

ผลของการนวดแบบมวยไทย การยืดเหยียดกล้ามเนื้อ และการนั่งพักที่มีต่อการฟื้นสภาพ
ของอัตราการเต้นของหัวใจ ความแข็งแรงของขา และความอ่อนตัว
ในนักกีฬาเซปักตะกร้อชายมหาวิทยาลัยราชภัฏสุรินทร์

Effects of Muaythai Massage, Stretching and Sitting on Recovery Rest
of Resting Heart Rate, Legs Strength and Flexibility between Set
in Male's Sepak Takraw Player Surindra Rajabhat University

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บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาผลของการนวดแบบมวยไทย การยืดเหยียดกล้ามเนื้อ และการนั่งพักที่มีต่ออัตราการเต้นของหัวใจ ความแข็งแรงของขา และความอ่อนตัว ในนักกีฬาเซปักตะกร้อชาย มหาวิทยาลัยราชภัฏสุรินทร์ กลุ่มตัวอย่างที่ใช้เป็นนักกีฬาเซปักตะกร้อชายมหาวิทยาลัยราชภัฏสุรินทร์ จำนวน 12 คน แบ่งออกเป็น 3 กลุ่มเท่า ๆ กัน ด้วยการสุ่มอย่างง่าย แบบจับฉลาก ศึกษาการฟื้นสภาพระหว่างการพักระหว่างเซต 3 รูปแบบ ประกอบด้วย การนวดแบบมวยไทย การยืดเหยียดกล้ามเนื้อ และการนั่งพัก กลุ่มตัวอย่างชุดเดียวกัน ปฏิบัติการทดลองทั้ง 3 รูปแบบ และการทดลองแต่ละครั้งเว้นระยะห่างกันเป็นเวลา 1 สัปดาห์ ทดสอบอัตราการเต้นของหัวใจ ความแข็งแรงของขา และความอ่อนตัว หลังการฝึกแต่ละครั้ง วิเคราะห์ข้อมูลโดยใช้ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตรฐาน วิเคราะห์ความแปรปรวนทางเดียวแบบวัดซ้ำ เปรียบเทียบความแตกต่างเป็นรายคู่ เมื่อพบความแตกต่างจะใช้การวิเคราะห์เป็นรายคู่ด้วยวิธีของตุกี กำหนดนัยสำคัญทางสถิติที่ระดับ 0.05 ผลการวิจัยพบว่า การฟื้นสภาพด้วยการนวดแบบมวยไทย การยืดเหยียดกล้ามเนื้อ และการนั่งพักสามารถช่วยลดอัตราการเต้นของหัวใจขณะพักได้ ไม่พบความแตกต่างในความแข็งแรงของขา และความอ่อนตัวอย่างมีนัยสำคัญทางสถิติที่ระดับ 0.05 โค้ชสามารถนำรูปแบบการฟื้นสภาพดังกล่าวไปใช้กับนักกีฬาเซปักตะกร้อเพื่อช่วยลดอัตราการเต้นของหัวใจได้

คำสำคัญ: การนวดแบบมวยไทย, การยืดเหยียดกล้ามเนื้อ, การฟื้นสภาพ, นักกีฬาเซปักตะกร้อ

Abstract

The purposes of this research are to study the effects of Muay Thai massage, stretching and sitting on recovery rest of resting heart rate, legs strength and flexibility between set in male's Sepak Takraw player Surindra Rajabhat university. The sample group was 12 male; Sepak Takraw Player in Surindra Rajabhat University and the player were divided into 3 equal groups by simple random sampling method, and then studied on recovery rest between set of 3 methods, including Muay Thai massage, stretching and sitting. The same sample group conducted all 3 methods in experiment and each experiment was spaced 1 week apart, tested the measured resting heart rate, legs strength and flexibility after each training section. The data were analyzed using mean, standard deviation, one-way analysis of variance with repeated measures, and compared the differences in pairs. When a significant difference was found, Tukey's post-hoc test was applied for pair-wise comparisons, the statistical significance was set at .05 level. The results showed that recovery through Muay Thai massage, stretching, and sitting can effectively reduce resting heart rate.

