

IMMEDIATE EFFECTS OF THAI MASSAGE ON GAIT PARAMETERS IN NORMAL ADULTS: A PILOT STUDY

Nutthanun Tatchananusorn¹, *Wichai Eungpinichpong², Uraiwan Chatchawan³ and Donlaya Promkeaw⁴

^{1,2,3} Research Center in Back, Neck, Other Joints Pain and Human Performance (BNOJPH), Khon Kaen University, Thailand.

^{2,3} Faculty of Associated Medical Sciences, Khon Kaen University, Thailand.

⁴ Improvement of Physical Performance and Quality of Life (IPQ) Research Group, Khon Kaen University, Thailand.

*Corresponding Author, Received: 14 Jan. 2018, Revised: 14 Feb. 2018, Accepted: 15 March 2018

ABSTRACT: The purpose of this study was to determine the immediate effects of Thai massage on gait parameters including stride length, step length, step width, and gait speed, hamstring flexibility, trunk flexibility, and hip, knee and ankle range of motion while walking in normal adults aged 19-25 years. A randomized crossover trial was used. Thirty healthy subjects (17 females and 13 males) with the tightness of hamstring muscles as indicated by a straight-leg-raising (SLR) ranged between 40 to 70 degrees participated. Each of them received a session of 1-hour Thai massage and a controlled condition of 1-hour resting on a bed with a 2-day washout period. Changes in all parameters between Thai massage session and control session results were analyzed by independent t-test. Changes between pretest and posttest for both sessions were performed by dependent t-test. Significantly differences were found between-group comparison in hamstring flexibility (4.88°; 95%CI, 1.52 to 8.23), trunk flexibility (2.35 cm.; 95%CI, 1.25 to 3.45), step length (1.94 cm.; 95%CI, 0.40 to 3.47), and stride length (4.77 cm.; 95%CI 2.12 to 7.41) ($p < 0.05$). However, no differences were found in changes of gait speed, the range of motion of hip, knee, and ankle. We concluded that one session of Thai massage could provide immediate effects to improve some gait parameters, body flexibility, and hamstring flexibility.

Keywords: Thai massage, Gait, Walk, Flexibility, Pilot study

1. INTRODUCTION

Walking is the important ambulatory activity in every day. There are many benefits of walking. A 30-minute walking affects to improve mental health and physical health. It may increase endorphin production to easing stress, tension, anger, fatigue, and confusion and improve sleep quality and cognitive performances [1]. Walking is also one of the best choices of physical activity to decrease and prevent risks of non-communicable diseases such as diabetes, heart diseases, osteoporosis, Alzheimer disease and cancer [2].

According to the lifestyle of people nowadays, they will easily have the abnormal signs of musculoskeletal system such as muscle tightness and decreased of flexibility, by prolonged abnormal postures [3]. Furthermore, prolonged abnormal postures may lead to decrease walking performances because muscles get tightness and decreased flexibility. Muscles that mostly be activated while walking are Hamstrings, Quadriceps, Gastrocnemius, Soleus, Tibialis Anterior, Hip Flexors and Hip extensors. Therefore, if these muscles become tightness, they will be decreased flexibility and affect walking performance such as short step length, decreased

step width, decreased walking speed, and abnormal posture [4].

Recently, Thai massage has become a popular treatment of massage therapy for Thai people. Some studies suggested that Thai massage help improve body flexibility and range of motion that is important for walking performance. However, there is no evidence of effects of Thai massage to walking performance in normal adults. This study aimed to examine the immediate effects of Thai massage on gait parameters in normal adults.

2. METHOD

2.1 Design and Setting

A crossover design study was conducted at the Department of physical therapy, Khon Kaen University, Thailand. The study was approved by the ethical committee of Khon Kaen University.

