

## EFFECTS OF TRADITIONAL THAI MASSAGE ON FREE THROW ACCURACY IN BASKETBALL ATHLETES

Krittachai Sarakul<sup>1</sup>, Wichai Eungpinichpong<sup>2</sup> and Thanarat Sripongngam<sup>3</sup>

<sup>1</sup>Exercise and Sport Sciences Program, Graduate School, Khon Kaen University, Thailand;

<sup>2</sup>Research Center in Back, Neck, Other Joint Pain and Human Performance, KhonKaen University, Thailand;

<sup>3</sup>Department of Health and Sport Science, Faculty of Education, Mahasarakham University, Thailand

**ABSTRACT:** The free throw is the single most important shot in the game of basketball. The factors influencing the ability of the basketball free throw accuracy consisted of skill, standing balance, muscle fatigue, and concentration. Massage has been used for reducing muscle fatigue in sports which may affect standing balance, concentration, and free throw accuracy. However, there were no research studies available on these regards. The aim of this study was to determine the effects of traditional Thai massage (TTM) on standing balance, muscle fatigue, concentration, and basketball free throw accuracy. Thirty male basketball athletes were randomly allocated into either traditional Thai massage (TTM) group or Control (C) group after which they were swabbed to receive the other one with a 2-week washed out period. Standing balance, perceived muscle fatigue, concentration, and basketball free throw accuracy were measured before and the next day after receiving either 1-hour session of TTM or rest. The study found that balance and concentration were significantly increased ( $p < 0.05$ ) only in the TTM group. Fatigue was significantly decreased ( $p < 0.05$ ) in TTM group while it was significantly increased ( $p < 0.05$ ) in C group. Between-group comparison revealed that standing balance and fatigue were significantly different ( $p < 0.05$ ). However, free throw accuracy was not changed in both within- and between- groups comparison. We conclude that a 1-hour session TTM could increase standing balance, decrease muscle fatigue, and increase concentration but could not affect free throw accuracy in basketball athletes.

*Keywords: Massage, Balance, Fatigue, Concentration, Accuracy*

### 1. INTRODUCTION

Basketball is a very popular sport competing in both national and international competitions including SEA Games, Asian Games and Olympic Games.

The free throw in the basketball game is very important. It may contribute 20 percent of the total score [1]. The free throw in basketball games is probably the easiest task because the player can shoot alone without protection from the opponents. The free throw area is only about 15 feet from the loop, and sophisticated skills are not needed. The steps of shooting include as follows. Firstly, holding the ball in the position of "lock and load". That is holding the ball with the fingertips and using another hand to hold it and direct the ball and bend the knee by holding the ball lower than the head. Secondly, eyes targeting and focusing at the loop and using another hand to reinforce the direction of ball. Normally, the player is suggested not to shoot with both hands because if one hand is far away from the ball, it is difficult to shoot accurately. Thirdly, throwing the ball directly to the loop at arm's length with elbow stretching and flicking of the wrist. The elbow of the hand shooting must be in the same line with the body so the arm is straight up and makes

shooting more accuracy. Fourthly, when releasing the ball with the fingertips, the ball should roll back and the middle finger will release the ball. At the end, the ball should follow through the fingertips, not with the palm. More than 80 percent of the free throw is missed. So, the most important thing while shooting free throw is the concentration of the basketball player, the balance of the body, and movement control without muscle fatigue.

Sport massage is currently receiving attention and commonly used because it may help athletes to improve in many aspects including facilitating recovery from fatigue, and reducing muscle tightness and pain resulting from the competition. Recent studies found that massage may help athletes reduce lactic acid in the muscles [2]-[3] and fatigue in the muscles (DOMS) [4]-[5]. Massage for athletes also helps muscles to return to normal condition quickly [3], [6]. Massage for athletes, according to the reports, has also helped reduce psychology [7], tension [8], depression [9], enhanced better mood [10], and quality of life [11]. Moreover, massage also improves the flexibility of the body, and reduces injuries from hard-working muscles [12].

