Effect of Green Tea Extract in Conjunction with Exercise Training on Anaerobic Performance of College Students

Qiping Mao

A Thesis Submitted in Partial Fulfillment of Requirements for
degree of Master of Science in Exercise and Sport Science
October 2024

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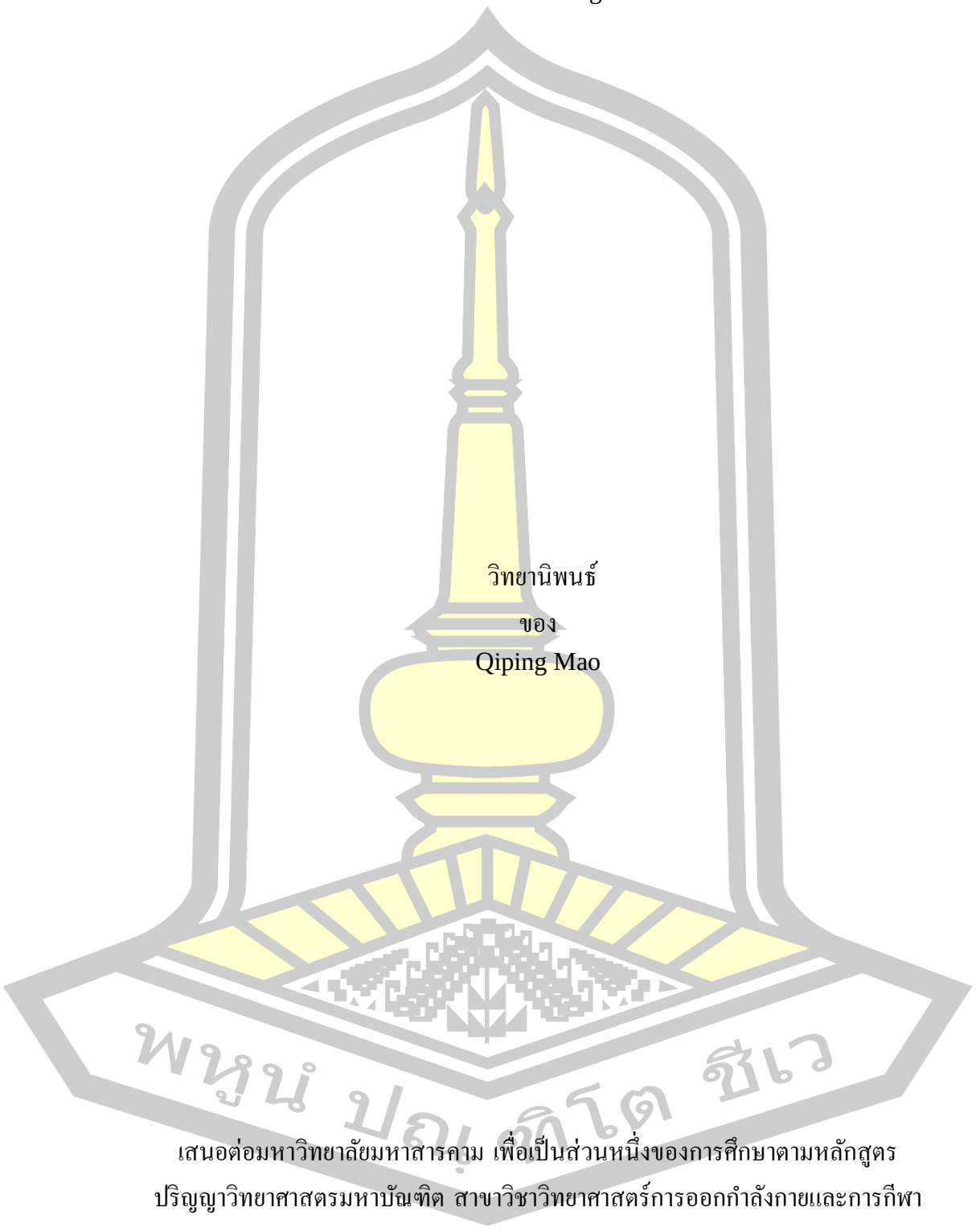

วิทยานิพนธ์

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เสนอต่อมหาวิทยาลัยมหาสารคาม เพื่อเป็นส่วนหนึ่งของการศึกษาตามหลักสูตร

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for Master of Science (Exercise and Sport Science)

October 2024

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TITLE Effect of Green Tea Extract in Conjunction with Exercise Training on Anaerobic Performance of College Students

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ABSTRACT

This study aimed to evaluate the effects of various interventions on anaerobic power, fatigue index, and overall performance in college students. Participants were 30 college students aged 18-22 years from Sichuan Vocational College of Health. Their height, weight, and anaerobic capacity were measured using the Running-based Anaerobic Sprint Test (RAST). Based on their RAST test scores, the students were divided into three groups of 10 participants each (3 boys and 7 girls). Group 1 received a placebo (500mg) combined with 4 weeks of athletic training, Group 2 received a single dose of 500mg green tea extract with exercise, and Group 3 received 500mg green tea extract combined with 4 weeks of athletic training. Pre- and post-experiment data were analyzed using paired T-tests, while differences between groups were assessed using one-way ANOVA with a significance level of $P < 0.05$. Results from the paired T-test showed no significant changes in anaerobic capacity for Group 1, while Group 2 displayed significant improvements in anaerobic capacity and mean power among girls ($P < 0.05$). Group 3 demonstrated significant enhancements in anaerobic power, fatigue index, and mean power for both boys and girls ($P < 0.05$). One-way ANOVA revealed significant differences in anaerobic power, average power, and fatigue index across the groups, with Group 3 showing the most notable improvements. The findings suggest that combining green tea extract with prolonged athletic training significantly improves anaerobic capacity, particularly in female participants. These results highlight the potential benefits of green tea extract in enhancing athletic performance, warranting further research to explore its long-term effects and the optimization of exercise interventions.

Keyword : Green tea extract, Anaerobic capacity, Exercise Performance, Exercise fatigue

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Qiping Mao

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CHAPTER 1
INTRODUCTION

1. Background

As is known to all, tea has a long history in China. The Tang and Song dynasties were important stages for the development of tea industry in ancient China. There is a saying that "flourished in Tang and flourished in Song"(Wang Qian,2018). Tea is one of the world's top three carbonated beverages. Different tea producing regions have formed different tea cultures based on their unique natural weather conditions. Studies have proven that tea has certain health care, pharmacological and other beneficial effects. Long-term moderate drinking tea is beneficial to human health. (Li Hailin 2014) At present, there are more than 60 tea-producing countries and regions in the world, and tea drinking population exceeds 2 billion (Fan Yanping, 2021).

The chemical ingredients produced during tea treatment relate to the unique taste and health benefits of tea. The health benefits of tea are in large part due to its bio-active compounds, such as polyphenols, alkaloids, pigments and free amino acids. (Jiang H，2019), They accounted for 18-36 %, 3-5 %, 0.3-2 % and 2-4 % of the dry weight of tea, respectively。The main ingredients in green tea extract are tea polyphenols and caffeine. (Wang Y,2019). Tea polyphenols have many health functions, such as antioxidant, anti-inflammatory, hypoglycemic, lipid lowering, prevention of senile dementia, prevention of arteriosclerosis and anti-tumor(Prasanth Ml，2019)。Especially (Epigallocatechin-3-Galatea) EGCG is the most effective antioxidant in tea, with anti-inflammatory, antioxidant, cancer prevention, regulation of glycolipid metabolism and other effects（Sanlier N，2018）。Caffeine can enhance cerebral cortex excitability, relieve and eliminate body fatigue (Meng Yang, 2020), and improve sleep quality（Baek Y，2018）。 The most significant effects

on human health have been observed with the consumption of green tea（Cabrera C，2006）. That's why green tea has been named one of the top 10 healthiest foods in the world by Time magazine（Moher D，2009）。

In the rapid development of modern society, the physical health of college students has become a general concern for society. In recent years, due to multiple factors, the physical health of college students is not optimistic. (Zhu Xiaomin 2023).

Anaerobic capacity. As one of the key indicators to measure the level of human health, it not only occupies a pivotal position in sports competitions, but also is closely related to the quality of daily life of college students. It is the energy system that the human body relies on during high-intensity exercise under hypoxic environment, and plays an important role in maintaining muscle strength and improving exercise endurance (Zhang Hui, 2004).In modern society, due to the change of lifestyle, the influence of environmental factors and the increase of academic pressure, the anaerobic capacity of college students is generally declining, which undoubtedly brings severe challenges to their healthy growth (Zhu Xiaomin 2023).

In this context, it is urgent to find effective ways to improve the anaerobic capacity of college students. "With the rapid development of the national economy, education and culture, the steady improvement of the basic quality of life and the educational conditions of the people, the people are more and more aware of the importance of health, and the concept of physical health has reached a new development stage which needs more attention than any other time and any stage in the past(Wang Yi.2021).Scientific research has shown that green grass tea active extract is a class of chemical with multiple physiological functions. Have antioxidants, anti-cancer, lower cholesterol, Anti-coagulation, protection of the heart,

antibacterial, Virus resistance, deodorization, prevention, weight loss, Improve immune function and anti-aging efficacy. Among them (Chu Hanxin, 2018) concluded in the paper that tea polyphenols are helpful for timely and effective relief of human fatigue. (Qu Ping, 2010) pointed out in the paper that tea extract has a certain effect on eliminating anaerobic exercise fatigue. American doctor James Hickson once incisively argued that:" the solution of the problem of nutrition will be one of the last areas of human fitness."（Ti Ye.2003）Thus, The Key role of sports nutrition in the development of youth sports.

In our annual physical tests and lectures, it is found that most of our current college students lack exercise training, especially poor anaerobic capacity, difficult recovery after exercise, resulting in poorer physical fitness. Green tea is rich in antioxidant substances, such as tea polyphenols, catechins, etc. These substances have strong antioxidant properties, can effectively remove free radicals in the body, reduce oxidative stress reaction, so as to protect the body from damage. Green tea extract can promote the synthesis of muscle protein, improve muscle mass and strength; However, exercise training can increase muscle volume and strength, and improve muscle endurance and explosive power. Therefore, this study chose green tea and its extract as the research focus to study the effects of green tea extract combined with exercise training on anaerobic capacity of college students, whether it can improve exercise performance, relieve fatigue, promote muscle recovery and improve cardiopulmonary function. To provide a scientific basis for the analysis of the efficacy of green tea extract and the development of drugs or health products to promote the anaerobic capacity of daily consumption.

2. Objective of the study

1. To compare it through a 4-week control experiment. The impact of inspection of green tea extract combined with exercise training on college students' anaerobic ability.

2. To compare the differences in anaerobic capacity of boys and girls before and after the experiment in the 3 groups.

3. Comparison of one-time consumption of 500 MG（Elham Ghasemi (2020)) of green tea extract. Differential anaerobic performance enhancement of college men and women by consuming 500 MG of green tea extract for 4 consecutive weeks.

3. Research Questions

1. While maintaining daily eating habits and regular exercise. Does consumption of green tea extract affect anaerobic capacity in college students.

2. Can green tea extract combined with exercise training effectively relieve post-exercise fatigue of ordinary college students (boys and girls) and improve post-exercise recovery?

3. Consumption of green tea extract and non-consumption of green tea extract in combination with standardized training on improving athletic performance. Reducing exercise fatigue. Is there a difference in enhancing anaerobic capacity?

4. What is the specific role of green tea extract combined with exercise training in improving anaerobic capacity in boys and girls? What are the differences between them?

4. Research Hypothesis

1. Consumption of 500 MG of green tea extract for 4 consecutive weeks. Consume 500 MG of green tea extract in a single dose. Consumption of 500 MG of generic for 4 consecutive weeks. Both boys and girls had better effects on anaerobic performance than before training.

2. Consumption of 500 MG green tea extract for 4 consecutive weeks. One-time consumption of 500 MG of green tea extract. Anaerobic performance was higher in both boys and girls than in the generic group.

3. Consumption of 500 MG of green tea extract for 4 consecutive weeks. Better anaerobic performance for boys and girls。

4. Boys had better anaerobic capacity than girls after the experiment

5. Scope of study

1. Population and sample

1.1. The volunteers were 52 sophomores in the Sichuan Vocational College of Health and Rehabilitation.

1.2. The sample group of this study is for sophomore students, aged between 18 and 22 years old. All 52 subjects volunteered to participate in the experiment. After investigation and other physical examination lists, all subjects were in good health without respiratory and cardiovascular diseases or a history of allergies. 30 students with similar height and weight were retained to participate in the experiment through the test of the height and weight tester, including 21 girls and 9 boys. Thirty subjects were randomly divided into three groups of 10. The first group was the 500mg generic drug group for 4 weeks, the second group was the single dose of 500mg green

tea extract group, and the third group was the 500mg green tea extract group for 4 weeks.

2. Scope of research content

2.1 This study is an experimental study investigating the effect of green tea extract on the anaerobic performance of college students.

3. Data collection time: From April 1 to May 1, 2024

4. Study variable

4.1. Argument

Green tea extract

4.2. Dependent variables include

4.2.1. Anaerobic performance

4.2.2. Sports training. Anaerobic power. Anaerobic capacity. Average power. Fatigue Index

4.3. Control variable

Age, sex, heart rate

6. Basic Agreement

1. The tools used are all tools that have been tested for effectiveness. The study subjects were college students aged 18-22 years in Sichuan Health and Rehabilitation Vocational College.

2.1. Consumption of green tea products

2.2. 6-8 hours of adequate sleep

3. Define the attributes for the following samples

3.1. The samples were for girls and boys, aged between 18 and 22.

3.2. Sample Sichuan Health Rehabilitation Vocational College students.

4. The sample volunteered and agreed to participate in the study and undergo a sprint training program

5. Anaerobic Sprint Test (RAST) is tested for The Running Based Anaerobic Sprint Test (RAST), which is a reliable and universally used fitness test.

6. Subjects never ingested green tea extract and controlled drinking of drinks or diet containing green tea ingredients, such as green tea mixed drinks, green tea cakes and other foods containing green tea ingredients.

7. During this process, the researchers collected the data manually and used the same instrument each time.

8. Subjects were in the same environment in a 4-week experiment.

7. Definitions of Terms

1. Green tea extract refers to unfermented green tea powder. In this study, capsules of Chinese Shengguardian Green tea extract, produced by Shandong Shengguardian Biotechnology Co., LTD., were used. The main components of tea extract medicine are tea polyphenols and catechins. 1G green tea extract contains 60% catechins and is proven to be safe. Generic: Generic capsules are made by a company that sells green tea extract.

2. Exercise training：Sports training refers to planned sports activities organized under the guidance of coaches in order to improve the athletic ability and performance of athletes. It is an important part of competitive sports. The main participants of

sports training are athletes and coaches rather than general sports participants. It is an organized and planned active process, whose purpose is to improve the training level and lay the foundation for sports achievements.

2.1. Parallel foot jump obstacle：Through 20 cm high PVC fence, 20 fences. Go through the fence as fast as you can, bouncing, jumping and landing knees should be bent. And walk back to the start for the next set.6 reps with 20 second breaks

2.2. Jump the obstacle on one foot： Jump fence (PVC) 20 cm high with both feet. 20 Jump with both feet and jump over 20 fences quickly. When jumping, take both feet off the ground at the same time and rise as vertically as possible. In the air, raise your feet as high as you can to ensure that you can cross the fence. When landing, touch the ground with both feet at the same time and bend your knees slightly to absorb the impact.

2.3. Double jump：Perform a double leg jump in a ring with a diameter of 60 cm.Ring 45 degree tilt, 20 rings. When jumping, take both feet off the ground at the same time and rise as vertically as possible. In the air, raise your feet as high as you can to ensure that you can cross the fence. When landing, touch the ground with both feet at the same time and bend your knees slightly to absorb the impact.6 reps with 20 second breaks

2.4.35m dash：35 Meters sprint. Stand on the starting line with your legs together and your feet gripping the ground. Bend your knees slightly and tilt your body's center of gravity forward for a better explosive starting position. At the signal to start, push your legs explosively with your whole body and quickly sprint away from the start line. The movement should be quick and powerful, aiming for maximum speed. 6 reps with 10 second breaks

2.5. High leg lifts continuously：The high leg raise is a common physical training movement that can help strengthen the abdominal and hip muscles and improve core stability. Place your arms straight out on either side of your body, palms down. Keep your legs straight and parallel to the ground. As you inhale, keep your abdominals tight and slowly lift your legs. At the same time, use your abdominal strength to lift your hips away from the floor so that your legs form an angle of about 90 degrees with your upper body. Exhale slowly and lower your legs without touching the floor. Use your abdominal muscles to control the speed of lowering your legs and make sure you still feel the tension in your core as you lower your legs.30 seconds each time. 6 reps with. 10 second breaks

2.6. Open and close jumps.：Bend your knees and hips and jump up with your legs. At the moment of jumping up, spread your legs apart quickly and stretch your arms out to the sides to form an "X" shape. Spread your legs as wide as possible and keep your feet slightly off the ground. When you are in the air, quickly close your legs and arms and return to the starting position. When your feet touch the ground, make sure your knees are slightly bent to slow down the impact. Jump 6 times for 30 seconds each time. Rest 10 seconds in between

2.7. Rope skipping exercise：Hold the handles of the jump rope, one hand on each handle. Stand up straight, keeping your body straight and your feet together. At the start, the rope should be behind you, and the next step is to quickly use your wrist to throw the rope in front of your head. As the rope quickly passes in front of your head, bounce up while quickly turning your wrist so that the rope passes under your body. Try to keep your jumps small and just high enough to allow the rope to pass. Keep breathing smoothly, don't hold your breath. Jump 6 times for 30 seconds each time. Rest 10 seconds in between

3. Sprint training： The energy supply of sprinting is mainly based on anaerobic energy supply. Sprinting refers to the displacement of the human body in unit time during the working process of the muscles. It is a sports event integrating technology, speed and strength（Cheng Yingying. 2019）

4. Anaerobic performance: refers to the movement of the human body under the condition of sufficient oxygen supply. In this process, the body's intake of oxygen and the needs of the body to achieve balance.