However, no statistically significant differences were found in leg strength and flexibility at the .05 level. Coaches may implement these recovery methods in Sepak Takraw to help lower athletes' heart rates.

Keywords: Muay Thai massage, Stretching, Recovery, Sepak Takraw Player

1. Introduction

Sports are a fundamental factor of paramount importance in human resource development, as evidenced by the fact that every country promotes and encourages its citizens to engage in sporting activities (Millour et al., 2025). Sepak Takraw has a long history of play. Matches are decided in a best of three sets format, where the team that wins two sets first is declared the winner. Consequently, the recovery process between sets is of paramount importance. If athletes can recover quickly, it provides a significant advantage in the subsequent set, shorter recovery durations resulted in a decrease in mean leg power and calorie expenditure, but led to a higher Rating of Perceived Exertion (RPE) compared to longer recovery periods (Rogers et al., 2024). Recovery is the application of specialized techniques, or a combination of multiple methods, aimed at accelerating the restoration process to reach full recovery as quickly as possible. It is the process of returning an athlete to a state equal to or better than their previous psychophysiological baseline or performance level (Vatne et al., 2025).

Currently, scholars have conducted various studies on recovery methods for different types of athletes. Massage therapy is one such method used for recovery; specifically, Deep Tissue Massage Therapy has become highly popular among athletes and professionals. It focuses on achieving results in enhancing physical performance and accelerating bodily recovery (Arsovski, 2025). In addition, Muay Thai Massage employs a dynamic technique of rhythmic squeezing, kneading, and pressing at a brisk pace, rather than applying heavy pressure throughout the body. This approach effectively releases muscle tension; it temporarily displaces blood from the vessels, and as pressure is released, a fresh surge of circulation returns to the area, promoting a profound sense of relaxation (Thongnum, 2025). Stretching has also been utilized as a recovery method, offering numerous physiological benefits. It helps reduce Delayed Onset Muscle Soreness (DOMS) after exercise. Furthermore, stretching is widely recognized for its role in fatigue recovery and is commonly used to increase the Range of Motion (ROM) of joints and reduce muscle tension (Daneshjoo et al., 2024). All of the aforementioned methods are highly beneficial to athletes. It is widely believed that active recovery promotes the restoration process by accelerating the body's return to homeostasis after competition. This process alleviates fatigue and muscle soreness, replenishes energy levels and physical performance, and enables athletes to tolerate higher training volumes ultimately leading to improved overall efficiency (Sedano & Izquierdo, 2025).

For these reasons, it was found that the majority of studies focus on post competition recovery, while the effects of recovery methods during active competition in Sepak Takraw athletes have not yet been studied. Consequently, the researcher is interested in studying the effects of Muay Thai massage, stretching, and sitting on recovery between Set in Male's Sepak Takraw Player Surindra Rajabhat University. The objective is to determine which method and format facilitate the fastest and most effective recovery for Sepak Takraw athletes during the two minute between set. The findings will serve as a practical guideline for athletes at all levels and effectively integrate sports science recovery principles to enhance the development of the Sepak Takraw community. Based on a review of the literature and relevant studies, the conceptual framework for this research is summarized as follows:

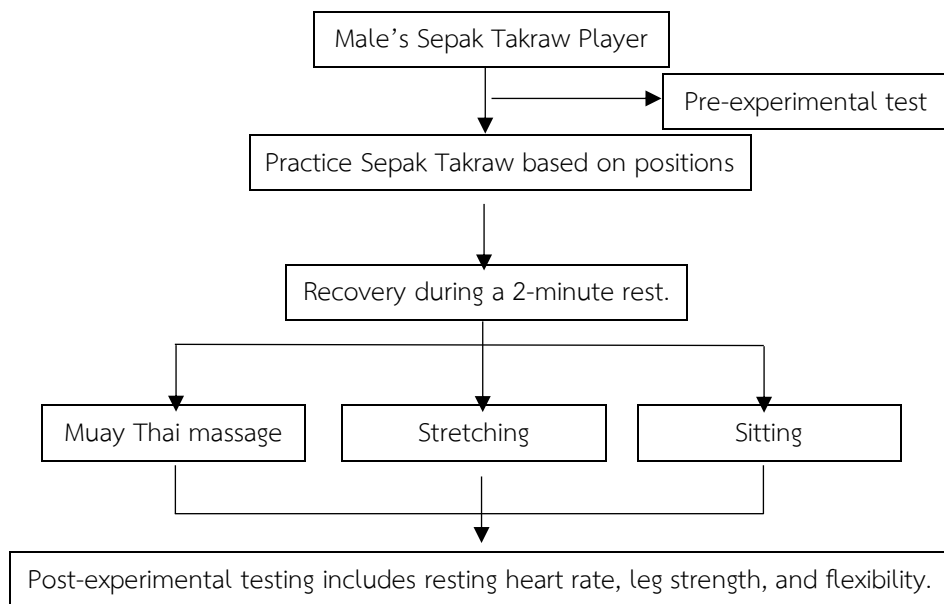


Figure 1. Conceptual Framework of the Study

2. Materials and methods

2.1 Participants

The sample size for this research was 12 male Sepak Takraw players from Surindra Rajabhat University who participated in the 48th Thailand University Games, selected using Purposive Sampling.

Inclusion criteria for this study were Sepak Takraw players of Surindra Rajabhat University who participated in the 48th Thailand University Games, no injuries in the past 6 months and provision of written consent.

Exclusion criteria for this study were history of recent surgeries or injuries (including injuries to the legs, ligaments, or joints) within the past 12 months and It is a serious contagious disease.

2.2 Research Instruments

2.2.1 The Muay Thai Massage Program (Thongnum & Eungpinichpong, 2016): The Muay Thai massage protocol lasted 2 minutes in total. Participants were seated on a chair while water was applied to the skin. The massage technique involved rhythmic squeezing, kneading, and pressing at a fast pace, without applying deep pressure, covering all body parts from the head, arms, and torso to the legs for 1.30 minutes. The remaining 30 seconds consisted of static stretching for the arms and legs, respectively.

2.2.2 The Stretching Program consists of the following:

- 1) Shoulder Stretch
- 2) Triceps and Lateral Trunk Stretch
- 3) Upper Back Stretch
- 4) Quadriceps Stretch
- 5) Calf Stretch
- 6) Knee-to-Chest Stretch
- 7) Toe-up stretch
- 8) Adductor Stretch
- 9) Hamstring Stretch
- 10) Thigh and Back Stretch

- 2.2.3 TKK Analog Leg Dynamometer (reliability = 0.89)
- 2.2.4 FBT Sit and Reach Box (reliability = 0.91)
- 2.2.5 Heart Rate measurement tool: Stethoscope (reliability = 0.89)
- 2.2.6 Weighing Scale
- 2.2.7 Stadiometer
- 2.2.8 Data Recording Form

2.3 Procedure

This study employed a quasi-experimental design with repeated measures. This research study has been approved by the Surindra Rajabhat University Institutional Review Board with approval number HE 642014.

2.3.1 The researcher submitted a formal letter requesting permission to conduct the research and use the facilities for data collection to the Dean of the Faculty of Education, Surindra Rajabhat University.

2.3.2 The researcher explained the research objectives, procedures, and duration, as well as the Muay Thai massage program and the 10-position muscle stretching program to the participants to ensure strict adherence to instructions. Furthermore, the researcher detailed the participants' rights and benefits, including the right to confidentiality and the right to accept or decline participation, ensuring that the decision to participate was made voluntarily.

2.3.3 The participants were divided into three groups to study three different types of inter-set recovery. Numbers 1–12 were written on slips for a random draw to assign participants to their respective experimental groups. Using a repeated measures design, the same set of participants was divided into three subgroups, and each group rotated through all three experimental conditions until they had completed all three trials, as shown in Table 1.

Table 1. Shows the three types of post-competition recovery for each group.

Sample Group	Trial 1	Trial 2	Trial 3
Group 1 (Nos. 1-4)	Muay Thai massage	stretching	Sitting
Group 2 (Nos. 5-8)	stretching	Sitting	Muay Thai massage
Group 3 (Nos. 9-12)	Sitting	Muay Thai massage	stretching

The same group of participants performed all three experimental protocols, with each trial separated by a one-week washout period.

2.3.4 Prior to the experiment, baseline measurements were recorded, including weight, height, resting heart rate, legs strength, and flexibility.