Traditional Thai massage (TTM) is a deep-pressure type of massage that the therapist applies

thumb or palm pressure along meridian lines on the body. It always affects the deep soft tissues (muscles, tendons, and ligaments) of limbs, neck, and back. It has been used for hundreds years to treat patients with chronic soft tissue injuries [13]. TTM has beneficial effects for both body and mind, for it can reduce pain in muscles and joints as well as anxiety. According to a study using TTM in patients with low back pain, it was found that TTM could reduce back pain perception and substance P in the subject's saliva [14]. Udompittayason (2003) [15] found that TTM can reduce the symptoms of stress and headaches. In addition, at the end of beta wave of electroencephalography: (EEG) is reduced which reflects that TTM may induce mental relaxation as well as significantly reduces pain in patients with scapula - thoracic pain [16]. Leelayuwat et al. (2001) [17] found that TTM can increase endurance of back muscles and significantly reduce back pain in patients with chronic back pain. Considering the effects of Thai traditional massage in soccer players, it was revealed that Thai traditional massage can relax muscles and decrease pulse rate significantly after practicing soccer. It was also noted that the players receiving massage can recover from fatigue effectively. It has been known that Thai traditional massage provides relaxation, recovery from the fatigue after practicing sports and increase of the durability of the muscles. Therefore, the researchers believe that Thai traditional massage is useful for improving the basketball free throw accuracy by reducing muscle fatigue and increasing efficiency during the race. Therefore, the objective of the study was to explore the effects of TTM on standing balance, muscle fatigue, concentration, and basketball free throw accuracy in basketball athletes.

## **2. MATERIAL AND METHOD**

The current study was a crossover randomized controlled trial, which was approved by the Ethical Committee of Khon Kaen University, Thailand (HE582041). Thirty male basketball athletes with average age of  $19.83 \pm 0.80$  year old, average weight of  $67.13 \pm 2.92$  kg, and average height of  $178.73 \pm 3.32$  cm. were randomly allocated into either traditional Thai massage (TTM) group or Control (C) group after which they were swabbed to receive the other one with a 2-week washed out period. Each of them signed an informed consent form to participate in this study. Exclusion criteria consisted of the participants receiving psychotropic drug, analgesic and anti-inflammatory drugs, moderate to severe of muscle or joint pain, impaired skin or hypersensitivity to

massage, and the participants sleeping less than 6 hours the night before participating in the experiment. Standing balance, muscle fatigue, concentration, and basketball free throw accuracy were measured before and the next day after received a 1-hour session of TTM or rest.

### **2.1 Procedure and Protocol**

The TTM group received moderate pressure massage on both side of arms, legs, and the body along the points of massage for 1 hour (Fig. 1). The massage was performed in supine, side lying on the left, and on the right positions. The participants rested in C group.

Flamingo balance test was used to test the standing balance of the body. The participants had to stand with one foot on a test stand (3 cm wide, 30 cm long and 5 cm high wood, and the stable area is 15 cm long and 2 cm wide on either side). Another leg must be bent with one hand holding the heel. One arm stretched out to balance the body. The test checker stood in front of the participant and the participant held the test checker's arm. After receiving the signal, the participants released the test checker's arm and maintained the balance as long as possible. The time was stopped when the participant lose his or her balance.

The muscle fatigue test was tested by visual analogue scale.

Concentration test was done by using the program in the mobile phone. The test was done by allowing the participants to identify whether the name of the color matched the color of the alphabets or not. For example, if the black color was shown with yellow alphabets, the participant had to choose the wrong mark (the cross mark), but if blue color was presented in blue alphabets, the participant had to choose the correct mark (check mark). There were 100 questions. If the participants answer incorrectly, the program will immediately stop. The record of time was used as the measurement of the concentration and the response of reaction.

The participants were tested with basketball free throw of 5 sets: and 10 balls per set. So, the total was 50 balls. This was used to assess basketball free throw accuracy.

### **2.2 Statistical Analysis**

The data were presented as mean  $\pm$  SD.

Shapiro-Wilk test was used to assess normal distribution. Paired t-test and Wilcoxon Sign Rank-Test were used to compare the outcome variables between before and after intervention within-group. Unpaired t-Test and Mann Whitney U-Test were used to compare outcome variables between-groups. Statistical significance was set at the  $p < 0.05$ .