5. RAST：The Running-based Anaerobic Sprint Test (RAST) has been developed at the University of Wolverhampton as a sports-specific anaerobic test. It is similar to the Wingate Anaerobic 30 cycle Test (WANT) in that it provides coaches with measurements on peak power, average power and minimum power along with a fatigue index. The tests differ with regard to specificity and cost of administration. The Wingate test is more specific for cyclists, whereas the RAST provides a test that can be used with athletes where running forms the basis for movement. The WANT necessitates the use of a cycle ergometer and computer which are not available for all coaches. The RAST requires only a stopwatch and a calculator for some simple computations. The RAST provides a more specific test of anaerobic performance in running-based sports（Skinner, J.S. 1996).

5.1. Anaerobic power: Anaerobic power- the highest value. Anaerobic power can be used to reflect the intensity and maximum sprint speed, and the study range is 676 ~ 1 054 W.

5.2. Anaerobic capacity: Minimum power - the lowest value. The minimum power can be used to calculate the fatigue index, and the study range is 319 ~ 674 W.

5.3. Average power: Average power - the sum of all six values ÷ 6. Average power is used to evaluate the athlete's ability to maintain high efficiency output. When the value is high, two aspects should be considered: 1) the athletes have high speed endurance and good anaerobic capacity; 2) the Anaerobic power is high, and the speed endurance is limited.

5.4. Fatigue Index: Fatigue Index - (Maximum power-minimum power) ÷ Total time for the 6 sprints. Fatigue index is the embodiment of the decline of output power and reflects the anti-fatigue ability of the body. The lower the value, the better the athletes' ability to maintain anaerobic status. If the fatigue index is greater than 10 and the anaerobic endurance is poor, it is necessary to concentrate on developing lactic acid tolerance. 2 is the exercise process is not trying hard. The average power can be compared with the fatigue index.

CHAPTER 2
LITERATURE REVIEW

In this study, drinking green tea extract combined with exercise training on the anaerobic performance of college students, the researchers studied the following related literature and studies

1. Green tea extract
    1.1 Overview of tea
    1.2 Effect of tea
    1.3Tea species
    1.4 The active ingredient in tea
2. Overview of Green tea Extract
    2.1Main component of green tea extract
    2.2. Main components of green tea
    2.3. Pharmacology of green tea
    2.4 Application of green tea
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    3.5.1 Sprint Speed and Speed Endurance
    3.5.2 Sprint strength training
    3.5.3 Sprinting technical training
4. Definition and function of anaerobic exercise

1. Green tea extract

1.1 Overview of tea

Tea tree is a perennial evergreen woody plant, It consists of several parts such as stem, leaves, flowers, fruit, seeds and roots. Tea is a network of veins, with obvious main veins, the main veins and divided into the lateral veins, The number of lateral veins is mostly 7-10 pairs, with obvious main veins, dorsal and leaf veins are convex, The lateral vein extends to one third from the edge of the upper lateral vein, Form a closed mesh system. The edge of tea has obvious serrations, and the number of serrations is generally 16-32 pairs. The flowers of tea tree are both sexual flowers, belonging to the plant mixed flowers.

1.2 Effect of tea

Tea can not only quench one's thirst, but also has a series of effects: for example, it can make people awake and sleepless; Calm the mind and calm the town Quiet; It can also improve eyesight and clear heat; Heat relief, detoxification; Digestion, benefit pharynx; Sober up, too greasy; Defecation; Expelling phlegm, dispelling wind and removing surface, etc. In daily life, it can be found that people who have the habit

of drinking tea are often less likely to suffer from hyperlipidemia, hypertension and other cardiovascular and cerebrovascular diseases（Cui Mingsi.2011）.

1.3 Tea species

Tea can be divided into green tea, black tea and oolong tea according to the difference of fermentation processes, treatment and ingredients（Li Penghong,1994）.According to its fermentation can be divided into the following three categories: non-fermented tea (green tea, white tea); Semi-fermented tea (oolong tea); Fully fermented tea (black tea, black tea)(Anhui Agricultural University 1994; Matsuki Jiro et al 2002; Kikuda and male 1998; Wang Congren 2001; Matsuki Jiro 1991)

1.4 The active ingredient in tea

The chemical composition of tea is very complex, about 500 kinds of substances have been isolated and identified, and the content of active ingredients varies with different tea varieties, places of origin and picking time. The main active ingredients in tea are as follows（Luo Xiaoming.2002）:

1. 4.1 Amino acids and proteins. More than 30 amino acids have been found in tea. There are mainly albumin, Gluten, protamine, and globulin, among which the content of glutamine phthalamine is the highest, accounting for about 0. 5%-1.2% of tea, it plays an important role in the taste and quality of tea. Most of the proteins in tea are insoluble in water, but only a small part of them is soluble in water, and these soluble proteins determine the flavor of the tea.

1.4.2 Polyphenols It is a class of phenolic compounds, catechin (about 15%-35% of tea dry weight) for It is the key component of tea and determines the color and taste of tea soup.

1.4.3 The content of tea polysaccharide determines the aging and tender of tea, and the content of sugar in fresh tea is about It's about 1%.

1.4.4 Alkaloid tea alkaloid to coffee, it has a strong heart, dress and other effects. Caffeine The physiological and pharmacological effects makes tea widely accepted by the public as a kind of energy drink.

1.4.5 Aromatic It is a volatile mixture that mainly determines the aroma of tea. It is insoluble In water, soluble in organic solvents, its composition is complex, according to the structure can be divided into alcohol, phenol, aldehyde, ketone, acid, cool, endogenous cool, nitrogen substances, hydrocarbons, oxides and phenolic acid compounds, etc., it also has a greater impact on the quality of tea.

1.4.6 Pigment. The pigment in tea is mainly divided into fat soluble pigment and water-soluble pigment. Chlorophyll Green pigment accounts for about 0.6% of tea dry weight) and carotenoid belongs to fat soluble pigments, and water-soluble pigments include anthocyanin, anthocyanin, etc., which belong to flavonoid compounds (phenolic derivatives), accounting for about 4.5% of tea dry weight.

2. Overview of Green tea Extract

1 Main component of green tea extract

Green tea, the main ingredients are, tea polyphenols, caffeine, lipopolysaccharide, thinning and so on, (Yang Xianqiang 2003) , Green tea extract (GTE) is a product extracted from green tea as the raw material, and the commercial extract is usually labeled as 60% of tea polyphenols, etc.(Shi Mingming. 2012)

2 Main components of green tea

The main feature of the green tea process is the use of high temperature to control the tea polyphenol oxidase, In order to maintain the original characteristics of the tender tea, and then by rolling, dry, Therefore, its composition is similar to that of fresh tea leaves, They are mainly tea polyphenols, accounting for about 30% of the dry weight of tea leaves. (Chang yun.1992)

2. Pharmacology of green tea

According to the long-term research of domestic and foreign scientists identified, Green tea extract (GTE) has a wide range of biological activities, Its pharmacological effect is mainly manifested in enhancing the antioxidant capacity of the body, Anti-cancer and anti-mutation; antibacterial, anti-inflammatory and antiviral; Blood lipid, blood pressure, hypoglycemia; anticoagulant, prevent arteriosclerosis and thrombosis; Protective effect on myocardial and cerebral ischemia-reperfusion injury (IRI), Anti-arrhythmia; weight loss; deodorant, caries prevention; anti-radiation; anti-allergy; protecting liver and kidney; enhance immune function; prevent aging and other aspects. (Li Guhe, 2003)

4 Application of green tea

Tea polyphenols have many effects, and different effects can be applied to different areas. At present, it has been widely used, mainly for the following purposes:

Food additives

Used for lipids and a variety of food natural antioxidants and pigment stabilizer, more safe than synthetic antioxidants.

Health drinks

As a food antioxidant, tea polyphenol has been officially listed in

GN2493_90 document of the Ministry of Health. It has been successfully used in animal and vegetable oils such as lard, peanut oil, rapeseed oil, ham, moon cake, instant noodles, coated peanuts, and cool drinks. （Lu Dongxu. 2005)

Cosmetics

For anti-wrinkle, spot removal, acne removal, sunscreen and other

cosmetics development

Deodorant

Used to absorb environmental odor, purification effect, etc.,

Drugs

For the treatment of cardiovascular disease, cancer disease,

inflammation, etc., is now being transferred from animal experiments to large-scale clinical trials. At present, tea polyphenols have been widely used in food and daily chemical products, but the clinical application research has just started. With the continuous improvement of living standards, people are more urgent to improve the survival and quality of life. It is believed that safe, economical and effective tea polyphenols will play an important role in the pharmaceutical industry.

5. Side effects of Green Tea

The safety of tea polyphenols has been extensively tested in modern

medicine: (Shen Xiaoheng, 2005) People et al. In fruit fly life feeding and mouse feeding experiments showed that tea polyphenols are added to feed and drinking water within a suitable range, It had no effect on the growth, development and longevity of fruit flies; There were no adverse effects on hemoglobin, red blood cell

number, white ocyte number, thymus, spleen cell number, liver weight and body weight of the mice，It has a promoting effect. Studies in Zhejiang University based on toxicological evaluation of food and medical safety also showed that tea polyphenols are natural low toxic compounds，Long-term administration is safe at the appropriate dose. (150-2000 mg per adults, 500 — 1000 mg per day) (Hou Tuan Zhang, 2004) The above toxicity results show that tea polyphenols are safe for animals; human tests show that tea polyphenols are a safe drug and suitable for long-term use.

3. Exercise training

1 Sports training overview

Sports training refers to planned sports activities organized under the guidance of coaches in order to improve the athletic ability and performance of athletes. It is an important part of competitive sports. The main participants of sports training are athletes and coaches rather than general sports participants. It is an organized and planned active process, whose purpose is to improve the training level and lay the foundation for sports achievements.

Definition of motion In fact, the word "motion" has everything in it: "motion" means running and cycling, and "motion" means activity and kinetic energy. The two words together is to our body fluids, energy and blood nutrition through joint activities, so that every capillary and tissue cells, nutrition and metabolism.

2 Types of movement

Exercise is divided into aerobic exercise and anaerobic exercise. Aerobic exercis e is when the muscles of the body are working and the energy needed by the muscles i s supplied with oxygen; Anaerobic exercise is when the muscles of the body need too

much oxygen during activity, and the amount of oxygen absorption cannot be increase d quickly enough to supply muscle movement, resulting in the temporary stop of mus cle operation（Wei Xiaolong.2020）

Common aerobic exercise is fast walking, jogging, cycling, etc., weight loss often exercise aerobic exercise benefits muscle can quickly get enough oxygen to operate. Common anaerobic exercise includes sprinting, weightlifting, long jump, diving, high jump, etc. If you want to achieve the effect of increasing metabolism and burning fat, then start with aerobic endurance exercise.

The following training methods will be used for training in this study.

2.1. Run 35 meters quickly. Rapid running movement essentials. Back pedal leg fully stirrup straight, swing leg actively swing forward, the Department of the front, both arms to the shoulder axis actively swing back and forth, relaxed and powerful; front swing arm does not exceed the size of the jaw police angle less than 90 degrees, back swing elbow slightly outward, the size of the arm angle of more than 90 degrees; the upper body try to remain upright; upper and lower limbs coordinate with the fastest possible speed to run the whole course. Run 6 times.

2.2. Crossing Fence (PVC). Height 20 cm. 20 pieces at a vertical distance of 90 cm

2.3. Jump the fence with both feet. 20 centimeters. Vertical 90 degrees. Twenty of them.

2.4. Running, jumping, feet on a ring 60 cm in diameter, angled. 45 degrees, 90 centimeters, 20 rings

2.5. Open and close jump. Keep your body upright, lift your head and chest, put your hands naturally on both sides of your body and jump upward, at the same time,

open your feet to both sides. Palm should be facing down at the beginning, in the process of jumping upward can slowly turn to palm facing forward to jump to the highest place when the hands crossed back and forth, at this time both hands and legs should be straight, the knees do not bend back to the ground, at this time, pay attention to should be the toes of the first landing at the same time the knees slightly bent, and so on and so forth.

2.6. Lunge Walk Movement Essentials. One leg step forward to bend. The body is upright, feet open shoulder-width apart, hands pinched at the waist. This is the starting position of the movement. Bend your knees and lower your hips to lower your body until the knee of the back leg almost touches the ground. Be careful to keep your upper body upright and keep the knee of your front leg from going over your toes. Then use the heel of the front foot to support the body upward to stand, while stepping the back leg forward and repeating the previous lunge squat movement.

2.7. Leg lifts. High leg action is to keep the upper body straight in the case of two legs alternately lifted to the level of the high leg movement is generally divided into in situ high leg and high leg running two kinds of high leg action in situ high leg action is the movement of the position of the player does not change; high leg running action is the movement of the movement of the player in the alternately lifting the legs at the same time to move forward (fast).

3 Sprint training definition

Sprinting is a competitive sport that focuses on speed and speed power (Tang Xinyu, 2022). The energy supply mode of sprint is mainly anaerobic energy supply. Sprint refers to the displacement of the human body in unit time during the working process of the muscles. It is a sports event integrating technology, speed and power.

4 Sprinting type

Sprint is the world sports history of the oldest competition item, is one of the track and field events, the general package Including 50 meters run, 60 meters run, 100 meters run, 200 meters run, 400 meters run, 4×100 meters relay run and other several (Li Rui. 2020)

5 Sprint quality training

5.1 Sprint Speed and Speed Endurance

Xie Xin (2018) pointed out in his article Speed Quality and Training of Sprinters that speed quality is mainly represented by reaction speed, starting speed, stopping speed, speed endurance and sensitivity, among which reaction speed, movement speed, displacement speed and maximum speed are the key factors that determine the competitive level of sprinters. The training methods of speed quality can be repeated training, decomposition training, alternate training, difficulty reduction training and difficulty increasing training.

Marques MC (2016) et al. believe that linear sprint speed is an essential physical quality for many athletes.

Fang Yong (2004) pointed out in his article "Strength and Speed Training for Sprinting" that the maximum speed training can be achieved by running between marching distances, short distance relay running, distance catch-up running, downwind running or downhill running. Reaction speed can be trained through ball games and signal stimulation.

Saraslanidis P (2011) et al. Argued that repetitive sprint training usually involves short sprints with insufficient recovery intervals and compared the effects of different rest intervals on muscle metabolism and sprint performance. Sixteen men trained

three times a week for eight weeks, with each session consisting of two sets of 80m sprints. Sprints spaced 10 s or 1 minute improved 。

5.2 Sprint strength training

Marques MC (2015). After six weeks of squats versus squats plus sprints, it was found that combining full squats and sprints improved sprint performance more than either method alone.

Professor Luo Jian (2001) showed in Sprint Strength Improvement Attributes and Training Principles that: "Sprint strength training principles should pay attention to the relative balanced and synchronous development of muscle strength in all parts of the body and the improvement of muscle strength in key parts.

Zhang Qilun (2019). In the article "Research on the Influence of Functional Strength Training on the Strength Quality of Sprinters", it is pointed out that traditional strength training and functional strength training should be combined with the strength training of sprinters. Functional strength training can carry out targeted training on the lower limb major muscle group or local minor muscle group, which is helpful to solve a series of problems such as weak core strength and sports injury.

Wang Baocheng (1999) pointed out that "the important strength quality of modern sprinting training is the high-speed swinging strength of the hip axis, which is the foundation for athletes to complete the fast running and the power source of sprinting."

To sum up, many scholars at home and abroad have conducted in-depth studies on the strength training of sprinters. It is very important to follow the speed attribute of sprinters in strength training and develop fast strength. Follow the principle of appropriate intensity load and pay attention to the balanced development of the small

muscle group while training the big muscle group. It has important guiding significance to the training arrangement of the general coaches

5.3 Sprinting technical training

According to the results of the investigation, the absolute speed training of Chinese high-level sprinters is arranged in one week Training accounted for 33%, strength quality training accounted for 23%, speed endurance training accounted for 25%, and sprint technical training accounted for only 19%. It can be seen from the data that compared with speed and speed endurance training and strength training; sprint technical training has not been paid enough attention by Chinese coaches (Li Rui. 2020).

Lai Yi (2015). In the article "Analysis of Chinese Men's 100-meter Technical Differences -- Taking Asian Games Men's 100-meter champion Lao Yi and world record holder Usain Bolt as a comparative case", the reasons for the big gap in athletic performance between domestic excellent sprinters and world excellent athletes Usain Bolt are summarized. In the 100-meter race, Chinese athletes' movements are stiff and not completely relaxed. Support low air, low center of gravity; Stride length is too long, limiting stride speed; Slow start reaction; Fast speed down in the rear and weak ability to maintain maximum speed.

Huang Shugang (2021). showed in his paper "Research on Starting Techniques and Training of Sprinters" that after firing a gun whistle, athletes bend their elbow joints and consciously swing back, while their lower limbs and legs push off quickly from the starting block for quick transition to the next movement.

To sum up, with the continuous improvement of our sports competitive level, the means of sprint training are constantly iterating and updating, emphasizing the

coordinated development of stride and stride frequency, and paying attention to the importance of swing arm movement to the athletes running process; The significance of relaxation running of athletes' ability to maintain maximum speed and energy loss in back running.

4. Definition and function of anaerobic exercise

The function of anaerobic capacity is to measure and evaluate the anaerobic working capacity of human body, which is of great significance to objectively analyze and evaluate the exercise capacity of human body, check the effect of exercise training, and explore the development of anaerobic working capacity and its adaptability to training and other theoretical and application problems. In sports practice, anaerobic capacity is the main index to evaluate the anaerobic metabolic capacity of athletes.

1 Methods for assessing anaerobic capacity

At present, there are four methods used to assess anaerobic capacity: Wingate test, Margaria step test, maximum cumulative oxygen deficit, and critical power (Zhang Hui. 2004). Wingate method, developed since 1970, is the standard method for determining anaerobic capacity and anaerobic power. 1996) Margaria step test was proposed by Margaria, a famous exercise physiologist in Italy, in the mid-1960s (Wu Hao. 1996) The maximum cumulative oxygen deficit was proposed by Krough and Lindhard in 1920, and further refined by Hermansen in 1969 with the area between the oxygen demand and oxygen uptake curves (HillDW.1993.); The critical power is defined as the slope of the linear relationship between work and time, which is the maximum ratio of work and time that can be achieved when the muscles are kept in a state of non-fatigue for a long time (Stoffolano SM.1993; Hill DW. 1993)

2 Factors affecting anaerobic capacity

Anaerobic capacity is mainly affected by muscle mass, muscle fiber type, reserves of different energy-supplying substances, efficiency of metabolic pathways, genetics, and training（Guo Yujie, 2014）。

3. Effects of green tea extract on anaerobic capacity

zhang Shujun (2018) studied the effect of green tea extract to eliminate anaerobic exercise fatigue. Conclusion Green tea extract can remove free radicals, improve the body's oxygen supply ability, promote the exchange of energy in various parts of the body, and improve the body's resistance to pressure.