2.3.5 The participants performed Sepak Takraw practice by simulating an actual competition, regardless of whether the ball remained in play or was out of bounds. The procedures are as follows:

1) For the server position, the player performed 3 continuous serves (from a teammate's toss), alternating with receiving 3 balls hit by a coach using a tennis racket. This combined sequence was counted as 1 repetition. The players completed 4 repetitions per set, with a 2-minute rest interval between each of the 3 sets.

2) For the setter position, the coach used a tennis racket to hit 3 balls for the player to set continuously, alternating with receiving 3 balls also hit by the coach. This sequence was counted as 1 repetition. The players completed 4 repetitions per set, with a 2-minute rest interval between each of the 3 sets.

3) For the attacker position, the coach hit balls with a tennis racket to the setter or server, who then set the ball for the attacker to perform 3 continuous attacks at the net. This was alternated with receiving 3 balls hit by the coach. This combined sequence was counted as 1 repetition. The players completed 4 repetitions per set, with a 2-minute rest interval between each of the 3 sets.

2.3.6 During the rest interval of each set, the resting heart rate, legs strength, and flexibility were recorded immediately after completing the Sepak Takraw drills. Following this, participants underwent a 2-minute recovery period according to their randomly assigned method. A second measurement was then recorded. This process was repeated for the second and third sets, with data collection following the same procedure as the first set.

2.3.7 Each participant was required to complete the Sepak Takraw drills and all three recovery protocols over a total of three trials. Each trial was separated by a one-week interval, during which participants were instructed to avoid high-intensity exercise or strenuous sports.

2.3.8 The results were recorded for subsequent statistical analysis.

3. Result

This research aims to investigate the effects of Muay Thai massage, stretching and sitting on recovery rest of resting heart rate, legs strength and flexibility between set in male's Sepak Takraw player Surindra Rajabhat university. The results of the data analysis are as follows:

3.1 The participants in the group 1 had a mean weight of 64.00 ± 9.49 kg and a mean height of 172.50 ± 7.94 cm. Group 2 had a mean weight of 66.50 ± 3.32 kg and a mean height of 171.50 ± 2.65 cm, while Group 3 had a mean weight of 65.50 ± 3.70 kg and a mean height of 172.00 ± 4.69 cm in Table 2.

Table 2. The mean and standard deviation of the participants' baseline in the study.

Group	Weight		Height	
	Mean	S.D.	Mean	S.D.
Group 1	64.00	9.49	172.50	7.94
Group 2	66.50	3.32	171.50	2.65
Group 3	65.50	3.70	172.00	4.69

3.2 After the first experiment, it was shown that no statistically significant differences at the 0.05 level in recovery of resting heart rate, legs strength, and flexibility between sets among male's Sepak Takraw Player at Surindra Rajabhat University across Group 1, Group 2, and Group 3 after the first trial in Table 3.

Table 3. This table shows a comparison of the effects of Muay Thai massage, stretching, and sitting on the recovery of resting heart rate, legs strength, and flexibility in Male's Sepak Takraw Player at Surindra Rajabhat University after the first trial among groups 1, 2, and 3.

List	SS	df	MS	F	Sig.
Resting heart rate					
Between Groups	462.50	2	231.25	3.68	0.07
Within Groups	581.75	9	64.64		
Total	1044.25	11			

Table 3. This table shows a comparison of the effects of Muay Thai massage, stretching, and sitting on the recovery of resting heart rate, legs strength, and flexibility in Male's Sepak Takraw Player at Surindra Rajabhat University after the first trial among groups 1, 2, and 3. (Cont.)

List	SS	df	MS	F	Sig.
Legs Strength					
Between Groups	0.00	2	0.00	0.00	0.99
Within Groups	1.74	9	0.19		
Total	1.74	11			
Flexibility					
Between Groups	4.17	2	2.08	0.13	0.88
Within Groups	146.50	9	16.28		
Total	150.67	11			

3.3 Following after the second trial, it was found that the recovery between sets of resting heart rate among Group 1, Group 2, and Group 3 was statistically significantly different at the .05 level. Meanwhile, leg strength and flexibility showed no statistically significant difference at the .05 level (Table 4). Therefore, a pairwise comparison of heart rate after the second trial among Group 1, Group 2, and Group 3 was conducted using Tukey's method, as shown in Table 5.