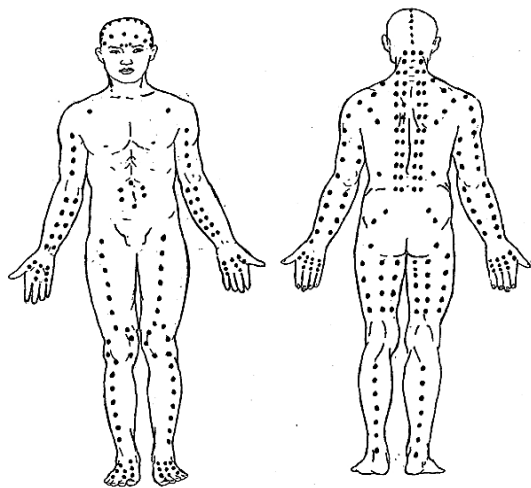


Fig. 1 The massage point or line is established by Eungpinichpong [18]

### 3. RESULTS

The present study demonstrated that standing balance was significantly increased only in TTM group ( $d = -1.20 \pm 1.03$ , 95 % CI = -1.58, -0.51,  $P = 0.001$ ). The time of concentration was significantly decreased only in TTM group ( $d = 3.13 \pm 4.24$ , 95 % CI = 1.54, 4.71,  $P = 0.001$ ). Muscle fatigue was significantly decreased in TTM group ( $P = 0.001$ ) (Table 1), and there was significantly increased in C group ( $P = 0.001$ ) (Table 2). Basketball free throw accuracy was not significantly changed in both groups (Table 1 and 2).

When comparing the outcomes between TTM and C groups, it was found that standing balance and muscle fatigue were significantly different ( $P = 0.017$ ). Basketball free throw accuracy and concentration showed no differences between the groups comparison (Table 3).

### 4. DISCUSSION

The findings of the present study revealed that TTM could increase standing balance, decrease muscle fatigue, and increase concentration.

Standing balance was significantly increased only in TTM group. This was consistent with Sefton et al. (2004) [19] which found that a 60-minute massage therapy could improve both static and dynamic balance in 35 older persons. The study of Ploypailin (2011) [20] also found that foot massage could improve the functional mobility and balance performance in 29 healthy elderly females.

We suggested that Flamingo balance test method may not be suitable because this test causes tiring of standing rather than sustaining loss of balance. Other methods such as the path of COP by using Force plate or a Wii Fit should be used for future studies.

This study demonstrated that TTM could decrease muscle fatigue which corresponded to Mori et al. (2004) [21]. They studied the effect of massage on blood flow and muscle fatigue following isometric exercise in 29 healthy male subjects. The subjects lay prone on the table and extended their trunks for 90 seconds (Load I). After that the subjects received either massage on lumbar region or rest for 5 minutes; then repeated the same load (Load II). They found that muscle blood volume was higher after massage than after rest ( $p < 0.05$ ). Skin blood flow was greater after massage than after rest ( $p < 0.05$ ), and fatigue was lower with massage than with rest ( $p < 0.01$ ). Leelayuwat et al. (2003) [17] found that the subject had longer isometric endurance time after a 2-hour Thai massage than after a 2-hour lie down due to the increasing of resistance to fatigue of back muscles.

The current study showed that TTM could increase concentration. This may be because massage produced mechanical pressure which increased parasympathetic and decreased sympathetic activity [22]-[24] leading to an increase of concentration. Moreover, concentration was associated with delta activity and the previous study also found that massage could increase delta activity. Butttagat et al. (2012) [16] studied a 30-min session of TTM in 40 patients with scapulocostal syndrome. They found a significant increase in relaxation as indicated by an increase in delta activity ( $p < 0.05$ ) and a decrease in theta, alpha, and beta activity ( $p < 0.01$ ).

Although TTM could increase standing balance, decrease muscle fatigue and increase concentration which are the factors influencing the ability of the basketball free throw accuracy, such changes could not affect this accuracy. The accuracy which is not changed much may depend on the skill of the athlete. The present study focused on the short-term effects of massage, however, we did not know whether long-term or cumulative effects of TTM would affect these variables or not.