Zhi Ji xin (2017) concluded that green tea extract could effectively eliminate anaerobic exercise fatigue and enhance the activity of body biochemical indexes. Athletes can appropriately take green tea extract during daily training to relieve their exercise fatigue and reduce damage to muscles.

Reza Bagheri（2020）this study demonstrates that GTE improves exercise-induced body composition changes by decreasing weight, BMI, WHR, and BFP. Moreover, GTE potentiated the anti-inflammatory effects of ET by decreasing hs-CRP levels

In conclusion, the effect of green tea extract on anaerobic capacity is positive, which is conducive to improving the function of athletes and enhancing the improvement of anaerobic capacity.

4 Anaerobic performance tests

Research selection, The Running Based Anaerobic Sprint Test (RAST) was devised at the University of Wolverhampton in the UK, and the standard version

involves six sprints over 35 meters with a 10 second recovery between each sprint, and provides measurements of peak power, average power and minimum power along with a fatigue index. (Draper Whyte, 1997)

5. Related research

International literature

Eric（2010）. Fourteen men aged 18 – 40 years passed health examination and had no history of liver disease, diabetes or gastric ulcer and intestinal disease. Seven in the control group took placebo and seven in the experimental group each took 300 mg of green tea extract daily, Take a week, Exercise on a treadmill, with 70% of the maximum heart rate. Studies showed that the exercise durability of the experimental group increased by 0.05 after taking green tea extract.

Richards (2011). Study the "Epigallocatechin-3-Gallate Increases Maximal Oxygen Uptake in Adult Humans". 19 People, eleven subjects were male and eight were female, Age was between 20 – 25 years old, Intake containing EGCG 300 mg of green tea extract, For 1 week, Eat it with breakfast to exercise your physical strength. Up to 70% of a large heart rate, and cycling, until fatigue. Studies have shown, after taking the green tea extract, Maximal oxygen absorption capacity was increased for both males and females, Male maximum oxygen inhalation capacity was statistically significant at 0.05.

Arpita Basu (2013), Study the Green tea supplementation increases glutathione and plasma antioxidant capacity in adults with the metabolic syndrome. Thirty-five obese participants with the metabolic syndrome were randomly assigned to receive one of the following for 8 weeks: green tea (4 cups per day), control (4 cups water per day), or green tea extract (2 capsules and 4 cups water per day) ,

The result shows Green tea extract significantly reduced plasma Fe content (128~92μg/d L, P<.02), but Cu, Zn and Se were not affected. These results support the hypothesis that green tea may provide antioxidant protection in metabolic syndrome.

Justin D Roberts（2015）. Study them. The effect of a decaffeinated green tea extract formula on fat oxidation, body composition and exercise performance. Nine endurance-trained men participated in this double-blind and placebo-controlled crossover study. At the end of the supplementation period with GTE (159 mg/day total catechins) or placebo, respectively, subjects cycled at 50 % of the individual maximal power output for 2 hours, followed by a 30-minute time trial， result display ， A 4-week dGTE intervention favourably enhanced substrate utilisation and subsequent performance indices, but did not alter TFA concentrations comparison to PL. The results support the use of catechin polyphenols from dGTE in combination with exercise training in recreationally active volunteers.

Ewa Jowko (2015). Studied The effect of green tea extract supplementation on exercise induced oxidative stress parameters in male sprinters. Sixteen male sprinters (ages 20-22) showed that, Supplementation with GTE prevents oxidative stress induced by RST in sprinters. Furthermore, GTE supplementation does not seem to hinder training adapts tone in the antioxidant enzyme system. On the other hand, neither prevention of exercise-induced muscle damage, nor an improvement in sprint performance is noted after GTE administration.

Daniel Gahreman (2016). Studied The Effect of Green Tea Ingestion and Interval Sprinting Exercise on the Body Composition of the body Overweight Males: A Randomized Trial. Forty-eight overweight males aged 25-27 years. The results show that After 12 weeks or 12 hours of ISE treatment, the overweight men had significantly lower body fat, or even greater body fat. Maximum vo2 only in interval sprinting, interval sprinting and green tea group. Both exercise groups also showed significant increases in lean mass. Green tea consumption by itself did not reduce body or belly fat.

Willian da Silva (2018). Study the Effect of green tea extract supplementation on exercise-induced delayed onset muscle soreness and muscular damage. Twenty untrained men aged (23 years) exercised before and after supplementation with green tea extract for 15 days (500 mg/day) or placebo (n = 10) to cause delayed muscle soreness in the surreal triceps group. The results show that green tea extract supplementation did not reduce the sensation of delayed onset muscle soreness but reduces the marker of muscle damage after exercise. It suggests the green tea extract supplementation has positive effects on muscle recovery after strenuous exercise.

Reza Baqeri (2020). Does green tea extract enhance the anti-inflammatory effect of exercise on fat loss. Thirty overweight women aged 38. 36±3.16 years participated in an 8-week endurance training program three times a week. The dose of GTE is 500 mg/day in the form of green tea capsules. The results showed that a further reduction in exercise-induced changes in body weight, body mass index, waist-to-hip ratio, and body fat percentage improved exercise-induced body composition. The combination of one type and exercise also produced greater changes in anti-inflammatory (increases in adiponectin) and metabolic (decreases in h's-CRP) markers than exercise alone.

Elham Ghasemi (2020), Study the Combined high-intensity interval training and green tea supplementation enhance metabolism and antioxidant status in response to acute exercise in overweight women. Thirty sedentary, overweight women were randomly assigned to three groups (n=10), including HIIT+green tea, HIIT+placebo and green tea. The training program included 3 sessions/week HIIT while the supplement consuming groups took 3 * 500 mg of green tea tablets/day for 10 weeks. Results indicated that 10 weeks of HIIT and green tea meaningfully pronounced baseline serum levels of SIRT1 ($P \leq 0.0001$), PGC-1α ($P \leq 0.0001$) and CAT

(P≤0.0001). In addition, a significant increase was observed in three indicators in the HIIT+green tea group in comparison with two other research groups. Further, the responses of SIRT1 (P≤0.01) and CAT (P≤0.002) increased significantly to second acute exercise in all three groups. The combination of HIIT and green tea consumption may induce increasing SIRT1 and CAT in response to acute exercise and can improve antioxidant system, body composition and VO2 max results rather than green tea and training alone, in young sedentary overweight women.

Sobhani V, Mehrtash M, Shirvani H, Fasihi-Ramandi M.（2020）Study the Effects of Short-Term Green Tea Extract Supplementation on VO2 Max and Inflammatory and Antioxidant Responses of Healthy Young Men in a Hot Environment，controlled trial (RCT) in which 15 young men (age 25.06 ± 2.1) were randomly assigned into the green tea (GT) and placebo groups. Subjects performed maximum aerobic exercises (shuttle run 20 m) in separate workouts (14 days) in summer. The results show that. The consumption of green tea supplements 90 min before aerobic exercise may decrease inflammation and oxidative stress factors and improve VO2 Max in summer.

Domestic research

Green tea extract is used as a nutritional supplement to eliminate fatigue, enhance endurance and improve achievement. The main components are tea polyphenol and caffeine. These nutrients can reduce the catabolism of protein and nitrogen-containing compounds, improve the body's adaptability to motor load, reduce the blood lactic acid level, prolong exercise time enhance exercise endurance, and have some anti-fatigue effect.

Qu ping (2010), The effect of green tea extract on eliminating anaerobic exercise fatigue was studied, of 40 male athletes, Age is 18- 20 years old, and 18 taekwondo

athletes, 22 wrestlers, Athletes in each event were randomly divided into 2 groups, The placebo and green tea extract were identical in appearance and were white tablets tested at 250 mg per grain，The test results show. Green tea extract can effectively inhibit and repair skeletal muscle damage caused by anaerobic exercise, reduce muscle cell membrane permeability or reduce cell membrane structure destruction, while inhibiting anaerobic exercise caused by the body structure protein and function protein decomposition, and by enhancing the athlete antioxidant enzyme activity, direct or indirect removal of oxygen free radicals and its metabolites, thus reduce excessive free radical damage to the body, enhance the antioxidant ability of the body, promote the elimination of exercise fatigue, enhance anaerobic exercise ability.

Peng Chun (2016) The anti-fatigue and lipid-lowering effects of tea drinking were studied. And 50 male elite athletes, 30 rowers, And 20 football players, Age of (age 16-18 years).Athletes of each sport are randomly divided into control and experimental groups, The active substance extracted from green tea reduced the serum creatine kinase activity in athletes, It indicates the inhibition and repair of skeletal muscle damage in the human body，The ability to repair the body's motility fatigue has been improved; Effectively reduce the BU content of the athletes, It means that it reduces the decomposition of the structural and functional proteins produced after exercise, Accelerate the physical recovery effect of athletes and promote the repair of body function.

Zhang jincai (2016), The effect of green tea polyphenols on anaerobic exercise fatigue was studied, 40 outstanding sports professional athletes (16 taekwondo athletes and 24 wrestlers), Age (17- -20 years old), Divide into two groups, The experimental group took green tea extract at 250mg / grain. The control group received 250mg of placebo. The result shows, green tea extract is indeed effective in

inhibiting and repairing the skeletal muscle damage caused by anaerobic breathing exercise, The decline of cell membrane permeability and the destruction of cell membrane structure and can inhibit the decomposition of structural and functional proteins produced by anaerobic exercise. Using the regulation of free radicals, so as to enhance the antioxidant capacity of the body, so that the exercise fatigue is eliminated, and enhances the anaerobic exercise ability.

Huang Tingfang (2016) The effect of green tea extract against fatigue in basketball players, and 100 basketball players, the mean age was 22 years. Divided into 2 groups, with 50 people in each group, And 2 hours after the end of the exercise, The control group received 2 tablets of placebo, Experimental group took 2 tablets of green tea extract drug (125mg / tablet).The result shows, Green tea extract repairs sports fatigue in basketball players, Transplant effect, Can avoid muscle injury in athletes, Of little damage to the body's cells, Can ensure the integrity of the cell structure, It can inhibit the protein decomposition in the body, enhance the enzyme activity in the body, and protect the athletes' body from less damage.

Guo Caiqin (2016) The effect of green tea extract on eliminating anaerobic exercise fatigue was studied, and 60 sport athletes, there are 30 taekwondo athletes and 30 wrestlers. Athletes in the two events were randomly divided into two small groups. Studies have shown. The resulting green tea extract has the effect of transplanting and repairing anaerobic exercise, it can prevent muscle damage in the athletes, reduce the damage of muscle cells, and ensure the integrity of the cell structure. In anaerobic exercise, it can promote the decomposition of proteins in the athletes, enhance the activity of enzymes in the athletes, reduce the damage of free radicals to the athletes, and enhance the antioxidant capacity of the athletes in the body.

Xin Liu (2017). The effect of active green tea extracts on the aerobic capacity of sports athletes was investigated.24 swimmers, age (16 years), randomized into 2 groups of 12 each, take 1 hour before the swimming competition, The control group received the comfort prize starch. Result display, taking a green tea active extract can improve the best performance of athletes, which is conducive to the improvement of sports performance, which is very beneficial for athletes, and contribute to the improvement of competition performance.

Zhang Yongzhen (2017), The effect of green tea on physical recovery in beach volleyball players was studied. 100 outstanding male beach volleyball players were randomly divided into a control group and an experimental group, with 50 participants in each group. The control group of beach volleyball players mainly used placebo to restore their physical fitness, while the experimental group of beach volleyball players used green tea active substance to restore their physical fitness. The results show that green tea has a very important role for beach volleyball players, the substances in green tea can speed up the athletes body metabolism ability, improve the ability of antioxidant enzymes, contact athletes because strenuous exercise the free base, as far as possible due to excessive free and body damage, prompting athletes can effectively repair athletes sports damage.

Hao Jian (2017) Studying the relief effect of green tea extract on anaerobic exercise fatigue, Of 100 study subjects, Of them, 60 wrestlers, 40 taekwondo athletes, All were randomly divided into the control group and the observation group, Green tea extract, placebo (250mg / tablet), result display, Green tea extract has a strong inhibition and repair effect on skeletal muscle injury induced by anaerobic exercise, It can drive reduced muscle cell membrane permeability, Reduced structural disruption of the muscle cell membrane, Can slow down the decomposition of body structural

proteins and functional proteins produced by anaerobic exercise, Can strengthen the antioxidant enzyme activity of the athletes, To eliminate oxygen radicals and their metabolites, Thus reducing the damage of excessive free radicals to the body, Enhance the antioxidant capacity of the body, Finally, the exercise fatigue can be relieved, Enhance the ability of anaerobic exercise.

Shu Jun Zhang (2018), The analysis of the green tea extract to eliminate anaerobic exercise fatigue included 40 athletes, 18 from the taekwondo group and 22 from the wrestling group. The two groups are randomly divided into two groups: the control group and the experimental group. The results showed that the intake of green tea extract can promote the improvement of athletes serum activity, can relieve muscle strain and repair anaerobic exercise, avoid the body bone and cell membrane damage, at the same time can slow down the body protein differentiation, enhance the human antioxidant enzymes, so as to promote the body's metabolism, improve athletes oxygen free radicals, thus enhance the ability of athletes anaerobic exercise.

Sheng Zhijin (2022). The effect of green tea extract combined with endurance training on human substrate metabolism was investigated. The study subject was among 18 healthy male college students from a university in He Fei. Age is in (21-25 years old). Have the habit of keeping sports for a long time. The results show that the subjects endurance training during the intake of GTE, carbohydrate (carbohydrate, CHO) oxidation rate, fat oxidation rate rise, the group of respiratory exchange rate (respiratory exchange ratio, ER) decreased significantly, blood lactate concentration and plasma glucose concentration basically unchanged, serum free fatty acid is higher trend. Habitual intake of GTE and combined with moderate intensity aerobic training, is beneficial to promote human substrate metabolism especially the utilization rate of whole-body fat.

To recap: Green tea extract polyphenols are a natural polyphenolic complex extracted from tea leaves. Tea is a traditional drink of Chinese people. As a kind of drink, it is loved and respected by many people. Tea drinking has a long history in China and even the world. Furthermore, green tea extracted polyphenols have been found to have medicinal and health benefits, such as anti-tumor and antioxidant effects. At present, the application of tea green tea extract tea polyphenols in health care is more, during anaerobic exercise is relatively less, some people have tried to study the effect of green tea extract on weight loss, but the application of green tea extract in non-athletes to improve the exercise ability, there are few reports. Considering that tea polyphenols from green tea extract can inhibit free radicals, strengthen the heart, resist fatigue, and effectively protect the integrity of mitochondria, tea polyphenols may have great application prospects in anaerobic exercise programs, which need to be studied.

6. Research Framework

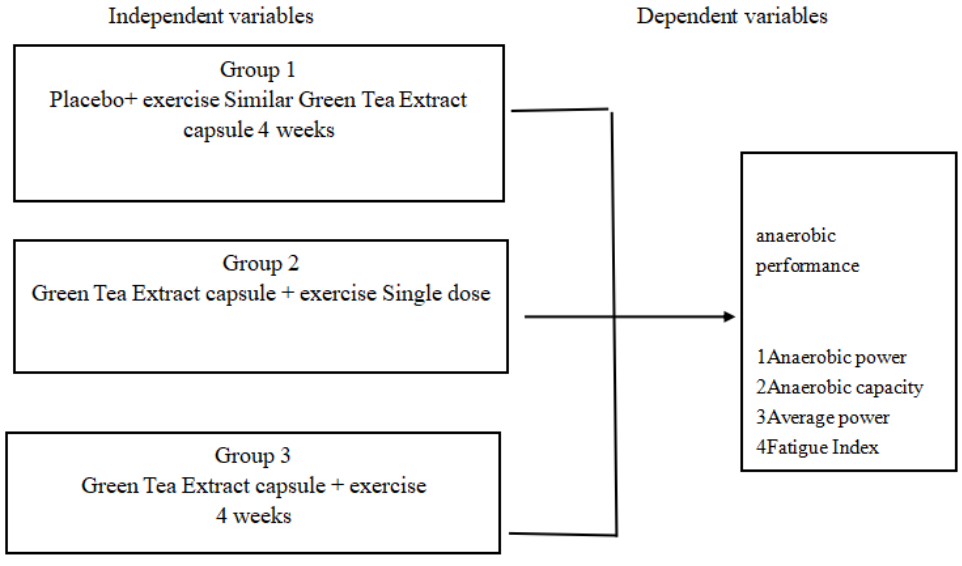

Figure 1 Study the frame design drawing

CHAPTER 3
RESEARCH METHODS

In this study, drinking green tea extract combined with exercise training on the anaerobic performance of college students, the researchers studied the following related literature and studies

1. Research participants
   1.1 population
   1.2 Study inclusion criteria
   1.3 Exclusion criteria
2. Research tools and equipment
   2.1 Experimental Tools
   2.2 Data collection tool
3. Research methods and data collection
   3.1 Research method
   3.2 Experimental method
4. Experimental procedure
5. Data collection flowchart
6. Experimental site
7. Data analysis
8. Research statistics
   8.1. Formula for calculating variables

1. Research participants

1. population

1.1. College students aged 18-22. From Sichuan Health Rehabilitation Vocational College

1.2. The sample was calculated according to Yamane (1967) formula, with an allowable error of 5% to get a result of 52 people.

1.3. In this study, the pre-experimental sample was 12 people, and the final research sample was determined to be 30 people.

1.4. Researchers conducted RAST tests and height and weight tests on 30 subjects. The best and worst performers were then paired based on RAST test scores from high to low. Then they were randomly divided into 3 groups, with 10 people in each group (3 boys and 7 girls). Group 1 500mg placebo as a generic+4 weeks athletic training. Take a meal after exercise. Group 2 500MG Green Tea Extract capsule + exercise Single dose. Take a meal after exercise. Group 3 500mgGreen Tea Extract+4 weeks athletic training. The experimental grouping was based on the study of Govindasamy Balasekaran (2021).

