-20 times/group, Two people cooperate to hit the head x 3 groups, 3min/group; reaction target practice x 2 groups, 1min/group, 2min interval, footwork practice x 2 groups, 2min/group, 2min interval, 20S left and right whip kick x 2 sets, 2 minutes rest

Weeks 5-8

Anaerobic endurance	6S sprint running x 6, 2min interval, 6S punch and leg combo	Sublactic acid threshold in
Aerobic endurance	air attack x 6, 2min interval, 400m x 4, 1min interval, 6 running x (4min 80%-95%HRmax + 3min interval 60%-70%HRmax)	
Strength endurance	Quick flat press, shoulder press, half squat, weighted lunge	Foam rolling
Maximum strength	jump x 4 groups (30%-50% 1RM, 15-20 times/group/content, circuit training method), 3 minutes interval, supine fly, deep	
Fast power	squat, hard pulling 45° sit-ups x 3 groups, 10-15/group. 3 minutes interval	
Explosive force		
Anaerobic endurance	6S boxing and leg combination movements are empty	Massage,
Coordination	strikes x 6 groups, with an interval of 2 minutes. 6S requires	Mind Relaxing
(Reaction)	boxing and leg combination movements for target shooting x 6 groups, with an interval of 2 minutes. Boxing and leg combination movements for hitting sandbags x 6 groups, 1 minute/group, 1 minute interval, and conditional actual combat x 4 Group, 1 minute and 30 seconds/group, 1 minute interval, changing direction and footwork, running forward and backward x 3 groups, 2 minute interval	
Strength endurance	Barbell plate, bench press, squats, weighted cross-step	Stretch
Core stability strength	jumps 1 minute, squatting with left and right whip legs x 2 groups, 1 minute/group, 1 minute interval; lying on the bag,	
Fighting force	raising hips and legs x 3 groups, 40 times/group, 2 minutes interval, balancing ball standing on one leg x 3 groups, 2 minutes/group, 2 minutes interval, three-point support on both feet x 2 groups, 3 minutes/group, two people hitting the head x 2 groups, 3 minutes/group, 2 minutes interval	

Weeks 9-12

Anaerobic	6S sprint running x 6, 2 min interval, 6S boxing and kicking	Sublactic acid threshold in
Speed	combo air attack x 6, 2 min interval, 400m x 4, 1 min interval reaction target practice, 3min/group, 1min interval, boxing and kicking combination movements with variable speed target shooting x 3 groups, 40S/group, 2min interval	
Coordination	Bench pull, weighted barbell rotation x 4 groups, 30%-50%	Foam rolling
(Reaction)	1RM, 15-20 times/group/content, 1 minute interval, power	
Strength endurance	clean x 3 groups, 5-10 times/group, <60% 1RM, 3 minutes interval, Supine weight-bearing neck lift, prone weight-	
Fast power	bearing (15-20kg barbell) neck lift x 3 groups, 15-20	
Explosive force	times/group, squat jump punch, squat left and right whip	
Fighting force		

BIOGRAPHY

NAME Jiangpo Ding

DATE OF BIRTH January 16th, 1987

PLACE OF BIRTH Zhumadian, Henan Province, China

ADDRESS No. 4, Annex 180, Huixing Road, Ziliujing District,
Zigong City, Sichuan Province, China

PLACE OF WORK 2006 to 2010 Bachelor's Degree in Ethnic Traditional
Physical Education, Henan University

2010 to 2013 Master's Degree in Physical Education and
Training, China West Normal University

2021 to 2025 Doctor of Philosophy Program in Exercise
and Sport Science, Mahasarakham University