Table 1 Comparison between before and after on the standing balance, muscle fatigue, concentration, and basketball free throw accuracy in TTM group.

outcome	TTM group (n = 30)	
	before	after
	mean±SD	mean±SD
Standing balance (min)	31.23±3.20	32.43±3.34**
95% CI	30.04, 32.43	31.19, 33.68
Muscle fatigue	4.80±0.81	3.73±0.83**
95% CI	4.50, 5.10	3.42, 4.04
Concentration (ms)	209.07±39.53	205.53±38.49**
95% CI	194.31, 223.83	191.56, 220.31
Accuracy (times)	28.30±3.54	28.5±3.74
95% CI	26.98, 29.62	27.10, 29.90

Note: TTM= traditional Thai massage  
\*\*Significant difference at p-value <0.01

Table 2 Comparison between before and after on the standing balance, muscle fatigue, concentration, and basketball free throw accuracy in control group.

outcome	C group (n = 30)	
	before	after
	mean±SD	mean±SD
Standing balance (min)	30.60±2.88	29.97±2.33
95% CI	29.52, 31.68	29.10, 30.84
Muscle fatigue	4.83±0.70	5.73±0.94**
95% CI	4.57, 5.09	5.38, 6.09
Concentration (ms)	209.40±39.46	210.33±39.41
95% CI	194.67, 224.14	195.62, 225.05
Accuracy (times)	28.53±3.66	28.40±3.42
95% CI	27.16, 29.90	27.12, 29.68

Note: C = Control  
\*\*Significant difference at p-value <0.01

Thus, Future studies should determine whether there are long-term effects of TTM on standing balance, muscle fatigue, concentration, and basketball free throw accuracy.

Table 3 Comparison between-groups on the standing balance, muscle fatigue, concentration, and basketball free throw accuracy.

outcome	After intervention	
	TTM group	C group
	mean±SD	mean±SD
Standing balance (min)	32.43±3.34	29.97±2.33*
95% CI	31.19, 33.68	29.10, 30.84
Muscle fatigue	3.73±0.83	5.73±0.94**
95% CI	3.42, 4.04	5.38, 6.09
Concentration (ms)	205.53±38.49	210.33±39.41
95% CI	191.56, 220.31	195.62, 225.05
Accuracy (times)	28.5±3.74	28.40±3.42
95% CI	27.10, 29.90	27.12, 29.68

Note: TTM = traditional Thai massage, C = Control

\*Significant difference at p-value <0.05

\*\*Significant difference at p-value <0.01

## 5. CONCLUSION

The present study showed that TTM could increase standing balance, decrease muscle fatigue, and increase concentration. However, basketball free throw accuracy was not changed after a single session of TTM. It was observed that balance and concentration were significantly increased ( $p<0.05$ ) only in the TTM group. However, the fatigue was significantly decreased ( $p<0.05$ ) in TTM group while it was significantly increased ( $p<0.05$ ) in C group. Group comparison revealed that the standing balance and fatigue were significantly different ( $p<0.05$ ). On the other hand, free throw accuracy was not changed in both within- and between- groups comparison.

## 6. ACKNOWLEDGEMENTS

The authors would like to express special thanks to the basketball athletes who participated in the study.