2. Study inclusion criteria

2.1. In good condition

2.2. Age, height, weight and height were small.

3. Exclusion criteria

3.1. Suffering from heart disease, hypertension and other diseases.

3.2. Volunteers are taking medication to treat other illnesses.

3.3. For other reasons, I do not want to continue to participate in the experimental test.

2. Research tools and equipment

1. Experimental Tools

1.1. Height and weight instrument

1.2. Digital weighing device

1.3. Heart rate monitor model number (Huawei bracelet)

1.4. RAST test tools: tape measure. Two stopwatches. whistle. Two cones

2. Data collection tool

2.1. General questionnaire

2.2. Health assessment record

2.3. Pre-Exercise Self-Assessment (PAR-Q)

2.4. Feelings and interview form after ingesting 500GM green extract

2.5. Speed test (35 meters) score report (RAST test)

2.6. RAST test result registration form

2.7. Anaerobic performance

2.8. The training program is submitted to three experts (Item Objective Congruence: IOC). The experts will check the rationality and effectiveness of the training program to assess the appropriateness of the training program and rate it.

rating +1 considered appropriate.

A rating of 0 is considered uncertain.

A rating of -1 is not considered appropriate.

2.9 Modify the training program based on the comments made by the experts. Make IOC scores passable

3. Research methods and data collection

1. Research method

1.1 Literature research method: This study took "green tea, green tea extract, sprinting, anaerobic capacity, sprint training" as the key words on Google, CNKNO.cn and ScienceDirect. Relevant data and literature were consulted and collected to provide a theoretical basis for the study, and then deduced and summarized the analysis on this basis.

2. Experimental method

Table 1 Experimental method design table

Experimental grouping	Take a meal after exercise	Training plan	Exercise intensity/ duration	dependent variable	test method
1. Group 1 （Placebo)	500mg placebo as a generic+4 weeks athletic training	Train 3 times a week for 4 weeks.	7 programs per training session, 35-40 minutes per session	anaerobic performance 1. Anaerobic power 2. Anaerobic capacity 3. Average power 4. Fatigue Index	RAST test to analyze anaerobic capacity
2. Group 2 Green Tea Extract capsule	500mgGreen Tea Extract+1 training session				
3. Group 3 Green Tea Extract capsule	500mgGreen Tea Extract+4 weeks athletic training				

2.1 Thirty college students aged 18-22 were divided into three groups, with 7 females and 3 males in each group.

2.2 Trial 1 was given 500mg placebo as a generic drug, trial 2 was given a single dose of 500mg green tea extract, and trial 3 was given 500mg green tea extract for 4 weeks.

2.3 The generic drug group was trained 3 times a week (1.3.5), continuously trained and took generic drugs for 4 weeks. Ensure that the amount of time and

amount of exercise per week are equal.

2.4 Experimental groups 3 were trained weekly (2.4.6), 3 times a week for 4 weeks, and were given green tea extract for 4 weeks. Ensure that the amount of time and amount of exercise per week are equal.

2.5 Experimental group 2 was only trained once, and data was collected on the second day.

2.6 Data were collected after the end of week 4 for both experiment 1 and Experiment 3

4. Experimental procedure

1. Six sets of data of 30 people were tested by RAST before the experiment.

2. Thirty people were randomly divided into three groups.

3.Participants report at 5 p.m. on the day of each training session and avoid strenuous exercise.

4. Avoid caffeinated alcohol and beverages for 24 hours and get enough sleep for 6-8 hours a day.

5.Group training, experimental group 1 training time is weekly (1.3.5). Experimental group 3 trained weekly (2.4.6) each training session was integrated according to the IOC training program. Experimental group 1 was not told before the experiment that they were taking generic drugs. Experimental group 1 and experimental group 3 do not meet at the beginning of the formal experiment.

6. Experimental group 2 was tested for 6 sets of data by RAST before the start of the experiment, 1 comprehensive training session was conducted according to the IOC training program, after the completion of the training, they ate the dinner prepared by the researcher, 500 GM of green extract was taken with the meal, they rested, and the next day, RAST test was conducted again for the experimental group 2 to collect 6 sets of data.

7. The Experiment 1 and Experiment 3 groups consumed a dinner prepared by the researchers after each training session, with 500 mg of green tea extract or generic along with the food.

8. Each training course of experiment group 1 and 3 was guaranteed to be carried out in the same environment. After the 4-week training, RAST was used for testing and 6 times of data was collected.

9. After taking green tea extract for more than 1 day, subjects will be interviewed about post-product symptoms such as abdominal pain, bloating, nausea, headache, etc.

1. Three experts were invited to check the quality of the research instrument:

Ms. Yan Hong, Associate Professor, Chengdu Institute of Physical Education.（National fitness and social sports. Calisthenics teaching and training theory and method）

Ms. Lei Ping, Associate Professor, Sichuan Normal University.（Sports humanities sociology. Physical education and training）

Mr. Yang Shiyong, Professor, Chengdu Institute of Physical Education. Doctoral supervisor.（Physical training. Sports scientific research methods. weightlifting）

The consistency of the results measured by running the training plan was 0.93.

11. Expert Advice:1. Don't use the same set of movements for the warm-up and relaxation stretches for all 3 training phases.2. Warm-ups should move to get from point A to point B. Don't stand still to warm up.3. Stretching requires static movements. Each movement should be stretched in place.

5. Data collection flowchart

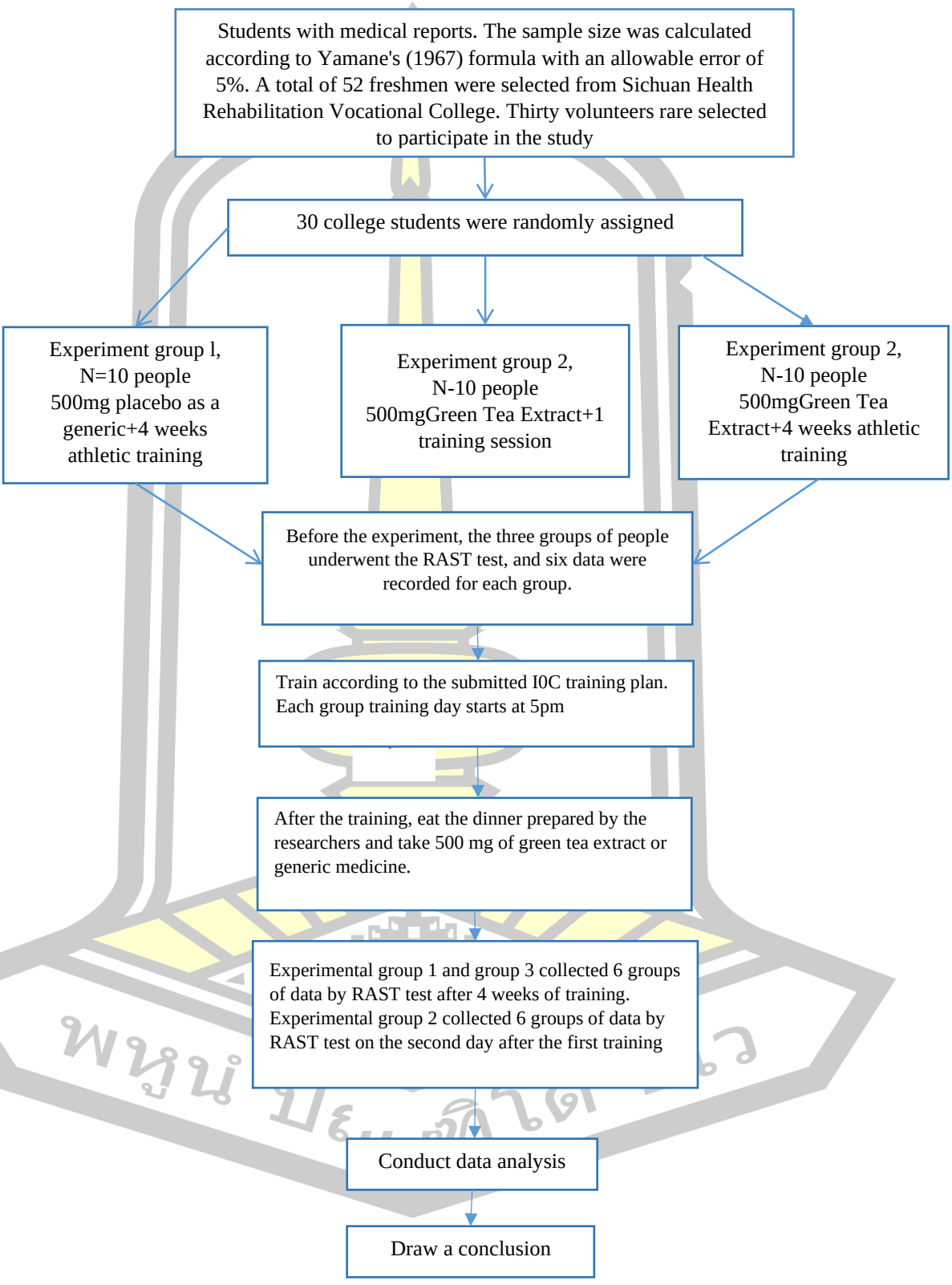

Figure 2 Experimental design flow chart

6. Experimental site

Sichuan Vocational College of Health and Rehabilitation gym

7. Data analysis

1. Find the mean and standard deviation of age. Weight and height of experimental group 1, group 2 and experimental group 3.

2. If differences were found by one-way ANOVA (repeated measures) (One-way Analysis of Variance for Repeated Measures: ANOVA), each pair of differences was compared using the Bonferroni method.

3.Paired sample t-test was used to compare the data before and after the experiment in each group.

4.The experimental data were statistically analyzed using Excel and SPSS 22.

8. Research statistics

1.Formula for calculating variables

1.1 RAST calculation formula：

Velocity = Distance (35m) ÷ Time

Acceleration = Velocity ÷ Time

Force = Weight × Acceleration

Power = Force × Velocity

Power = Weight × $Distance^2$ ÷ $Time^3$

From the six times, calculate the power for each run and then determine

Maximum power - the highest value

Minimum power - the lowest value

Average power - the sum of all six values ÷ 6

Fatigue Index - (Maximum power - Minimum power) ÷ Total time for the

2.The paired sample T test was used to compare the data of each group before and after the experiment.

3. F test one-way Anova was adopted to analyze the average value of the three groups of data.

4. The following formula is used to calculate the number of participants.

5. According to the formula：$n = \frac{N}{1+Ne^2}$

wherein：n represents the required sample size

N represents the total population

e represents significance level error

CHAPTER 4
DATA ANALYSIS RESULTS

This study collected data and analyzed the results based on statistical methods derived from the comparison of results. Effects of green tea extract combined with exercise training on anaerobic exercise capacity in college students. Researchers offer 500 MG of green tea extract. The variability between the maximum power，Anaerobic capacity mean power, and fatigue index of anaerobic capacity was tested using RAST（Runing-based Anaerobic Sprint Test）over the past 4 weeks. Statistical results were obtained through SPSS data analysis. The steps are as follows:

1. Symbols used in data analysis
2. The steps of data analysis results
3. Data analysis results

1. Symbols used to indicate the results of data analysis:

$\bar{X}$ Representing the average value

S.D Representing standard deviation

P Representative significance value

F Representing values of the f-test

df Representing degrees of freedom

t Represents the magnitude of the difference between two samples. The larger the t-value, the greater the difference the smaller the t-value, the smaller the difference

f Represents the difference in sample variance. The larger the f-value, the greater the variance difference, and the smaller the f-value, the smaller the variance difference

2. The steps of data analysis results

1. Calculate the average and standard deviation of the age, height, and weight of three groups of volunteers. and verify whether the experimental data follows a normal

distribution.

2.Compare the data before and after the experiment using paired sample t-test to determine if there is a significant difference.

3.Data were compared between the 3 groups after the experiment using one-way ANOVA Bonferroni test.

3. Data analysis results

1 Calculate the average and standard deviation of the age, height, and weight of three groups of volunteers (See Table 2for details). And verify whether the experimental data follows a normal distribution (See Table 3 for details).

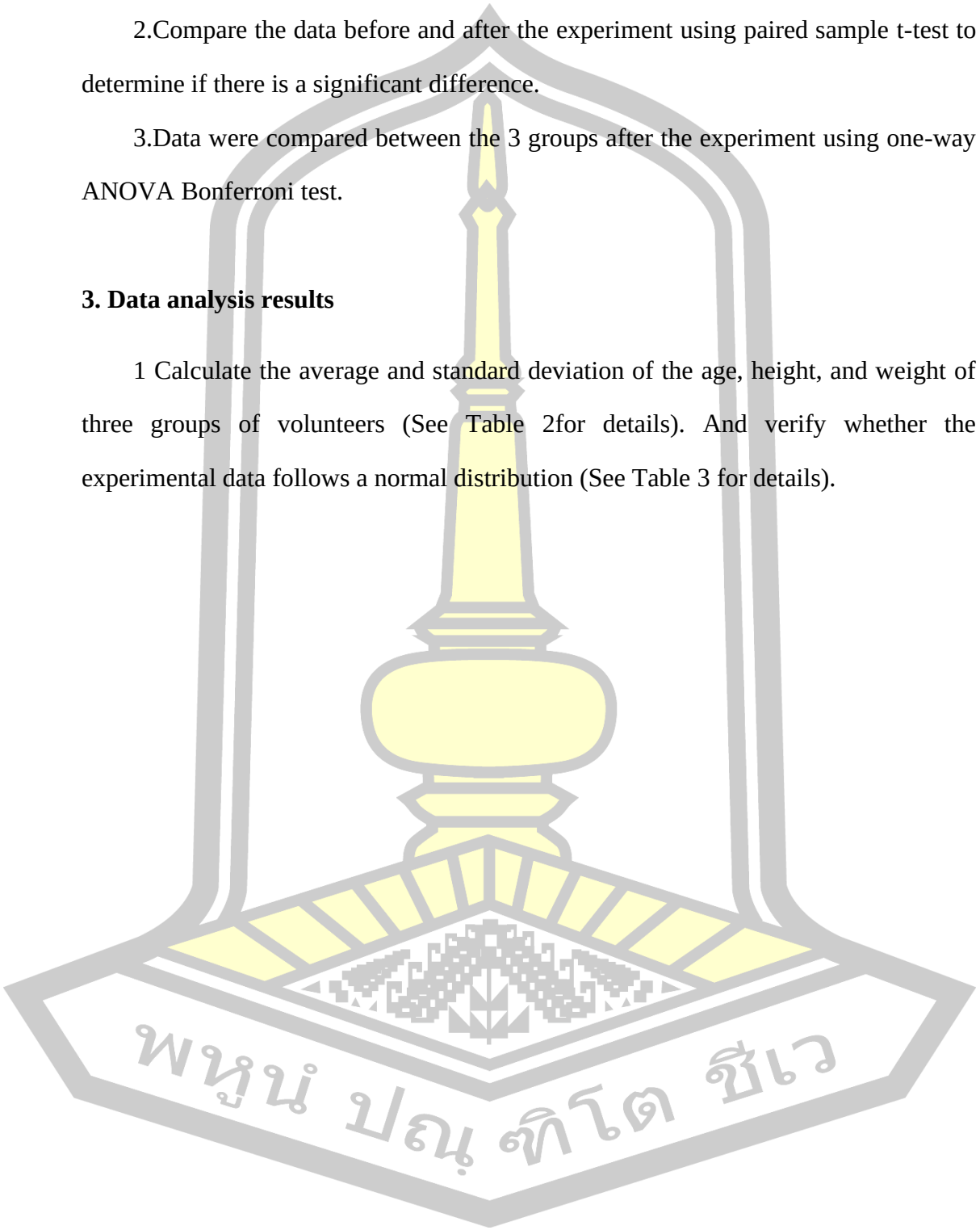

Table 2 Data analysis of age, height, and weight of three groups of volunteers

Gender	Variable	Research group	x̄	S.D.
Boys	Age (years)	group 1（n=3）	19.00	1.00
		group 2（n=3）	20.00	1.00
		group 3（n=3）	19.30	0.57
	Height (cm)	group 1（n=3）	168.33	2.88
		group 2（n=3）	168.33	2.88
		group 3（n=3）	170.00	5.00
	Weight (kg)	group 1（n=3）	59.33	2.08
		group 2（n=3）	55.00	5.00
		group 3（n=3）	59.00	7.81
Girl	Age (years)	group 1（n=7）	20.00	0.81
		group 2（n=7）	19.50	1.19
		group 3（n=7）	19.42	1.27
	Height (cm)	group 1（n=7）	165.57	3.77
		group 2（n=7）	166.00	3.69
		group 3（n=7）	167.00	4.28
	Weight (kg)	group 1（n=7）	50.14	4.87
		group 2（n=7）	50.28	4.23
		group 3（n=7）	54.71	3.81

Table 2 compares the basic information about age, height and weight of boys and girls in the control group (group1) and the two experimental groups (group2 and group3) before the experiment. The results showed that there was no significant difference in the above indexes among the three groups.

Table 3 Normal analysis of 4 experimental variables

Gender	variable	$\bar{x}$	S.D.	P
Boys	Anaerobic power	359.93	91.65	0.34
	Anaerobic capacity	217.14	31.33	0.18
	Average power	283.16	60.41	0.78
	Fatigue Index	3.79	2.09	0.90
Girl	Anaerobic power	178.84	27.11	0.56
	Anaerobic capacity	111.27	21.45	0.20
	Average power	138.17	22.69	0.68
	Fatigue Index	1.45	0.50	0.31

Table 3 According to the results in, $p>0.05$ indicates that all experimental data follows a normal distribution. Paired sample t-test can be performed.

2. Compare the data before and after the experiment using paired sample t-test to determine if there is a significant difference (See Table 4-6 for details).

Table 4 Comparison of Before the experiment and after the experiment data for 500 mg placebo + 4 weeks of exercise training（group1 n=10）

Gender	Variant	Before the experiment		4 Weeks Later		P
		x̄	S.D.	x̄	S.D.	
Boys	Anaerobic power	310.97	73.38	339.81	51.73	0.38
	Anaerobic capacity	268.75	30.86	217.10	22.69	0.83
	Average power	215.81	54.21	273.34	43.04	0.69
	Fatigue Index	2.48	1.38	3.18	0.95	0.42
Girl	Anaerobic power	185.80	28.80	182.19	31.66	0.75
	Anaerobic capacity	104.87	13.61	110.97	18.13	0.23
	Average power	137.14	20.35	142.37	24.57	0.53
	Fatigue Index	1.76	0.20	1.56	0.23	0.41

P<0.05 indicates significant differences in the data.