2.2 Participants

Healthy participants with the tightness of Hamstring muscle, aged 19-25 years, were recruited through flyers posted around Khon Kaen University. These recruitment announcements called for

individuals who had experienced tightness in legs to volunteer to take part in the study. Participants for inclusion in this study were selected by a physical therapist who conducted a detailed physical examination and collected baseline data. Participants must not have evidence of underlying disease or anatomical abnormalities. (e.g. malignancy, osteoporosis, spondylolisthesis, scoliosis, herniated nucleus pulposus, and spondylosis)

2.3 Intervention

A whole body of Thai Massage session was used as an intervention in this study. The 1-hour Thai massage protocol consisted of deep pressure massage and stretch on major muscles of the body. Firstly, therapist applied gently and deep thumb pressure massage along the meridian lines that covered neck, back, lower and upper extremities and foot consequently (Fig. 1 – 11). Thumb pressure was maintained at each point on the meridian lines for 5-10 seconds each point and repeated 3 times. The intensity of thumb pressure was not exceeded pressure pain threshold of participants and was adjusted by the therapist. After massage session, the therapist applied gentle stretch for those muscles including calf, hamstring, and quadriceps as shown in Fig. 12 – 14.



Fig.1 Massage lines of the neck area.

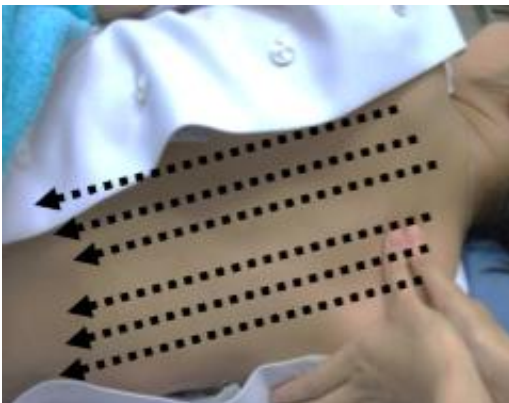


Fig.2. Massage lines of the back area.

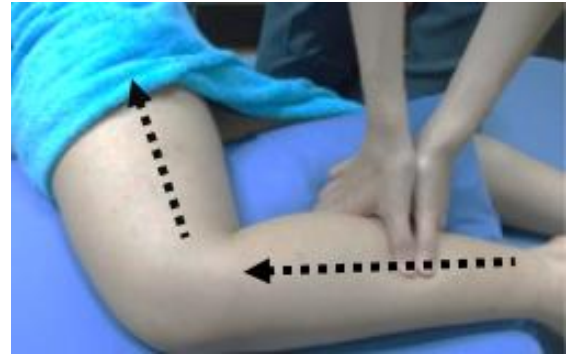


Fig.3 Massage lines of lower extremity (Lateral side)

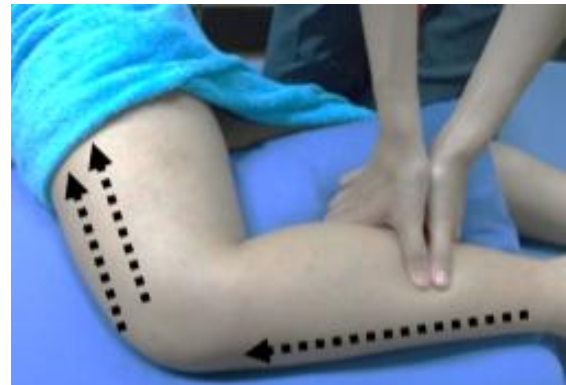


Fig.4 Massage lines of lower extremity (Anterior side)

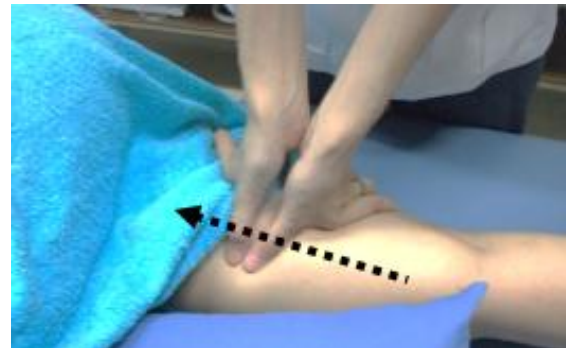


Fig.5 Massage line of lower extremity (Medial side)