Table 4. This table shows a comparison of the effects of Muay Thai massage, stretching, and sitting on the recovery of resting heart rate, legs strength, and flexibility in Male's Sepak Takraw Player at Surindra Rajabhat University after the second trial among groups 1, 2, and 3.

List	SS	df	MS	F	Sig.
Resting heart rate					
Between Groups	513.17	2	256.58	4.28*	0.04
Within Groups	539.50	9	59.94		
Total	1052.67	11			
Legs Strength					
Between Groups	.02	2	0.01	0.05	0.95
Within Groups	1.73	9	0.19		
Total	1.75	11			
Flexibility					
Between Groups	56.00	2	28.00	1.65	.25
Within Groups	153.00	9	17.00		
Total	209.00	11			

* $p < 0.05$

Table 5. Presenting the results of the post-hoc pairwise comparison of heart rates after the second experiment between Group 1, Group 2, and Group 3 using Tukey's method.

Group	Mean Difference	Sig.
Group 1 vs Group 2	15.50*	0.04
Group 1 vs Group 3	4.25	0.73
Group 3 vs Group 2	11.25	0.16

* $p < 0.05$

According to Table 5, the post-hoc pairwise comparison of resting heart rates after the second trial revealed a statistically significant difference between Group 1 and Group 2 at the 0.05 level.

3.4 After the third trial, the recovery between sets of resting heart rate among Group 1, Group 2, and Group 3 was statistically significantly different at the .05 level. Meanwhile, leg strength and flexibility showed no statistically significant difference at the .05 level (Table 6). Consequently, Tukey's post hoc test was performed to determine the pairwise differences in resting heart rate among Groups 1, 2, and 3 after the third trial, as shown in Table 7.

Table 6. This table shows a comparison of the effects of Muay Thai massage, stretching, and sitting on the recovery of resting heart rate, legs strength, and flexibility in Male's Sepak Takraw Player at Surindra Rajabhat University after the third trial among groups 1, 2, and 3.

List	SS	df	MS	F	Sig.
Resting Heart Rate					
Between Groups	592.67	2	296.33	7.15*	.01
Within Groups	373.00	9	41.44		
Total	965.67	11			
Legs Strength					
Between Groups	.02	2	.01	.07	.94
Within Groups	1.45	9	.16		
Total	1.47	11			
Flexibility					
Between Groups	52.17	2	26.08	1.50	.28
Within Groups	156.75	9	17.42		
Total	208.92	11			

* $p < 0.05$

Table 7. Presenting the results of the post-hoc pairwise comparison of resting heart rates after the third experiment between Group 1, Group 2, and Group 3 using Tukey's method

Group	Mean Difference	Sig.
Group 1 vs Group 2	16.00*	.02
Group 1 vs Group 3	2.50	.85
Group 3 vs Group 2	13.50*	.04

* $p < 0.05$

Table 7 indicates that after the third trial, there were statistically significant differences in resting heart rate ($p < 0.05$) between group 1 and group 2, and between group 3 and group 2.

4. Discussion

The hypothesis stated that the Muay Thai massage, stretching and sitting have significantly different effects on recovery resting heart rate, legs strength and flexibility between set in male's Sepak Takraw player Surindra Rajabhat University.