Table 4 shows the means and standard deviations for the control group (group 1). The results of the paired samples t-test showed that there was no statistical significance before and after the experiment for boys and girls.

Table 5 Comparison of data before and after 500mg green tea extract experiment + 1 exercise training session（group2 n=10）

Gender	Variant	Before the experiment		4 Weeks Later		P
		x̄	S.D.	x̄	S.D.	
Boys	Anaerobic power	359.45	72.59	361.44	70.85	0.68
	Anaerobic capacity	193.07	40.46	191.40	20.57	0.50
	Average power	252.08	17.10	253.93	40.41	0.56
	Fatigue Index	4.27	1.56	4.37	1.41	0.52
Girl	Anaerobic power	173.55	22.26	179.69	27.42	0.58
	Anaerobic capacity	112.47	21.40	122.57	20.23	0.04*
	Average power	137.77	18.73	148.21	24.94	0.01*
	Fatigue Index	1.31	0.53	1.27	0.38	0.88

P<0.05 indicates significant differences in the data.

Table 5 shows the mean and standard deviation of the experimental group (Group 2) before and after the experiment. The results of paired samples t-test showed that. There is no statistical significance for male students. Anaerobic capacity, mean power of female students is significant.

Table 6 Comparison of data before and after the experiment of 500mg green tea extract + 4 weeks of exercise training (group 3 n=10)

Gender	Variant	Before the experiment		4 Weeks Later		P
		x̄	S.D.	x̄	S.D.	
Boys	Anaerobic power	458.12	77.92	522.38	70.33	0.03*
	Anaerobic capacity	242.55	28.98	252.09	30.42	0.78
	Average power	338.03	61.56	381.66	40.09	0.08
	Fatigue Index	5.97	1.99	7.6733	1.44	0.03*
Girl	Anaerobic power	177.16	32.13	220.08	28.42	0.01*
	Anaerobic capacity	116.46	28.45	125.63	23.60	0.34
	Average power	139.60	30.78	167.71	25.26	0.01*
	Fatigue Index	1.28	0.34	2.11	0.28	0.01*

P<0.05 indicates significant differences in the data.

Table 6 shows the mean and standard deviation of the experimental group (Group 3) before and after the experiment. The results of the paired samples t-test showed that. after 4 weeks of training. Aerobic capacity and fatigue index were statistically significant for both boys and girls. The mean power of the girls was statistically significant.

3. A one-way ANOVA Bonferroni test was used to compare the data after the 3 groups of experiments. (Table 7 for boys. Table 9 for girls) Multiple comparisons were made if significant (Table 8 for boys. Table 10 for girls)

Table 7 Comparison of post-experiment data of male subjects in placebo group 1, experiment group 2 and experiment group 3 (9 Boys)

variable		Sum of Squares	df	Mean Square	F	P
Anaerobic power	Between Groups	59706.36	2.00	29853.18	7.08	0.02*
	Within Groups	25283.48	6.00	4213.91		
	Total	84989.84	8.00			
Anaerobic capacity	Between Groups	2820.22	2.00	1410.11	0.93	0.45
	Within Groups	9150.79	6.00	1525.13		
	Total	11971.01	8.00			
Average power	Between Groups	28426.50	2.00	14213.25	8.37	0.01*
	Within Groups	10184.73	6.00	1697.46		
	Total	38611.23	8.00			
Fatigue Index	Between Groups	32.52	2.00	16.26	9.76	0.01*
	Within Groups	9.99	6.00	1.67		
	Total	42.51	8.00			

P<0.05 indicates significant differences in the data.

Table 7 shows the data after the experiment for the 3 groups of boys. One way ANOVA Bonferroni test was used. The results showed that the boys' Anaerobic power. average power. fatigue index. were statistically significant

Table 8 Placebo group 1. experimental group 2. experimental group 3. comparison of two-way differences in boys

Variable	Group	Average value	Placebo group 1	Experiment 2 group	Experiment 3 group
Anaerobic power	Placebo group 1	339.80	-	21.63	182.58 (0.04)
	Experiment 2 group	361.44	-21.63	-	160.94
	Experiment 3 group	522.38	-182.58 (0.04)	-160.94	-
Average power	Placebo group 1	273.34	-	-19.41	108.32 (0.05)
	Experiment 2 group	253.93	19.41	-	127.73 (0.02)
	Experiment 3 group	381.66	-108.32 (0.05)	-127.73 (0.02)	-
Fatigue Index	Placebo group 1	3.18	-	1.19	4.49 (0.01)
	Experiment 2 group	4.37	-1.19	-	3.30
	Experiment 3 group	7.67	-4.49 (0.01)	-3.30	-

P<0.05 indicates significant differences in the data.

Table 8 shows multiple comparisons of the 3 groups of experiments according to the Bonferroni test. The results show that. Average power was statistically significant for experimental groups 2 and 3. Anaerobic power Fatigue Anaerobic as statistically significant in experimental group 3.

Table 9 Placebo group 1. experimental group 2. experimental group 3. comparison of bi-directional differences in girls' post-experimental (21 girls)

Variable		Sum of Squares	df	Mean Square	F	P
Anaerobic power	Between Groups	7174.21	2.00	3587.10	4.20	0.03*
	Within Groups	15372.87	18.00	854.05		
	Total	22547.08	20.00			
Anaerobic capacity	Between Groups	838.00	2.00	419.00	0.97	0.40
	Within Groups	7771.20	18.00	431.73		
	Total	8609.20	20.00			
Average power	Between Groups	2467.22	2.00	1233.61	1.99	0.17
	Within Groups	11184.55	18.00	621.36		
	Total	13651.76	20.00			
Fatigue Index	Between Groups	2.59	2.00	1.29	6.30	0.01*
	Within Groups	3.69	18.00	0.21		
	Total	6.28	20.00			

P<0.05 indicates significant differences in the data.

Table 9 shows the data after the experiment for the 3 groups of girls. One way ANOVA Bonferroni test was used. Anaerobic power Fatigue Index was statistically significant in 3 groups of girls after the experiment.

Table 10 Comparison of female differences between placebo groups 1, experiment 2 and experiment 3

Variable	Group	Average value	Placebo group 1	Experiment 2 group	Experiment 3 group
Anaerobic power	Placebo group 1	182.19	-	-2.50	37.89 （0.02）
	Experiment 2 group	179.68	2.50	-	40.40 （0.01）
	Experiment 3 group	220.08	-37.89 （0.02）	-40.40 （0.01）	-
Fatigue Index	Placebo group 1	1.55	-	-0.29	0.55 （0.03）
	Experiment 2 group	1.26	0.29	-	0.84 （0.01）
	Experiment 3 group	2.11	-.55 （0.03）	-0.84 （0.01）	-

P<0.05 indicates significant differences in the data.

Table 10 shows multiple comparisons of the 3 groups of experiments according to the Bonferroni test. The Average power Fatigue Index was statistically significant in experimental groups 2 and 3.

CHAPTER 5
CONCLUSION DISCUSSION AND SUGGESTIONS

Effects of green tea extract combined with exercise training on anaerobic performance of college students. The researchers summarized their findings based on the following topics:

1. Research purpose

2. Conclusion

3. Discussion

4. Suggestions for applying research

1. Research purpose

1. Through a 4 -week control experiment. The impact of inspection of green tea extract combined with exercise training on college students' anaerobic ability.

2. To compare the differences in anaerobic capacity of boys and girls before and after the experiment in the 3 groups.

3. Comparison of one-time consumption of 500 MG of green tea extract. Differential anaerobic performance enhancement of college men and women by consuming 500 MG of green tea extract for 4 consecutive weeks.

2. Conclusion

1. Consumption of 500 green tea extracts for 4 consecutive weeks boys and girls had significantly higher Anaerobic power and fatigue index than the control group with a significance of $P < 0.05$. and the mean power of the boys was also significant.

2. Group 1Placebo + exercise Similar Green Tea Extract capsule 4 weeks. before and after the experiment was not significant. Group 2Green Tea Extract capsule +

exercise Single dose Boys were not significant and girls' Anaerobic capacity and Mean power P < 0.05. Group 3Green Tea Extract capsule + exercise 4 weeks. Anaerobic power and fatigue index for boys and girls P < 0.05, mean power for girls P < 0.05.

3.Group 3Green Tea Extract capsule + exercise4 weeks. girls 'Anaerobic power and fatigue index were higher than Group 2 (P < 0.05). The mean power of boys was higher than that of Group 2 (P＜0.05)

3. Discussion

1. There was no significant difference between the control group before and after the experiment, which increased the credibility of the effect of green tea extract in the experimental group. Green tea extract combined with exercise training significantly improves anaerobic capacity (Willian da Silva (2018)) and reduces exercise fatigue (Qu Ping (2010) Zhang Jincai (2016)) in college students, especially male students. The stability of the control group further supports this finding and validates the experimental design.

2. After a single intake of 500 mg of green tea extract, significant changes in minimum and average power were observed only in girls. This may be related to the following factors.

2.1 Gender differences between boys and girls (Wong, P. H. L., & Ko, M. L. K. (2003)).The basal metabolic rate of female students may affect the way they absorb and utilize supplements, leading to different effects (McMahon, C. H., & Hall, C. L. (2001))。Girls may be better able to demonstrate the short-term effects of green tea extract during specific types or intensities of exercise (Lejeune, R. J. J. W. B. N. T. M. (2012)) whereas boys may require longer interventions to observe similar effects

(Eric (2010)).Antioxidant components in green tea (such as catechins) (Yuhe Li,2003) have a short half-life in the body and a single intake may not be sufficient to produce significant physiological effects on a sustained basis. (Liu, Y., et al. (2013)).It may be true that a one-time intake of 500mg of green tea extract will not maintain antioxidant levels in the body for a sufficiently long period of time, and therefore may have limited effects on long-term exercise recovery and anaerobic capacity enhancement. The significant changes in minimum and mean power after a single intake of 500 mg of green tea extract in female students may be related to a number of factors such as gender differences, dose effect, exercise load, baseline level, and psychological factors. Understanding these factors will help to further optimize the experimental design and ensure a more accurate assessment of the effect of green tea extract on athletic performance across genders.

3. After ingesting 500 mg of green tea extract for four consecutive weeks, there was a significant increase in maximal power, mean power and fatigue index in boys, as well as Anaerobic power and fatigue index in girls, which may be related to the following factors.

3.1 Anaerobic capacity is mainly influenced by muscle mass, muscle fiber type, reserves of different energy-supplying substances, efficiency of metabolic pathways, genetics and training (Yujie Guo, 2014)。Consumption for 4 consecutive weeks increased antioxidant levels in the body more consistently and may have longer lasting effects on reducing oxidative stress, promoting muscle recovery and improving athletic performance (Vahid Sobhani (2020))。These effects manifest differently between boys and girls and may be related to biological differences (L. C. K. M. Johnson (2011)).Green tea extract removes free radicals, improves the body's ability to supply oxygen, promotes the exchange of energy in all parts of the body,

and improves the body's ability to resist stress (Shujun Zhang 2018).Components in green tea may promote fat oxidation and energy production, helping to delay fatigue and improve exercise capacity (Willian da Silva (2018)).Athletes can take green tea extracts appropriately during their daily training to alleviate their own athletic fatigue and reduce the damage caused to their muscles 郅 (Ji Xin (2017)).Green tea extract can effectively inhibit and repair skeletal muscle damage caused by anaerobic exercise, promote the elimination of exercise fatigue and enhance anaerobic exercise capacity (Qu, P. (2010)).The anti-inflammatory properties of green tea may help reduce muscle pain and inflammation after exercise, leading to faster recovery and less fatigue(Li Yuhe (2003)).The sample of this study was 21 female students and 9 male students, the small overall sample size and especially the small number of male students may also lead to statistically insignificant experimental results for both male and female students after ingesting green tea extracts.

After consuming 500 mg of green tea extract for four consecutive weeks, maximal power, mean power and fatigue index were significantly increased in boys, and Anaerobic power and fatigue index in girls. This phenomenon may be related to the multiple physiological effects of green tea extracts. Catechins in green tea possess powerful antioxidant capacity (Qu, Ping (2010) Peng, Chun (2016) Guo, Caiqin (2016)), which can reduce exercise-induced oxidative stress, protect muscle cells, and thus enhance exercise performance. In addition, green tea extract may further enhance exercise anaerobic capacity by improving blood circulation, increasing fat oxidation, and raising basal metabolic rate (Hao Jian (2017)), as well as its anti-inflammatory and psych modulatory effects. Improvements in exercise performance and reductions in fatigue with green tea extract show its potential benefits in exercise recovery and performance optimization.

4. Suggestion

1. Suggestions for applying research

1.1. The present study showed that green tea extract has some positive effects in relieving fatigue of exercise training, but the consumption of green tea extract is related to the health and safety of exercise trainers. Therefore, how to scientifically and rationally intake green tea extract to enhance the effect of exercise training, reduce muscle damage and enhance the antioxidant capacity of the body are the contents worth focusing on.

1.2. Test for anaerobic performance. The proper workload must be set. In order to get the correct experimental results, no harm will be caused to the sample due to excessive workload. And the instrument must be calibrated each time to ensure the accuracy of the test.

1.3. The venue can be chosen from a large indoor stadium, outdoors will have an effect on the sample training due to temperature differences.

1.4. As a nutritional supplement to enhance and restore body functions, green tea extract is not a substitute for medication. When taking green tea extract, you should have a clear understanding of its possible side effects and target your supplementation according to your expected exercise effect or post-exercise recovery effect.

2. Suggestions for applying research

2.1. Next in the study. The effect of consumption of green tea extract should be studied and compared with other types of sports like long distance running, swimming, volleyball, badminton, skating etc. as there are very few studies to evaluate the performance of various sports.

2.2. Green tea extracts are studied and compared with the effects of drinking

other teas such as black, white, black, and oolong teas to understand their efficacy and to further consider the choice of such products to help with exercise.

2.3. Further exploration of the optimal dose of green tea extract can be considered.

2.4. Consider whether a longer study is needed to explore the effects of green tea extract in different populations (e.g., different age groups, genders).

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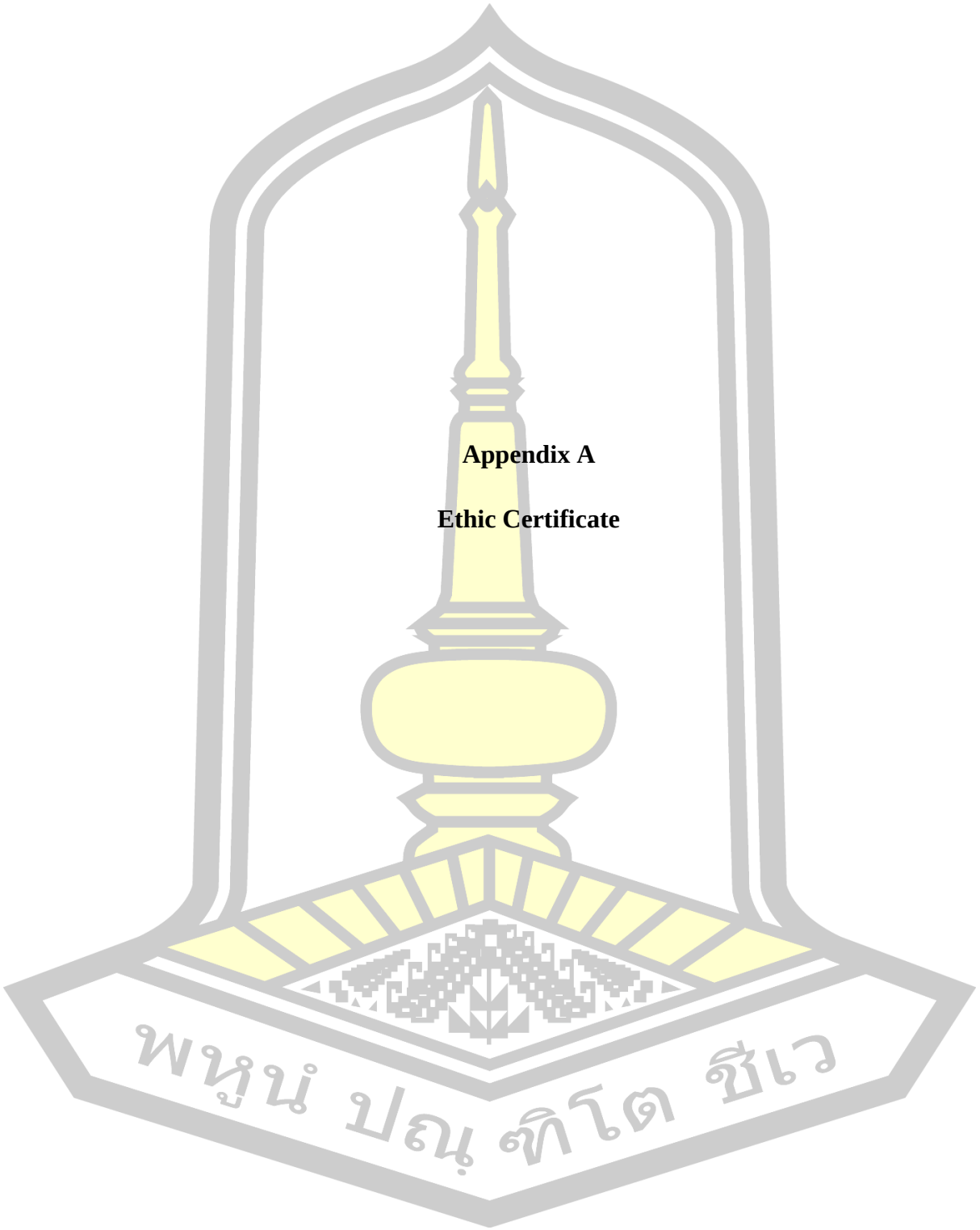
APPENDIX



Appendix A

Ethic Certificate

MAHASARAKHAM UNIVERSITY ETHICS COMMITTEE FOR RESEARCH INVOLVING HUMAN SUBJECTS

Certificate of Approval

Approval number: 064-534/2024

Title : Effect of green tea extract in conjunction with exercise training on anaerobic performance of college students.

Principal Investigator : Qiping Mao
Responsible Department : Faculty of Education
Research site : Zigong in Sichuan Province

Review Method : Expedited Review

Date of Manufacture : 31 January 2024 **expire :** 30 January 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)

ECMSU01-05.03 (English) 2023

Clarification documents for the volunteers who answered the questionnaires (Respondents must be above 18 years of age to participate in answering the questionnaires.)