Fig.6 Massage line of lower extremity (Medial side)

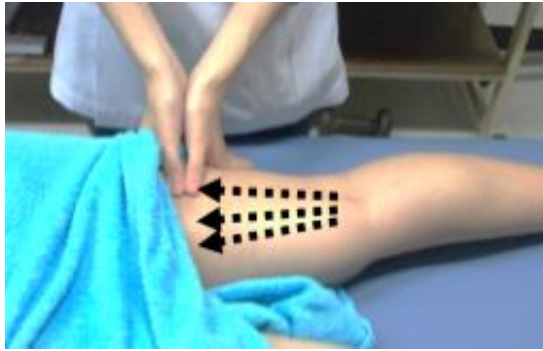


Fig.7 Massage lines of lower extremity (Posterior side)

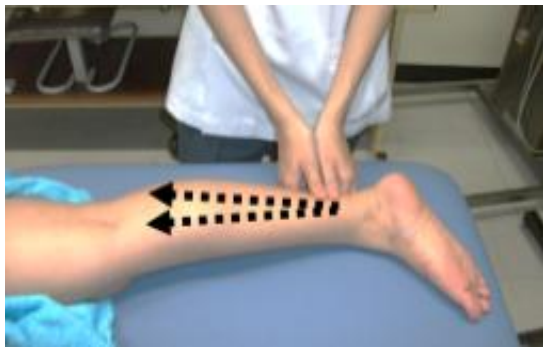


Fig.8 Massage lines of lower extremity (Posterior side)



Fig.9 Massage lines of the upper extremity (Anterior side)



Fig.10 Massage lines of the upper extremity (Posterior side)



Fig.11 Massage lines of feet



Fig.12 Calf muscles stretching



Fig.13 Hamstring muscle stretching



Fig.14 Quadriceps muscles stretching

3. PROCEDURE

3.1 Randomization

Thirty participants who met the above inclusion/exclusion criteria were recruited and randomly allocated into one of the two groups using block-randomized allocation with block sizes of 2 and 4. The groups were assigned using a pre-

generated random assignment scheme enclosed in envelopes, which resulted in a total of 15 participants per group.

3.2 Treatment

Participants in group A received an hour Thai massage and took a rest in supine lying position after taking Thai massage 2 days later. Whereas participants in group B took an hour rest in a supine lying position and 2 days after they took a rest, they received one-hour Thai massage. The same pre-assessments and post-assessments were conducted on both groups.

In keeping with the recommendation of Khon Kaen University's ethical committee, all participants gave informed consent before participation in the study.

4. ASSESSMENT

Prior to and following Thai massage and control sessions, all outcome measures were assessed by one physical therapist. Details of outcome measures and assessments are described below.

4.1 Gait Parameters

Gait parameters were assessed by walking in preferred gait speed on 10-meter ink-mat footprint walkway. Outcomes consisted of stride length, step length, and step width. [4]

Kinovea program (version 0.8.15) was used to measure a range of motion of hip, knee, and ankle while walking and preferred gait speed.

The range of motion of the hip, knee, and ankle was measured by recording the video while walking at heel strike and toe-off phases. Prior to walking, markers were placed at the shoulder joint, greater trochanter, lateral epicondyle, lateral malleolus and middle phalange of the participants.

Preferred gait speed was measured by 10-meter walk test. This test was repeated 3 times and calculated for the average values.

4.2 Body Flexibility

A Sit-and-reach box was used to measure body flexibility. [5]. Allow participants to practice in the 1st trial and record the other 2 trials. The value considered as the test result is the best value of 2 trials.