## 7. REFERENCES

- [1] Kozar B, Vaughn RE, Lord RH, Whitfield KE, Dve B, "Importance of free throw at various stages of basketball game", *Perceptual and Motor Skill*, Vol. 78(1), 1994, pp. 243-248.
- [2] Robertson A, Walt JM, Galloway SD, "Effect of leg massage on recovery from high intensity cycling exercise", *Br J Sport Med*, Vol. 38, 2004, pp. 173-176.
- [3] Monedero J, Donne B, "Effect of recovery interventions on lactate removal and subsequent performance", *Int J Sport Med*, Vol. 21, 2004, pp. 593-597.
- [4] Hilbert JE, Sforzo GA, Swensen T, "The effect of massage on delayed onset muscle soreness", *Br J Sport Med*, Vol. 37, 2003, pp. 72-75.
- [5] Farr T, Nottle C, Nosaka K, Sacco P, "The effects of therapeutic massage on delayed onset muscle soreness and muscle function following downhill walking", *J Sci Med Sport*, Vol. 5, 2002, 297-306.
- [6] Hemming B, Smith M, Graydon J, Dyson R, "Effect of massage on physiological restoration, perceived recovery, and repeated sports performance", *Br J Sports Med*, Vol. 34, 2000, 109-114.
- [7] Moyer CA, Round J, Hannum JW, "A meta-analysis of massage therapy research", *Psychol Bull*, Vol. 130, 2004, pp. 3-8.
- [8] Weinberg R, Jackson A, Kolodny K, "The relationship of massage and exercise to mood enhancement", *The Sport Psychologist*, Vol. 2, 1988, pp. 202-211.
- [9] Jones NA, Field T, "Massage and music therapies attenuate frontal EEG asymmetry in depressed adolescents", *Adolescence*, Vol. 34, 1999, pp. 529-534.
- [10] Hernandez – Reif M, Field T, Hart S, "Smoking cravings are reduced by self-massage", *Prev Med*, Vol. 28, 1999, pp. 28-32.
- [11] Birke TJ, Mcgrady A, Mac Arthur RD, Khuder S, "The effects of massage therapy alone and in combination with other complementary therapies on immune system measures and quality of life in human immune deficiency virus", *J Altern complement Med*, Vol. 6(5), 2000, pp. 405-414.
- [12] Maclaren DP, Gibson H, Parry-Billings M, Edwards RH, "A review of metabolic and physiological factors in fatigue", *Exerc Sport Sci Rev*, Vol. 17, 1989, pp. 29-66.
- [13] The Institute of Thai Traditional Medicine, Thai massage. Bangkok: Thai veteran organization, 2001.
- [14] Mackawan S, Eungpinichpong W, Pantumethakul R, Chatchawan U, Hunsawong T, Arayawichanon P, "Effects of traditional Thai massage versus jointmobilization on substance P and pain perceptionin patients with non-specific low back pain", *Journal of Bodywork and Movement Therapies*, Vol. 11, 2007, pp. 9–16.
- [15] Udompittayason W, "Effects of Thai Massage on Reduction of Tension - Type Headache", Prince of Songkla University, 1999.
- [16] Buttagat V, Eungpinichpong W, Chatchawan U, Arayawichanon P, "Therapeutic effects of traditional Thai massage on pain, muscle tension, and anxiety in patients with scapulocostal syndrome: A randomized single-blinded pilot study", *Journal of Bodywork and Movement Therapies*, Vol. 16(1), 2012, pp. 57-63.
- [17] Leelayuwat N, Eungpinichpong W, Manimmanakorn A, "The effects of Thai massage on resistance to fatigue of back muscles in chronic low back pain patients", *J Med Tech Phy Ther*, Vol. 13, 2001, pp. 13-19.
- [18] Eungpinichpong W, Therapeutic Thai massage. Bangkok: Suweeriyasarn Printing Press, 2008.
- [19] Sefton JM, Yarar C, Berry JW, "Massage Therapy Produces Short-term Improvements in Balance, Neurological, and Cardiovascular Measures in Older Persons", *Int J Ther Massage Bodywork*, Vol. 5(3), 2012, pp. 16-27.
- [20] Ploypailin N, "Immediate effect of foot massage on functional mobility and balance performance in the elderly", Khon Kaen University, 2014.
- [21] Mori H, Ohsawa H, Tanaka TH, Taniwaki E, Leisman G, Nishijo K, "Effect of massage on blood flow and muscle fatigue following isometric lumbar exercise", *Med Sci Monit*, Vol. 10, 2004, pp. CR173-178.
- [22] Buttagat V, Eungpinichpong W, Chatchawan U, Kharmwan S, "The immediate effects of traditional Thai massage on heart rate variability and stress related parameters in patients with back pain associated with myofascial trigger points", *J Bodyw Mov Ther*, Vol. 15, 2011, pp. 15-23.
- [23] Lindgren L, Rundgren S, Winsö O, Lehtipalo S, Wiklund U, Karlsson M, Stenlund H,

Jacobsson C, Brulin C, “Physiological responses to touch massage in healthy volunteers”, *Auton Neurosci*, Vol. 158(1-2), Dec. 2010, pp. 105–110.

- [24] Pishbin T, Firoozabadi SM, JafarniaDabanlo N, Mohammadi F, Koozehgari S, “Effect of Physical Contact (Hand-Holding) on Heart Rate Variability”, *International Journal of Advanced Computer Science*, Vol. 2(12), Dec. 2012, pp. 452–456.

---

*International Journal of GEOMATE, Dec., 2016, Vol. 11, Issue 28, pp. 2910-2915.*

MS No. 1395 received on Sept. 28, 2015 and reviewed under GEOMATE publication policies.

Copyright © 2016, Int. J. of GEOMATE. All rights reserved, including the making of copies unless permission is obtained from the copyright proprietors. Pertinent discussion including authors’ closure, if any, will be published in Dec. 2017 if the discussion is received by June 2017.

**Corresponding Author: Wichai Eungpinichpong**

---