To All respondents

I am (Sichuan Vocational College of Health and Rehabilitation. researcher. Mr.QIPING MAO. Mahasarakham University the Faculty of Education.M.Sc.is now doing on research name "Effect of green tea extract in conjunction with exercise training on anaerobic performance of college students". Targets college students ages 18-22. The benefits that you will receive from this research are "Master sports training methods. Build up your physique. Learn about the actual benefits of green tea extract. "You may not directly benefit from participating in this research project. But the information obtained will be useful for Academic.

If you decide to participate in the research, the researcher will ask you to answer the questionnaire on. (Have you ever learned about green tea extract). which consists of questions in total of 13 items answer the questionnaire is taking about 5 minutes. The time period specified must be from minutes. Testimonies test. researcher will receive the questionnaire by collect it by themselves.

There are some risks involved in this study, as you could cause a sports injury during training. Our training process involves the whole process of the doctor, who will provide timely treatment in case of accidental injury or physical discomfort. In order to avoid the physical discomfort caused by the consumption of green tea extract, we will ask the volunteers to fill in the physical condition and feeling questionnaire after consuming 500MG green tea extract capsule to avoid the discomfort caused by the consumption of green tea extract capsule. In case of an emergency, most of the school's professional teachers are doctors, who can get professional medical assistance and first aid treatment in time. The college is only a 10-minute drive from the branch of the affiliated hospital. If you are interested in this study, you will need approximately 4 minutes to fill out a general questionnaire about the green tea extract study. If you decide to participate in the study after answering the questionnaire, we also have a Physical Activity Readiness Questionnaire (PAR-Q) for you to complete.

If you feel uncomfortable or feel uncomfortable with some questions, You have the right to not answer those questions. You have the right to withdraw from this project at any time without prior notice. The refuse of participating in the research or withdrawing from this research project Will not have any effect to does not affect your studies.

The information in your questionnaire will be kept. Not disclosed to the public on an individual basis, only the overall research results will be reported. Researcher will destroy relevant information after the research is completed. In this research, you will not receive any compensation or any fees.

If you have questions about the research Please contact us at (Mr.QIPING MAO.Health and Sport Science. Educational Faculty, Mahasarakham University, Phone: +8618990084977) If you have not performed as stated or want to know your rights while participating in this research, please contact "Committee on Ethics for Research in Humans Mahasarakham University Division of Research" Tel. 043-754416, 1758

Sincerely

.....

(Mr. Qiping Mao)

Researcher

ECMSU01-06.03 English 2023

Volunteers Consent Form
(For volunteers over 18 years old)

I (Mr./Miss/Mrs.) ..... Surname .....
Age.....Year.
House number ..... Village No..... Sub-district ..... District ..... province.....

Read the explanation / listen to the explanation from (Sichuan Vocational College of Health and Rehabilitation. researcher. Mr. QIPING MAO.) about volunteering in the research project on "Effect of green tea extract in conjunction with exercise training on anaerobic performance of college students", the explanatory text consists of Full details about the purpose of the research, details of the research. That I have to do and be treated, the benefits that I may gain from the research and the risks that may arise from participating in the study. Including guidelines for questions that may arise throughout. It has also received an explanation and an answer to any questionnaire / interview / test from the research project leader.

As well as the testimony from the researcher that will keep my information confidential. In addition, not anonymously or private information individually to the public. The results of the research will be presented in the form of an overview that is a summary of the research results for academic purposes only.

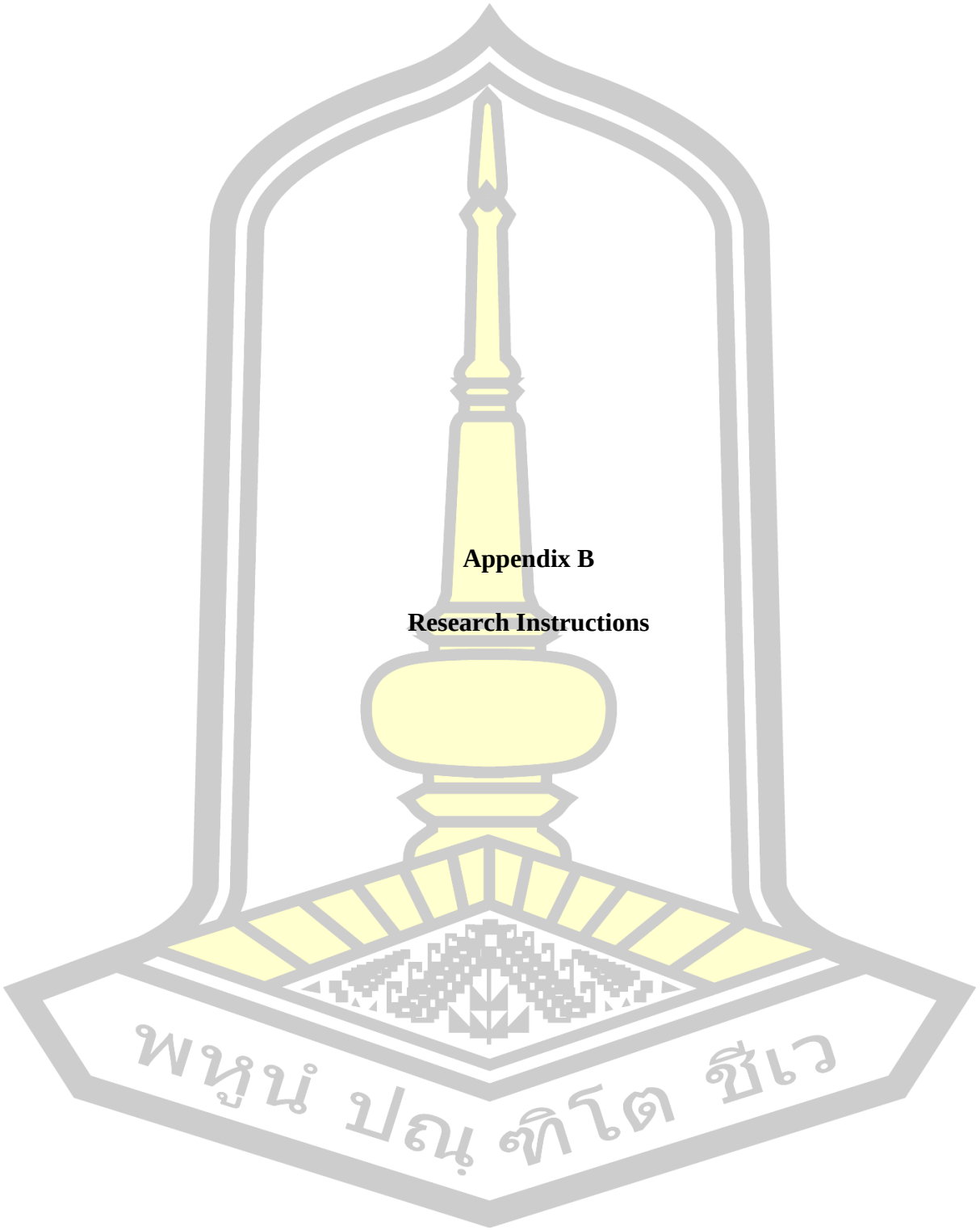
I know there are some risks to this research. I could get injured during training or feel sick from eating green tea extract. I know that during the training process, there is the guidance of the researchers and the full participation of the doctors. In case of accidental injury or physical discomfort, the doctor can provide timely treatment. As a volunteer, I agreed to participate in this 4-week experiment. I agreed to train for 40 or 45 minutes three times a week. Take 500MG green tea extract capsules or a placebo before training. And agree to participate in the RAST test.

"In participating as a volunteer of this research project I join voluntarily." And I can withdraw from this study at any time. If I wish which will not have any effect and will not lose any rights in study or work that I will receive in the future.

sign..... Volunteer
(.....)
Date.....

sign..... witness
(.....)
Date.....

sign..... researcher
(.....)
Date.....



Appendix B

Research Instructions

Research Permit

As a signatory at the end of this article, I agree to participate in this study.

Project name: Effect of green tea extract in conjunction with exercise training on anaerobic performance of college students

The name of the researcher：MAO QIPING

Supervisor：Dr.Napatsawan Thanaponganan

Study site: Sichuan Vocational College of Health and Rehabilitation

Telephone: +8618990084977

I have gone into detail about the source and purpose of the study. Measures that must be taken or taken, risks, dangers and benefits. Based on this research, I have been reading the description in the paper and learning about it. The researchers' explanation also brought this home to me.

So, I volunteered for this research project. In the research report I submitted, the research I agreed to participate in is. Green tea Extract 500mgwas consumed with food for 4 weeks with 40 minutes of training 3 times a week using the PAST test. And record every achievement. Green tea Extract 500gm was consumed with food for 4 weeks with 40 minutes of training 3 times a week using the PAST test. And record every achievement.

I have the right to withdraw my research at any time without giving reasons. Dropping out of the study didn't make any difference to me.

Guarantee that the researchers will treat me according to the information listed in the file.

Any information about the study participants and about me will be kept confidential by the researchers.

The research data is just an overview. There's nothing in the report to identify me.

I've signed in front of the witnesses, and I've received a statement from one of the participants. Copies of the study and consent form

Signatory study participant Sign the principal investigator

( ) ( )

Witness The guardian

( ) ( )

Research agreement

In order to effectively conduct anaerobic performance testing, we require that participants cooperate in accordance with the following provisions:

1. Participants were not allowed to take green tea extract before and during the test. The week before the test, athletes need to rest for at least eight hours.

2. There is no change in the daily diet, and if there is a change, the test results will change. Please tell the researchers.

3. Athletes should drink plenty of water before the test and do not over exercise at least before the test. If necessary, please inform the researcher.

4. No caffeinated alcohol or beverages within 24 hours

5. Test dates require no drugs or stimulants, such as tea, coffee, or smoking。

6. Subjects should wear clothing suitable for exercise, keep warm before the test and stretch after the test. Stretch every time.

7. If the test results cause negative effects, the tester shall be ordered to stop the test, or the tester shall be notified.

8. Do your best to test.

Consent to join study

We invite you to participate in a study of college students aged 18 to 22.

Thirty eligible subjects were divided into three groups:

1.The first group was given 500mg of generic drug for 4 weeks, the second group was given 500mg of green tea extract in a single dose, and the third group was given 500mg of green tea extract for 4 weeks

2. All participants can participate in normal activities, such as diet, exercise, but be careful not to drink tea, coffee, weight loss, etc.

3. The sample reported at 5pm on the day of each training session and avoided strenuous exercise.

4. Avoid caffeinated alcohol and beverages for 24 hours and get enough sleep for 6-8 hours a day.

5. The training time of experiment group 1 was weekly (1.3.5). The experimental group 3 conducted comprehensive sprint training every week (2.4.6), and each training included 6 sets of 35 meters sprint. Sprint intervals of 10 seconds or 1 minute. Group 1 was not told it was a generic drug before the experiment. Experiment 1 and experiment 3 do not meet at the beginning of the formal experiment.

6.Experiment 2 tested 6 sets of data with RAST before the experiment began, and then performed 6 sets of 35-meter sprints. The sprinting interval was 10 seconds or 1 minute. After the training, they ate the dinner prepared by the researchers, took 500GM green extract with the meal, took a rest, and conducted RAST test again for experiment group 2 on the next day to collect 6 groups of data.

7. Experiment 1 and Experiment 3 groups ate a dinner prepared by the researchers after training and consumed 500mg of green tea extract or generic medicine with food.

8. Each training of experiment group 1 and group 3 was guaranteed to be carried out in the same environment. After 4 weeks of training, RAST was used for testing and 6 groups of data were collected.

9. After taking green tea extract for more than 1 day, subjects will be interviewed about their post-product symptoms, such as abdominal pain, bloating, nausea, headache, etc.

10. Acceptance or refusal to participate in the study do not affect the sample. All information is confidential and used for the purpose only. The findings are provided with an overview. A sample may be issued with an application to leave the study before the end of the study without any reason or explanation.

If you have any questions, please contact Mr. MAO QIPING, thank you for your cooperation

Sign:

Appendix C Research tools

1. General questionnaire

2. Health assessment record

3. Pre-Exercise Self-Assessment (PAR-Q)

4. Feelings and interview form after ingesting 500GM green extract

5. Speed test (35 meters) score report (RAST test)

6. RAST test result registration form

7. Circuit training program

General Questionnaire

Hello, I have two minutes of your time. I am doing a study on the effects of drinking green tea extract combined with exercise training on anaerobic exercise performance of college students, hoping to select suitable experimental subjects through questionnaire competition. If you are willing to participate in this experiment, please fill in the following questions, thank you.

Name: Tel:

1.Hello, what grade are you in?

Big 1 （） Big 2 （） Big 3 （）

2.What is your gender?

Male （） female（）

3.What are your height and weight?

Weight （） kg Height（） cm

4.How old are you?

18—20years old（） 20—22years old（）

4.Do you smoke?

Never Smoked（） Occasional smoking (1-3 days/week)（）

I used to smoke, but I quit now（）

Quit smoking for more than 1 year（）

Quit smoking for less than one year（）

5.Have you ever had green tea?

Yes（） No（）

6.Are you allergic to green tea?

Yes（） No（）

7.What do you know about the benefits of green tea?

Know （） Don't know （）

8.Do you know the ingredients of green tea?

Know （） Don't know （）

9.Do you know green tea extract?

Know （） Don't know （）

10.Have you ever eaten green tea extract?

Yes（ ） No（ ）

11.Would you like to participate in the experiment?

Yes（ ） No（ ）

12.Food you usually eat (optional 1)

（）1.Oily food. Such as pig leg rice, chicken leg rice, pig lean meat, coconut milk.

（）2.Sweets.Such as cold coffee, soda, cake, dessert, ice cream

（）3. Salty food, such as salted eggs, salted fish, sausage

（）4.Spicy food. Such as chilli and garlic

（）5.Do not select any options

13.Off for the past month

（）Less than 4 hours per day （）For 4-5 hours per day

（）And 6-8 hours a day （）More than 8 hours per day

This study involved college students who were not allowed to drink alcohol while on campus, so the design did not have the option to investigate drinking issues.

sign_____ Research participants

Weight： Height：

Health assessment record

1.Family medical history

2.Personal disease history

3.Medication History

3.1Drug use

3.2History of drug allergy

4.This table shows health information from samples diagnosed by doctors

list	Test Results
1.Heart rate (times/minute)	
2. Cardiovascular examination, blood pressure measurement, listening to heartbeat and recording his pulse	
3Musculoskeletal System Screening	
☐.Balanced, shoulder level	
☐.neck movements	
☐.Shoulder joint movement	
☐.Wrist and finger movements	
☐.Anterior lateral symmetry of the knee joint	
☐.spine line	
☐.Leg muscle strength	
☐.Balance of the spinal line curves	
Medical report	☐. Normal ☐. Unusual ☐. Can take part in the study ☐. Unable to participate in the study
Doctor, inspector signature:	

Pre-workout self-assessment

(Physical Activity Readiness Questionnaire =PAR-Q)

If you are between the ages of 15 and 69, please answer the 7 questions below. Answer the questions. The evaluation will tell you whether you should be checked by a doctor before you start exercising.

Please read these questions carefully and answer them truthfully within the past 6 months. All information on this form will be treated confidentially.

Health questions: Please read carefully and answer yes or no (Y/N) to the following. Y/N		/N
1	Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?	
2	Do you feel pain in your chest when you do physical activity?	
3	In the past month, have you had chest pain when you were not doing physical activity?	
4	Do you lose your balance because of dizziness, or do you ever lose consciousness?	
5	Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?	
6	Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?	
7	Do you know of any other reason why you should not do physical activity?	

I read and understood this and filled out a self-assessment form before each workout, which was voluntary.

Study participant The researcher

Signature Signed the

( ) ( )

Feelings and interview form after ingesting 500GM green extract

Let the participants in the research take notes on the subject-related questions after taking green tea extract.

Yes No

☐ ☐Are you experiencing Nausea / vomiting?

☐ ☐Are you experiencing Dizziness / headache?

☐ ☐Are you experiencing eruption?

☐ ☐Are you experiencing The chest is tight?

☐ ☐Are you experiencing have a stomachache?

☐ ☐Are you experiencing diarrhea?

☐ ☐Are you experiencing dry lips, dry tongue?

☐ ☐Are you experiencing Tired of food?

☐ ☐Are you experiencing tachycardia?

☐ ☐Are you experiencing can't fall asleep?

☐ ☐Are you experiencing little upset?

☐ ☐Are you experiencing appetite is growing up?

☐ ☐Are you experiencing constipate?

☐ ☐There is no abnormality

☐ ☐If yes, please describe other symptoms

Sign_____Study participants

Speed test (35 meters) score report (RAST test)

The Running-Based Anaerobic Sprint Test (RAST) is a sport-specific anaerobic test developed at the University of Wolverhampton. RAST only requires a stopwatch and a calculator to perform some simple calculations. RAST provides a more specific test of anaerobic performance in running (Skinner, J.S. 1996).

Purpose.：Test your anaerobic capacity. The maximum run is 35 meters.

Equipment: 1. Speaker 2. Stopwatch 3. Conical barrel. 4. A whistle. 5. Calculator

Test Methods：

1. Weighing

2.Have subjects performed warm-up and stretching exercises.

3.Rest for 5 minutes before testing.

4.The test subject traveled 6 times at a maximum speed of 35 meters. There is a rest interval of 10 seconds in between.

5.Have subjects perform 5 minutes of warm-up and stretching exercises.

Take notes:Record the time of 6 runs every 35 meters and calculate the maximum anaerobic capacity.