5. STATISTICAL ANALYSES

Changes in all parameters between Thai massage session and control session results were analyzed by independent t-test. Changes between pretest and posttest for both sessions were

performed by dependent t-test. All statistical analyses were calculated by Stata 10 software (StataCorp LP, 4905 Lakeway Drive College Station, Texas 77845, USA) and presumed that there are no carryover effects. A P-value of less than 0.05 was considered statistically significant.

6. RESULTS

Thirty-five potential participants responded to flyers or word-of-mouth; 5 were excluded after screening for eligibility. A total of 30 adults met the inclusion /exclusion criteria and were randomly assigned to the treatment group and to the control group. A flow chart of participant progression through the trial is presented in Fig.15

The characteristic of the study population was shown in Table 1. There were 17 females and 13 males. The mean age was 21 ± 1 years. The mean weight and height were 57 ± 9 kilograms and 166.10 ± 9.26 centimeters respectively.

Step length, stride length and sit and reach test showed significant improvement after Thai massage session. SLR test showed significant improvement after both sessions (Table 2). However, Thai massage session gave better results in step length ($P=0.015$), stride length ($P<0.001$), SLR ($P=0.006$) and sit and reach ($P<0.001$) tests (Table 3).

Table 1 Characteristics of the study population

Participant Data	n=30
Gender (number; female/male)	17/13
Age (year)	21 ± 1
Weight (kilogram)	57 ± 9
Height (centimeter)	166.10 ± 9.26

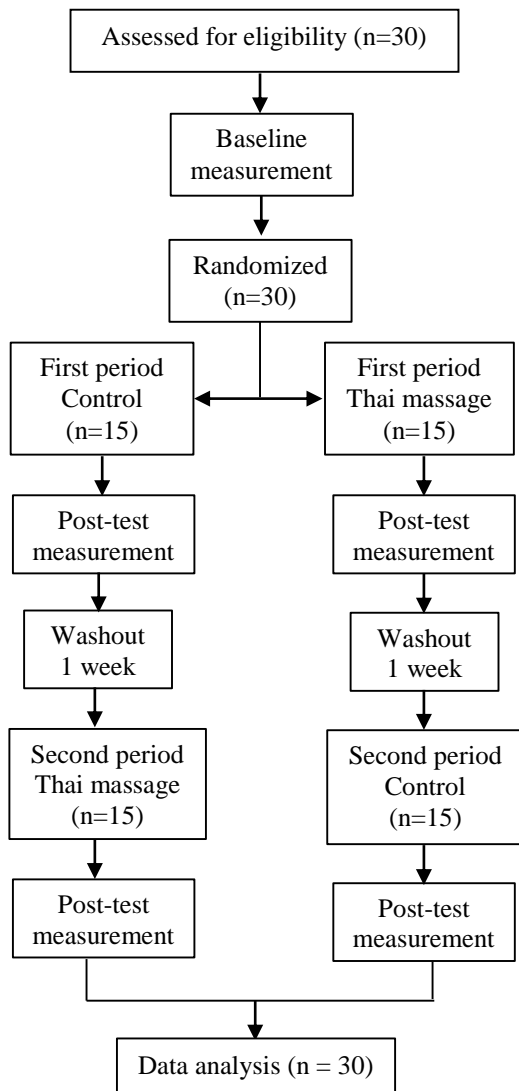
7. DISCUSSION

This study showed that one session of 1-hour whole body Thai massage could provide immediate improvements on walking performance and flexibility, including step length, stride length, SLR and sit and reach, in normal adults with muscle tightness of hamstring muscles. Our results are consistent with previous studies reporting that Thai massage is able to improve lumbar flexibility and hamstring muscle length which tested by the sit and reach and the SLR test. [9] Thai massage, using deep pressure followed by passive stretching, is applied along meridian lines covers all taut bands of the whole body. The potential of Thai massage is stimulation of Golgi tendon organ and send to the spinal cord. Within the spinal cord, an inhibitory interneuron will release the neurotransmitter glycine then inhibit alpha motor neuron to inhibit stretch reflex and relieve muscle with tension. Thus,

it affects to reduce pain, release the taut band in the tissues and help increase muscle length. This provides the muscles to have more flexibility [6], [7], [8], [9]. Moreover, flexibility helps improve step length and stride length [10].