4.1 Resting heart rate

This finding supports the proposed hypothesis, the research findings revealed that after the second experiment, there was a significant difference between Group 1 (stretching) and Group 2 (sitting). Furthermore, after the third experiment, significant differences were observed between Group 1 (sitting) and Group 2 (Muay Thai massage), as well as between Group 3 (stretching) and Group 2 (Muay Thai massage). Specifically: after Sepak Takraw athletes have completed the prescribed training program, the heart will work harder. With consistent training, heart rate will undergo physiological changes, as noted by Benavides-Roca et al. (2025) concluded that Resistance Training (RT) and High-Intensity Interval Training (HIIT) result in immediate significant changes in blood pressure and heart rate variability. Notably, HIIT demonstrates a more pronounced impact on autonomic nervous system adaptation, which is consistent with the findings of Guo & Wang (2025) stated that regular exercise, performed for 30–40 minutes per session with a frequency of 3–5 times per week, significantly improves blood pressure and resting heart rate. Furthermore, Yunus et al (2023) found that incorporating aerobic exercise into the treatment process can help reduce resting heart rate in patients with chronic stroke, as noted by Deng et al. (2024) found that exercise training has positive effects on heart rate variability, resting systolic blood pressure, and heart rate in patients with hypertension, which is consistent with Song et al. (2025) concluded that both High-Intensity Interval Training (HIIT) and Moderate-Intensity Interval Training (MIT) can similarly improve Heart Rate Recovery (HRR) in patients with coronary heart disease in the short term, which is also consistent with Edwards et al. (2023) stated that various forms of exercise training can help reduce resting blood pressure, particularly Isometric Exercise, which is consistent with the findings of Chauhan & Kumar (2023) discovered that regular exercise can lead to improved cardiovascular health, as measured by a decrease in heart rate, which may result in more efficient cardiac function. Furthermore, Yasuda & Kubo (2024) concluded that the significant reduction in heart rate observed during static stretching was not associated with changes in blood circulation within the tendons and muscles. Similarly, Ahirvar & Pathak (2024) concluded that active recovery is significantly more effective than passive recovery. Consequently, it is recommended that after exercise or physical activity, athletes should utilize active recovery techniques to facilitate a more efficient reduction in heart rate.

4.2 Legs Strength

The results did not support the stated hypothesis. This is because leg strength increases or decreases depending on a training program using an intensity of 80% of the maximum capacity for each exercise over a period of 6 – 8 weeks, as stated by Maliki et al. (2025) concluded that plyometric training yields better results than the control group, and bodyweight training can increase the peak power of leg muscles in youth volleyball players. Consequently, all three recovery methods could not increase or decrease leg strength, which is consistent with Mpampoulis et al. (2024) concluded that training only once a week (or once every two weeks) for a period of 3 months may help maintain muscle mass or strength adaptations and aerobic power gained from systematic concurrent training (a combination of endurance and strength training) at 90% to 95%, which is consistent with Zhang et al. (2025) found that post-exercise

stretching, when used as the sole recovery method, did not significantly improve muscle soreness, strength, physical performance, flexibility, or pain levels.

4.3 Flexibility

The results did not support the hypothesis. This may be attributed to the fact that the sample group underwent a warm-up session involving stretching prior to training. Generally, all types of exercise enhance flexibility, thereby increasing the range of motion and preventing injuries. Therefore, recovery using the aforementioned methods resulted in no significant difference in the flexibility of the sample group, as noted by Pranoto et al. (2025) stated that this study confirms that

regular exercise significantly improves flexibility, particularly in athletes, which is consistent with the findings of Alimoradi et al. (2023) concluded that incorporating calf muscle stretching into regular training routines can provide benefits to female soccer players in terms of performance variables, as noted by Hidayatullah et al. (2022) explained the study findings that both passive tactical stretching and PNF (Proprioceptive Neuromuscular Facilitation) can increase flexibility. However, empirical evidence indicates that PNF stretching is more effective in improving flexibility, which is also consistent with the findings of Favro et al. (2024) concluded from the experimental results that Resistance Training can be utilized as a strategy to improve joint flexibility. Specifically, high-intensity resistance training yields better results in increasing body flexibility. Furthermore, Hosseini et al. (2025) specified in the research that both NHE (Nordic Hamstring Exercise) and DHS (Dynamic Hamstring Stretching) have positive effects on muscle performance, range of motion, balance, and agility. However, NHE has been proven to be more effective in developing these various variables compared to DHS training.

5. Conclusion and suggestions

The study results indicate that all three recovery methods effectively reduce heart rate between set. Consequently, coaches and trainers can implement Muay Thai massage, stretching, and sitting as recovery protocols for Sepak Takraw athletes across all levels of competition. However, a limitation of this study is that the recovery methods were conducted within a timeframe of only two minutes. Consequently, applying these methods to other sports with longer or shorter rest intervals must be carefully considered and adjusted accordingly to ensure maximum benefit for the athletes.

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