2.RAST calculation formula：

Velocity = Distance (35m) ÷ Time

Acceleration = Velocity ÷ Time

Force = Weight × Acceleration

Power = Force × Velocity

Power = Weight × $Distance^2$ ÷ $Time^3$

From the six times, calculate the power for each run and then determine

Maximum power - the highest value

Minimum power - the lowest value

Average power - the sum of all six values ÷ 6

Fatigue Index - (Maximum power - Minimum power) ÷ Total time for the

RAST test results sheet

Name：_____ Age：

Height：_____ Weight：

Frequency	Time (seconds)	Power
1		
2		
3		
4		
5		
6		

Training Record Form (Complete tick)

500mgplacebo as a generic

Student ID		A01	A02	A03	A04	A05	A06	A07	A08	A09	A10
week 1	Monday										
	Wednesday										
	Friday										
Week 2	Monday										
	Wednesday										
	Friday										
week 3	Monday										
	Wednesday										
	Friday										
Week 4	Monday										
	Wednesday										
	Friday										

500mgGreen Tea Extract+exercise Single dose

Student ID		B01	B02	B03	B04	B05	B06	B07	B08	B09	B10
week 1	Monday										

500mgGreen Tea Extract

Student ID		C01	C02	C03	C04	C05	C06	C07	C08	C09	C10
week 1	Monday										
	Wednesday										
	Friday										
Week 2	Monday										
	Wednesday										
	Friday										
Student ID		C01	C02	C03	C04	C05	C06	C07	C08	C09	C10
week 3	Monday										
	Wednesday										
	Friday										
Week 4	Monday										
	Wednesday										
	Friday										

Collection form for data analysis before and after the experiment

500mgplacebo as a generic

Student ID		A01	A02	A03	A04	A05	A06	A07	A08	A09	A10
Maximum power	Before testing										
	After 4weeks										
Minimum power	Before testing										
	After 4weeks										
Average power	Before testing										
	After 4weeks										
Fatigue Index	Before testing										
	After 4weeks										

500mgGreen Tea Extract+exercise Single dose

Student ID		A01	A02	A03	A04	A05	A06	A07	A08	A09	A10
Maximum power	Before testing										
	After 4weeks										
Minimum power	Before testing										
	After 4weeks										
Average power	Before testing										
	After										

	4weeks										
Fatigue Index	Before testing										
	After 4weeks										

50mgGreen Tea Extract

Student ID		C01	C02	C03	C04	C05	C06	C07	C08	C09	C10
Maximum power	Before testing										
	After 4weeks										
Minimum power	Before testing										
	After 4weeks										
Average power	Before testing										
	After 4weeks										
Fatigue Index	Before testing										
	After 4weeks										

Quality assessment of research tools (IOC)

There are 3 specialists to check and confirm the effectiveness of pre-exercise warm-up, exercise training program and post-exercise stretching to be evaluated.

SECTION 1：Weeks 1-2 Athletic pre-training warm-up summary sheet

Three experts evaluated the objective consistency of the program, examining and confirming the effectiveness of the warm-up prior to athletic training, as follows:

No.	Items	Expert Evaluation			IOC Value
		1	2	3	
1	Warm up (10 minutes)	1	1	1	1
2	Easy jogging(400m/ 3 minutes)	1	1	1	1
3	Back kick and run(20times /set,2 set)	1	1	1	1
4	Side kick(20times /set,2 set)	1	1	1	1
5	Arm Chest Expansion and Drawing Circle(20times /set,2 set)	1	1	1	1
6	Alternate Side Torso(20times /set,2 set)	1	1	1	1
7	Turns with forward bends(20times /set,2 set)	1	1	1	1
8	Alternate Arrow Squat(20times /set,2 set)	1	1	1	1

SECTION 2：Athletic Training Program Summary for Weeks 1-2

Three experts evaluated the objective consistency of the program and examined and confirmed the effectiveness of the athletic training program as follows:

No.	Items	Expert Evaluation			IOC Value
		1	2	3	
1	Training Program (30 minutes)	1	1	1	1
2	Run over the fence (20times/set,4 set)	1	1	1	1
3	Jump over the fence with both feet （20times/set,4 set)	1	0	1	0.66
4	Jumping in circles with legs (20times/set,4 set)	1	1	0	0.66
5	Run 35 meters sprint (3 times)	1	1	1	1
6	High kicks(20times/set,4set)	0	1	1	0.66
7	Open and close jumps (20times/set,4 set)	1	1	1	1
8	Jump Rope (30times/set,4 set)	1	1	1	1

SECTION 3：Athletic Training Stretching Summary for Weeks 1-2

Three experts evaluated the objective consistency of the program and examined and confirmed the effectiveness of stretching after athletic training as follows:

No.	Items	Expert Evaluation			IOC Value
		1	2	3	
1	Rest in place (5 minutes)	1	1	1	1
2	Cool Down (10 minutes)	1	1	1	1
3	Neck Stretch(10s/times,4times) Stretch 10s to the left, 10s to the right, 10s to the forward, 10s to the back	1	1	1	1
4	Upper arms stretch posture (2 minutes)	1	1	1	1
5	Straight Shoulder Stretch (2 minutes)	1	1	1	1
6	Posterior Shoulder Stretch (2 minutes)	1	1	1	1
7	Front Leg Muscle Stretch (1 minute)	1	1	1	1
8	Side Stretch (1 minute)	1	1	1	1
9	leg and back stretches (1 minute)	0	1	1	0.66

SECTION 4：Weeks 2—4 Athletic pre-training warm-up summary sheet

Three experts evaluated the objective consistency of the program, examining and confirming the effectiveness of the warm-up prior to athletic training, as follows:

No.	Items	Expert Evaluation			IOC Value
		1	2	3	
1	Warm up (10 minutes)	1	1	1	1
2	Easy jogging (400m/ 3 minutes)	1	1	1	1
3	Back kick run (20times /set,2 set)	1	1	1	1
4	Side kick (20times /set,2 set)	1	1	1	1
5	Arm Chest Expansion and Drawing Circle (20times /set,2 set）	1	1	1	1
6	Alternate Side Torso (20times /set,2 set)	1	1	1	1
7	Turns with forward bends (20times /set,2 set)	1	1	1	1
8	Alternate Arrow Squat (20times /set,2 set)	1	1	1	1
9	Waist Warm-up (20times /set,2 set)	1	1	0	0.66
10	Walking in Place (20times /set,2 set)	1	0	1	0.66

SECTION 5：Athletic Training Program Summary for Weeks 2-4

Three experts evaluated the objective consistency of the program and examined and confirmed the effectiveness of the athletic training program as follows:

No.	Items	Expert Evaluation			IOC Value
		1	2	3	
1	Training Program (45 minutes)	1	1	1	1
2	Run over the fence (20times/set,6 set)	1	1	1	1
3	Jump over the fence with both feet （20times/set,6 set)	1	0	1	0.66
4	Jumping in circles with legs (20times/set,6 set)	1	1	0	0.66
5	Run 35 meters sprint (3 times)	1	1	1	1
6	High kicks (20times/set,6 set)	0	1	1	0.66
7	Open and close jumps (20times/set,4 set)	1	1	1	1
8	Jump Rope (30times/set,4 set)	1	1	1	1

SECTION 6：Athletic Training Stretching Summary for Weeks 2-4

Three experts evaluated the objective consistency of the program and examined and confirmed the effectiveness of stretching after athletic training as follows:

No.	Items	Expert Evaluation			IOC Value
		1	2	3	
1	Rest in place (5 minutes)	1	1	1	1
2	Cool Down (10 minutes)	1	1	1	1
3	Neck Stretch(10s/times,4times) Stretch 10s to the left, 10s to the right, 10s to the forward, 10s to the back	1	1	1	1
4	Upper arms stretch posture (2 minutes)	1	1	1	1
5	Straight Shoulder Stretch (2 minutes)	1	1	1	1
6	Posterior Shoulder Stretch (2 minutes)	1	1	1	1
7	Front Leg Muscle Stretch (1 minute)	1	1	1	1
8	Side Stretch (1 minute)	1	1	1	1
9	leg and back stretches (1 minute)	0	1	1	0.66

Practice and training methods

Experiment group 1 Take green tea extract generics. Circuit training for 4 weeks

The group was tested with RAST before formal training and trained according to the following steps. After the training, 500mg of generic drug was taken with the meal. Then rest. Train 3 times a week. In Week 4, the PAST test data was collected. End the experiment

1.Warm up and stretch before practice. 10 minutes

2.Training is conducted on a standard-sized futsal pitch, based on consecutive training points.

3.Crossing Fence (PVC). Height 20 cm. 20 pieces at a vertical distance of 90 cm.

4.Jump the fence with both feet. 20 centimeters. Vertical 90 degrees. Twenty of them.

5.Running, jumping, feet on a ring 60 cm in diameter, angled. 45 degrees, 90 centimeters, 20 rings

6.Sprint 35 meters.

7.All training is done continuously at 70-75% of the maximum heart rate. The maximum heart rate is compared with the time, then the time is used as a criterion to determine the heart rate, and at the end of the training, walk.

8.Do 6 reps of each exercise with a 10-second rest interval.

9.Cool Down and stretch for 10 minutes

Experiment group 2 Single circuit training program.

The group only trained once and collected data through RAST test before training. Then train with the following steps. Take 500mg of green tea extract with a meal at the end of the training session, then rest. Come back the next afternoon for the RAST test. End the experiment

1.Warm up and stretch before practice. 10 minutes

2.Training is conducted on a standard-sized futsal pitch, based on consecutive training points.

3.Crossing Fence (PVC). Height 20 cm. 20 pieces at a vertical distance of 90 cm.

4.Jump the fence with both feet. 20 centimeters. Vertical 90 degrees. Twenty of them.

5.Running, jumping, feet on a ring 60 cm in diameter, angled. 45 degrees, 90 centimeters, 20 rings

6.Sprint 35 meters.

7.All training is done continuously at 70-75% of the maximum heart rate. The maximum heart rate is compared with the time, then the time is used as a criterion to determine the heart rate, and at the end of the training, walk.

8.Do 6 reps of each exercise with a 10-second rest interval.

9.Cool Down and stretch for 10 minutes

Experiment group 3： Cycle training with 500mg of green tea extract for 4 weeks.

The group was tested with RAST before the formal training and trained according to the following steps, 500mg of green tea extract with the meal after the training, and then rest. Train 3 times a week. In Week 4, the PAST test data was collected. End the experiment

1.Warm up and stretch before practice. 10 minutes

2.Training is conducted on a standard-sized futsal pitch, based on consecutive training points.

3.Crossing Fence (PVC). Height 20 cm. 20 pieces at a vertical distance of 90 cm.

4.Jump the fence with both feet. 20 centimeters. Vertical 90 degrees. Twenty of them.

5.Running, jumping, feet on a ring 60 cm in diameter, angled. 45 degrees, 90 centimeters, 20 rings

6.Sprint 35 meters.

7.All training is done continuously at 70-75% of the maximum heart rate. The maximum heart rate is compared with the time, then the time is used as a criterion to determine the heart rate, and at the end of the training, walk.

8.Do 6 reps of each exercise with a 10-second rest interval.

9.Cool Down and stretch for 10 minutes

Appendix D Four training points

Training 1

1.Through 20 cm high PVC fence, 20 fences

2.Go through the fence as fast as you can, bouncing, jumping and landing knees should be bent. And walk back to the start for the next set.

3.6 reps with 20 second breaks



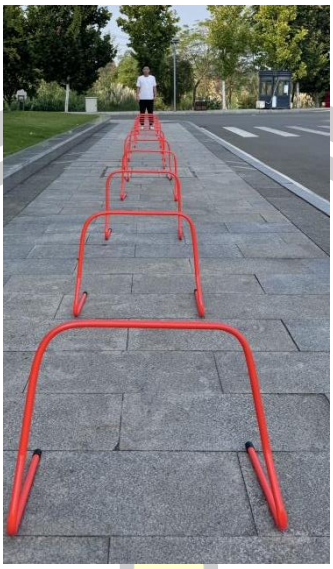
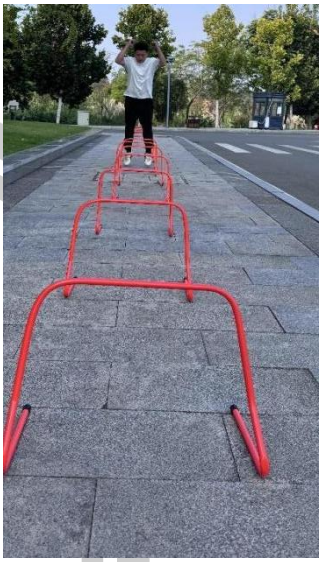
Training 2

1.Jump fence (PVC) 20 cm high with both feet. 20 fences

2.Jump with both feet and jump over 20 fences quickly. When jumping, take both feet off the ground at the same time and rise as vertically as possible. In the air, raise your feet as high as you can to ensure that you can cross the fence.

3.When landing, touch the ground with both feet at the same time and bend your knees slightly to absorb the impact.

4.6 reps with 20 second breaks

Training 3

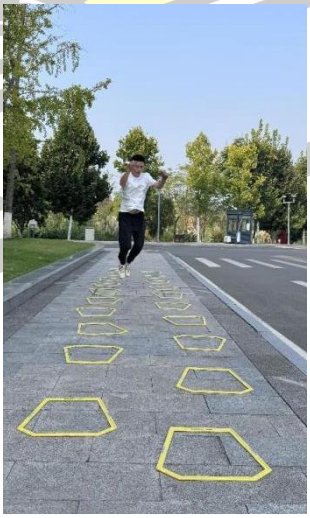
1.Perform a double leg jump in a ring with a diameter of 60 cm.

2.Ring 45-degree tilt, 20 rings

3.When jumping, take both feet off the ground at the same time and rise as vertically as possible. In the air, raise your feet as high as you can to ensure that you can cross the fence. When landing, touch the ground with both feet at the same time and bend your knees slightly to absorb the impact.

4.6 reps with 20 second breaks



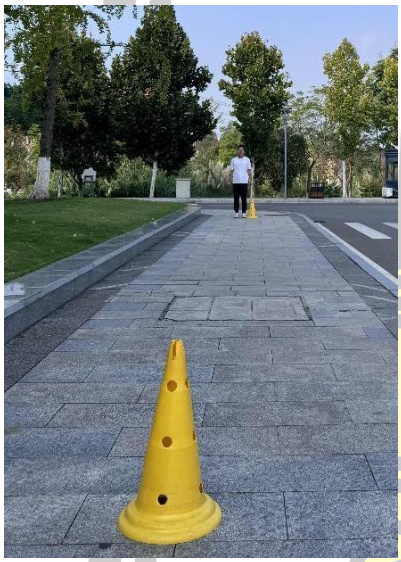


Training 4

1.35 Meters sprint.

2.Stand on the starting line with your legs together and your feet gripping the ground. Bend your knees slightly and tilt your body's center of gravity forward for a better explosive starting position. At the signal to start, push your legs explosively with your whole body and quickly sprint away from the start line. The movement should be quick and powerful, aiming for maximum speed.

3. 6 reps with 10 second breaks



Training 5

The high leg raise is a common physical training movement that can help strengthen the abdominal and hip muscles and improve core stability.

1. Place your arms straight out on either side of your body, palms down. Keep your legs straight and parallel to the ground.

2. As you inhale, keep your abdominals tight and slowly lift your legs. At the same time, use your abdominal strength to lift your hips away from the floor so that your legs form an angle of about 90 degrees with your upper body.

3. Exhale slowly and lower your legs without touching the floor. Use your

abdominal muscles to control the speed of lowering your legs and make sure you still feel the tension in your core as you lower your legs.

4. 30 seconds each time. 6 reps with. 10 second breaks

Training 6

Open and close jumps

1. Bend your knees and hips and jump up with your legs.

2. At the moment of jumping up, spread your legs apart quickly and stretch your arms out to the sides to form an "X" shape.

3. Spread your legs as wide as possible and keep your feet slightly off ground.

4. When you are in the air, quickly close your legs and arms and return to the starting position.

5. When your feet touch the ground, make sure your knees are slightly bent to slow down the impact.

6. Jump 6 times for 30 seconds each time. Rest 10 seconds in between


Training 7

Jumping rope is a simple but effective full-body aerobic exercise that can help improve cardio health, coordination and endurance

1. Hold the handles of the jump rope, one hand on each handle.

2. Stand up straight, keeping your body straight and your feet together.

3. At the start, the rope should be behind you, and the next step is to quickly use your wrist to throw the rope in front of your head.

4. As the rope quickly passes in front of your head, bounce up while quickly turning your wrist so that the rope passes under your body.

Try to keep your jumps small and just high enough to allow the rope to pass.

5.Keep breathing smoothly, don't hold your breath

6.Jump 6 times for 30 seconds each time. Rest 10 seconds in between



Appendix E Warm-up exercise

1. Easy Jogging

Easy jogging is a soothing aerobic exercise for people of all ages and fitness levels. It helps to improve cardiorespiratory fitness, increase endurance, relax the mind and body as well as improve overall health.

1. Keep your body straight, head naturally lifted and eyes forward.

2. Relax your shoulders to avoid tension.

3. Swing naturally with your arms, not too hard.

4. Pay attention to your breathing and try to keep it deep and even

5. Relax and jog for 400 meters.

2. Rear Kick

Rear kicks are a common exercise that can be used to work the muscles on the back of the thighs, especially the glutes and hamstrings.

1. From the starting position, shift your weight onto one leg and slightly lift and straighten the other leg.

2. Firmly extend the lifted leg back until you feel the muscles on the back of

your buttocks and thighs tighten.

3. Hold this position for about 1 second, then slowly lower your leg back to the starting position.

4. Repeat the same movement, but this time with the other leg.

5. Repeat 10 times each time. Do 2 sets. Rest 10 seconds in between.

3. Side Kick

Side kicks are an effective training movement for the glutes, outer thighs and core muscles.

1. From the starting position, shift your weight onto one leg and lift the other leg slightly.

2. The lifted leg should straighten and then start kicking out to the side. This should be a sideways kicking motion so that the lifted leg kicks to the side.

3. Kick as high as you can, but don't over-bend at the waist.

4. Hold this position for about 1 second, then slowly lower the leg back to the starting position. Repeat the same movement, but this time with the other leg.

5.Repeat 10 times each time. Do 2 sets. Rest 10 seconds in between.

4. Arm Chest Expansion Circle

The arm chest circle is an effective movement to exercise the shoulder and chest muscles.