As the immediate results of some gait parameters were not founded any differences after one session of 1-hour whole body Thai massage because of 3 factors including a number of Thai massage session, characteristic of participants and gait measurement.

Fig. 15 Diagram of study design and participants



One session of 1-hour whole body Thai massage could not provide a great result. Further study should investigate the multiple sessions on these effects. The characteristic of participants were healthy subjects with hamstring tightness. This is the reason for small changes after one Thai massage session. Further study should research in the other specific population such as older adults. Gait measurements in this study were to walk on

preferred gait speed. Preferred gait speed is the normal pace of walking and it is not the maximal performance of participant. Further study should examine the effects on maximal gait speed [11].

Table 2. Evaluation of outcome measures (mean \pm SD). Variables showing a significant difference between groups have been signed with *, ** and *** (p -value is 0.015, 0.006 and <0.001 respectively).

Parameter	Pre-A	Post-A	Pre-B	Post-B
Step length (cm.) *	65.51 ± 5.53	65.41 ± 5.45	65.34 ± 5.23	67.18 ± 5.17
Stride length (cm.) ***	131.41 ± 10.93	130.84 ± 10.50	129.89 ± 9.83	134.09 ± 10.29
Step width (cm.)	6.38 ± 1.86	6.26 ± 2.40	6.58 ± 2.33	6.66 ± 2.33
SLR (Degree) **	54.83 ± 5.83	59.11 ± 8.49	54.45 ± 6.38	63.60 ± 9.80
Sit and reach (cm.) ***	-1.56 ± 8.73	-2.20 ± 9.28	-1.79 ± 9.32	-0.07 ± 9.32
Heel strike (ROM)				
Hip Flexion (Degree)	22.66 ± 2.88	22.37 ± 3.17	22.50 ± 3.46	23.14 ± 3.87
Knee Flexion (Degree)	4.68 ± 3.37	4.22 ± 3.39	3.82 ± 3.81	4.89 ± 4.56
Ankle Plantar Flexion (Degree)	10.32 ± 2.38	10.56 ± 2.30	10.20 ± 2.40	10.16 ± 4.60
Toe off (ROM)				
Hip Flexion (Degree)	-7.57 ± 3.38	-7.81 ± 3.54	-8.41 ± 3.03	-8.13 ± 3.31
Knee Flexion (Degree)	41.62 ± 4.30	41.62 ± 4.26	40.44 ± 3.36	41.03 ± 4.17
Ankle Plantar Flexion (Degree)	24.92 ± 3.48	27.09 ± 4.97	24.70 ± 3.47	26.01 ± 3.69
Speed (m/s)	1.30 ± 0.15	1.29 ± 0.14	1.29 ± 0.13	1.31 ± 0.13

A: control session, B: Thai massage session

Table 3. Comparison of the mean change between control session and Thai massage session by independent t-test, where a significant difference was found.

Parameters	Within-group difference		Between-group difference (95%CI)	p -value
	Control	Massage		
Step length	1.84	-0.10	1.94 (0.40 to 3.47)	0.015
Stride length	4.20	-0.57	4.77 (2.12 to 7.41)	0.001
SLR	9.16	4.28	4.88 (1.52 to 8.23)	0.006
Sit and Reach	1.71	-0.63	2.34 (1.25 to 3.45)	0.001

All data were pooled and analyzed without considering interaction effects of the result between each session. However, baseline data of both sessions were similar. Further study should analyze the data correctly with interaction effects of the result.

Although changings of a range of motion while walking of hip, knee and ankle were not significant.

Thai massage still provided little effects relate to the result that Thai massage helps improve flexibility and lengthen the muscle. [12], [13]. Moreover, when muscles lengthened and reached the optimal resting length, it could produce the maximal force and improve mobility [14].

8. CONCLUSION

According to the results of this pilot study, we concluded that 1-hour Thai massage session may provide some immediate improvement of gait parameters and flexibility parameters, especially for step length, stride length, SLR, and Sit-and-reach. In a further study, a randomized controlled trial and a long-term treatment with following up are suggested. The other types of participants such as older adults are also suggested

9. ACKNOWLEDGEMENT

The authors would like to thank the participants who participated in this study. The study was supported by the Research Center of Back, Neck, Other Joint Pain and Human Performance (BNOJPH), Khon Kaen University, Thailand.

10. REFERENCES

- [1] Johansson M., Hartig T. and Staats H. "Psychological Benefits of Walking: Moderation by Company and Outdoor Environment" *Applied Psychology: Health and Well-being*. Volume 3 No.3, 2011, pp. 261–80.
- [2] Cooper K. and Hancock C. "The Benefit of Regular Walking for Health, Wellbeing and the Environment – a Review Document by C3". C3 Collaborating for Health [serial online] 2012. pp.3-7.
- [3] DeLisa J. "Gait Analysis in the Science of Rehabilitation Industrial Biofouling". District of Columbia: Department of Veterans Affairs; 1998.
- [4] Wilkinson MJ., Menz HB. "Measurement of Gait Parameters from Footprints: a Reliability Study" *The Foot*. Volume 7, 1997, pp.19-23.
- [5] Mayorga-Vega D., Merino-Marban E., Viciano J. "Criterion-Related Validity of Sit-and-Reach Test for Estimation Hamstring and Lumbar Extensibility: a Meta-Analysis" *Journal of Sports Science and Medicine*. Volume 13, 2014, pp.01-14
- [6] 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" *Journal of Bodywork and Movement Therapies*. Volume 15 No.1, January 2011, pp. 15-23.
- [7] Srionla C. and Thong-iam R. "Effect of Thai Massage on Running Performance in Runner." Thesis for Bachelor Degree of Science Physical Therapy), Khon Kaen University. Khon Kaen: Khon Kaen University; 2003
- [8] Hongsuwan C., Eungpinichpong W., Chatchawan U., Yamauchi J. "Effects of Thai Massage on Physical Fitness in Soccer Players". *Journal of Physical Therapy Science*. Volume 27 No.2, 2015, pp.505-508.
- [9] Barlow A. et al. "Effects of Massage of the Hamstring Muscle Group on Performance of the Sit and Reach Test". *British Journal of Sports Medicine*. Volume 38, 2004, pp.349-351.
- [10] Christiansen C. "The Effects of Hip and Ankle Stretching on Gait Function of Older People". *Archives of Physical Medicine and Rehabilitation* August. Volume 89, 2008 pp.1421-1428.
- [11] Middleton, Addie, Stacy L. Fritz, Michelle Lusardi. "Walking Speed: The Functional Vital Sign." *Journal of Aging and Physical Activity* Volume 23 No.2, Apr 2015, pp.314–322.
- [12] Zajac FE, Neptune RR, Kautz SA. "Biomechanics and Muscle Coordination of Human Walking. Part I: Introduction to Concepts, Power Transfer, Dynamics and Simulations". *Gait Posture*. Volume 16 No.3, Dec 2002, pp.215-32.
- [13] Brunner R, Rutz E. "Biomechanics and Muscle Function during Gait". *Journal of Children's Orthopaedics*. Volume 7 No.5, 2013, pp.367-371.
- [14] Rassier DE, MacIntosh BR, Herzog W. "Length Dependence of Active Force Production in Skeletal Muscle". *Journal of Applied Physiological* (1985). Volume 86 No.5, May 1999, pp.1445-57.

Copyright © Int. J. of GEOMATE. All rights reserved, including the making of copies unless permission is obtained from the copyright proprietors.