1. Slowly raise your arms so that they are parallel to the ground.

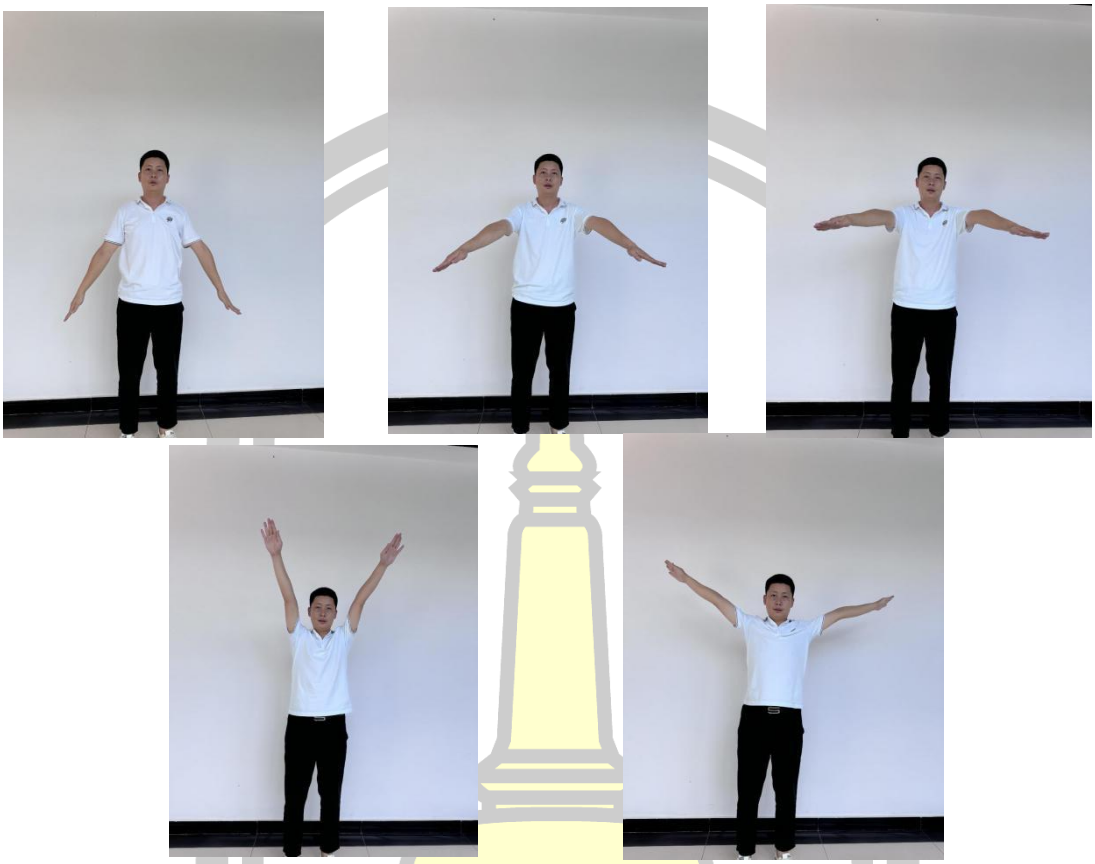
2. Start with your hands on either side of your body, then draw a large circle forward and upward, bringing your arms above your head.

3. Above your head, you should keep a distance between your hands while making sure your shoulders are down and your chest is extended forward.

4. Next, slowly lower your hands in a large circle back to the starting position.

5. Raise your arms as you inhale and lower them as you exhale. Keep breathing smoothly.

6.Repeat 10 times each time. Do 2 sets. Rest 10 seconds in between.



5. Alternate Side Body

Alternating Side Trunk is an effective movement to work the side abdominal muscles (lats). This movement can help strengthen the side abdominal muscle groups, improve core stability, and improve strength and flexibility in the lower back.

1. To begin, slide one hand down one side of the body, extending it as far as possible, while the other hand naturally reaches in the opposite direction, extending to the top of the body.

2. As one hand slides down the side of the leg, the other hand should be above the head.

3. Hold in this position for about 1 second, then slowly return to the starting position. Repeat the same movement, but this time with the other hand.

4.Repeat 10 times each time. Do 2 sets. Rest 10 seconds in between.

6. Lumbar Turning Stretch

The Lumbar Turn Stretch is a simple yet effective movement used to relax and stretch the muscles of the lower back. This stretch can help relieve tension in the lower back and improve flexibility in the lower back.

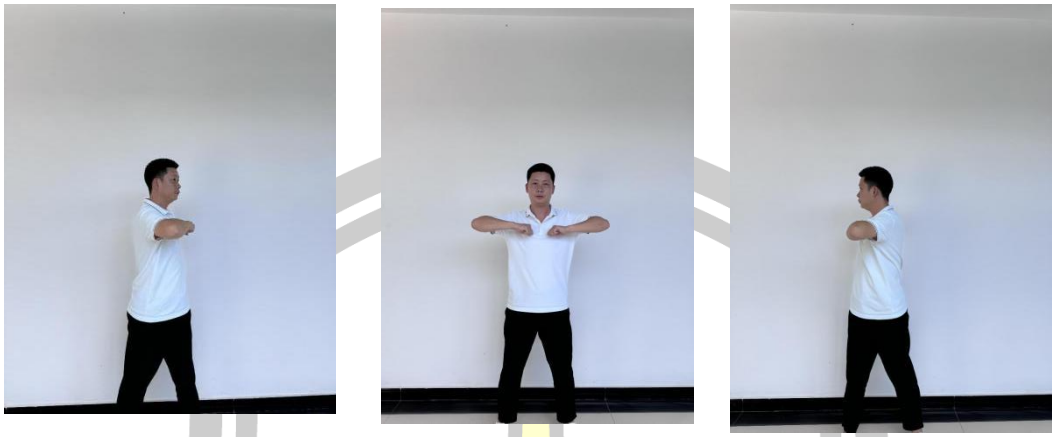
1. Slowly raise your arms to shoulder level and straighten your arms parallel to the floor.

2. Keep your head facing forward, feet facing forward and legs slightly bent.

3. Slowly rotate your upper body to the side, extending one arm to the opposite side as far as possible while gently pushing your body with the other arm to enhance the stretch.

4. Slowly return your body to the center position, then rotate to the other side and repeat the stretch.

5.Repeat 10 times each time. Do 2 sets. Rest 10 seconds in between.



7. Alternating Arrow Squat

The alternating arrow squat is a full-body exercise that works the thighs, buttocks, core and lower body muscles.

1. Step forward with one foot, and the step should be larger than normal.

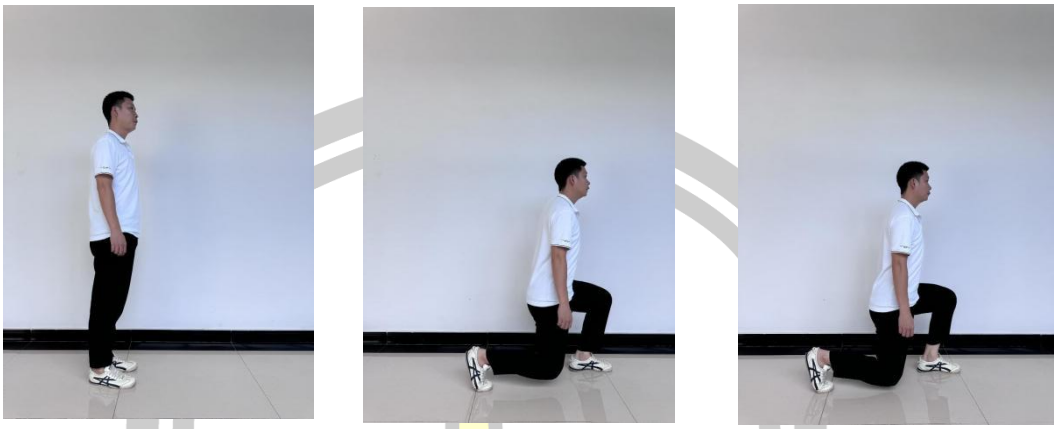
2. Bend the front leg until the back knee almost touches the ground, creating a 90-degree knee bend angle.

3. At the same time, the knee of the back leg descends toward the ground, but does not touch the ground.

4. Keep your upper body straight, do not bend at the waist or lean forward.

5. Pause for a moment at the lowest point of descent, then use the strength of your front leg to push yourself back to the starting position. Repeat by alternating steps and bringing the other foot forward.

6.Repeat 10 times each time. Do 2 sets. Rest 10 seconds in between.



8. Lumbar Warm-up

Warming up the lower back is an important step before performing lower back related exercises or activities, which can help improve blood circulation to the lower back muscles, increase joint flexibility and reduce the risk of injury

1. Stand straight with your legs slightly apart.

2. Slowly rotate your upper body to one side and then the other, twisting your lower back as much as possible.

3. Repeat this movement for 10-15 seconds on each side.

4.Repeat 10 times each time. Do 2 sets. Rest 10 seconds in between.

9. Walking in place

Walking in place is a simple but effective cardio exercise that can help improve cardio health, burn calories and increase muscle strength in the lower body.

1. Lift one foot and gently place it on the ground, then lift the other foot as if you were walking in place.

2. Touch the ground gently with the soles of your feet to mimic the action of walking and maintain a continuous pace.

3. You can swing your arms naturally to increase the aerobic effect.

4.Repeat 10 times each time. Do 2 sets. Rest 10 seconds in between.

Relax your body (Cool Down)

1. Neck Stretch

Method

1. Tilt your head forward, gently bring your chin close to your chest and feel the slight stretch in your neck.

2. Tilt your head to the left, pull your head with your left hand, press your left ear close to your left shoulder and feel the stretch on the left side of your neck.

3. Tilt your head to the right and pull your head with your right hand. Place your right ear close to your right shoulder and feel the stretch on the right side of your neck.

4. Tilt your head back and lift your chin as high as possible to feel the stretch in the back of your neck.

5. Do each movement 1 time. Hold for 30 seconds.

2. Upper arm stretch posture

method

1. Lift one arm and fold it back.

2. Use the other hand to pull down the elbow and hold for 10 seconds, 3 times.


3.straight shoulder position

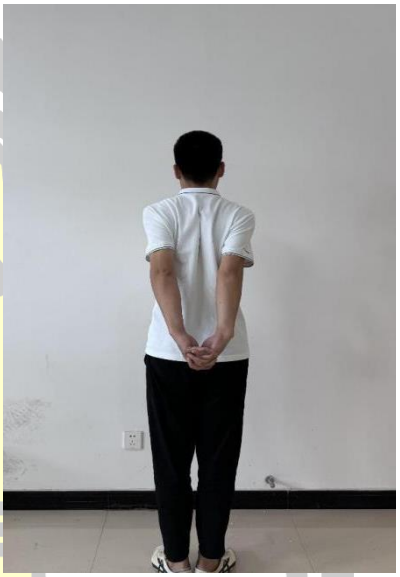
method

1. Put your hands behind your back
2. Straighten your hands
3. Raise your arms upward, hold for 10 seconds, and repeat 3 times.


4. Shoulder Back Extension

Method

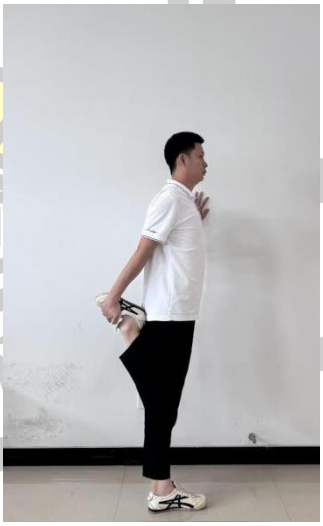
1. Put your hands behind your back
2. Straighten your arms
3. Lift your arms upwards, hold for 10 seconds and repeat 3 times.

5. Front Leg Muscle Stretching

Method

1. Hold your ankle with one hand.
2. Fold the leg to the back
3. Pull the ankle with your hand and hold for 10 seconds on each side, 3 times.

6. Side Leg Stretch

Method

1. Sit with legs crossed.

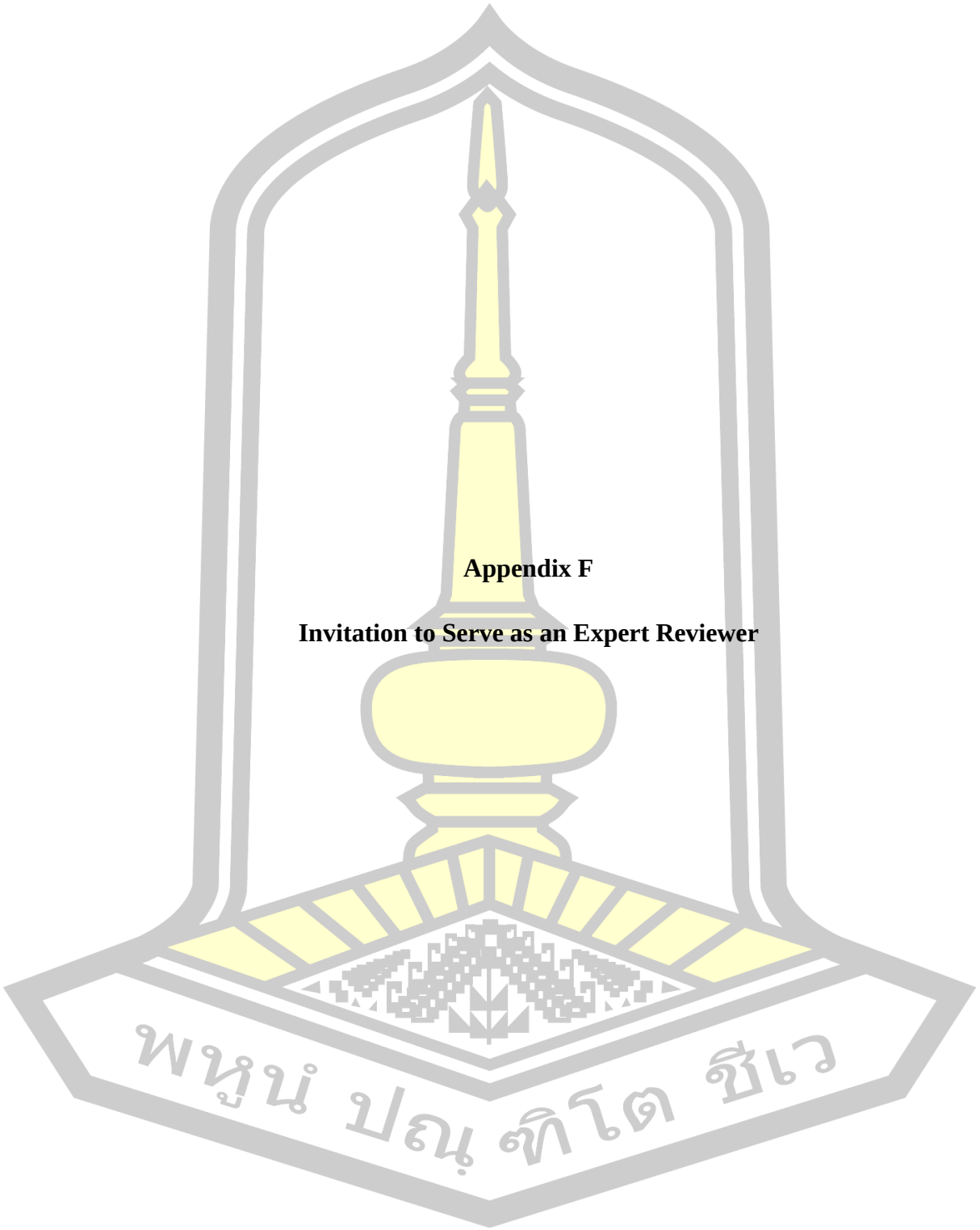
2. Press your leg with one hand and twist it in the opposite direction, hold for 10 seconds, 3 seconds per side

7. Stretch legs and back

1. Sit with your feet on the ground

2. Stretch your arms out in front of you

3. Bend forward and hold for 10 seconds 3 times



Appendix F

Invitation to Serve as an Expert Reviewer

FACULTY OF EDUCATION
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Center for International Affairs

MHESRI No. 0605.5 (2) / CL1096 Date: March 26, 2024

To: **Professor Yan Hong**
Chengdu Institute of Physical Education
Professor Lei Ping
Chengdu Institute of Physical Education
Professor Yang Shiyong
Chengdu Institute of Physical Education

Subject: Expert Invitation

Our student, **Mr. Qiping Mao, student ID 63010556009,** majoring in the M.Sc. Exercise and Sport Science Program is currently undertaking a research project titled **"Effect of green tea extract in conjunction with exercise training on anaerobic performance of college students"** under the guidance of Asst.Prof. Napatsawan Thanaponganan.

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

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Tel/fax +66 43 713 174
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MHESRI No. 0605.5 (2) /CL1097 Date: March 26, 2024

Data Collection Permission Request

To: Whom It May Concern
Sichuan Vocational College of Health,

Subject: Data Collection Permission Request

Our student, **Mr. Qiping Mao, student ID 63010556009** majoring in the M.Sc. Exercise and Sport Science Program is currently undertaking a research project titled "Effect of Green Tea Extract in Conjunction with Exercise Training on Anaerobic Performance of College Students" under the guidance of Asst.Prof. Napatsawan Thanaponganan.

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: Effect of Green Tea Extract in Conjunction with Exercise Training on Anaerobic Performance of College Students
Period of data collection: April 1, 2024 to May 1, 2024
Thesis advisor: Asst.Prof. Napatsawan Thanaponganan

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

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Student Permission Letter

This permission letter serves to

Student name: **Mr. Qiping Mao**

Student ID: **663010556009**

Program: **M.Sc. Exercise and Sport Science Program**

The mentioned student has been registered as a of the Faculty of Education, Mahasarakham University, Thailand. To fulfill the program requirements, the student is required to make significant progress on their thesis. This letter serves to formally offer the student the opportunity to undertake their thesis research abroad, contingent upon the research being directly aligned with their approved research topics.

The details of the data collection of **Mr. Qiping Mao** are as follows:

Thesis title: Effect of Green Tea Extract in Conjunction with Exercise Training on Anaerobic Performance of College Students
Location of data collection: China
Period of data collection: April 1, 2024 to May 1, 2024

The student's thesis project, under the supervision of Asst.Prof. Napatsawan Thanaponganan requires data collection abroad due to the specific population and sample group that is essential for their research. We acknowledge that the student has made the necessary preparations, including obtaining approval for the thesis title from our institution.

Should you require further clarification or information regarding the student's academic record, please do not hesitate to contact our office at your convenience.

Issued on March 26, 2024

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

BIOGRAPHY

NAME	Mr. Qiping Mao
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PLACE OF BIRTH	Luzhou, China
ADDRESS	Yantan District, Zigong City, Sichuan Province
POSITION	Teacher
PLACE OF WORK	No.3 Deming Road, Xiantan Community, Xianshi Town, Yantan District, Zigong City, Sichuan Province, China
EDUCATION	2009 to 2013 Bachelor of Arts in Dance Performance. Neijiang Normal College 2021 to 2024 Master of Science Program in Exercise and Sport Science, Mahasarakham University