Available Online at www.e-iph.co.uk
Indexed in Clarivate Analytics WoS, and ScienceOPEN

E-B Environment - Behaviour Proceedings Journal

AcE-Bs2024Langkawi

https://www.amerabra.org

e-IPH e-International Publishing House Ltd., United Kingdom

12th ASIAN Conference on Environment-Behaviour Studies,
Holiday Villa Beach Resort & Spa, Langkawi Island, Malaysia, 01-03 Mar 2024

Effects of Traditional Malay Massage on Muscle Tone, Muscle Function and Physical Performance in Patients with Stroke

Rosyahairani Rosli[1], Sharmila Gopala Krishna Pillai[1], Vikram Mohan[2], Fatim Tahirah Mirza[1*]
** Corresponding Author*

[1] Centre for Physiotherapy Studies, Faculty of Health Sciences, UiTM Selangor, Malaysia,
[2] Department of Rehabilitation and Sport Science, Faculty of Health and Social Sciences, Bournemouth University, Bournemouth, United Kingdom.

roslirosyahairani@gmail.com, sharmilapillai@uitm.edu.my, vmohan@bournemouth.ac.uk, fatim_mirza@uitm.edu.my,
Tel: +601 99085258

Abstract
Traditional Malay Massage (TMM), although is not the standard of care in the Malaysia Stroke Clinical Practice Guidelines, is common among stroke patients. This is despite the availability of clear evidence on the benefits of TMM in this population. The present study aims to investigate the effects of TMM on muscle tone, muscle function and physical performance in stroke patients. We found that as short as two weeks of TMM improved motor function and physical performance in subacute stroke patients. No change was observed on muscle tone. Future larger scale study is warranted to validate this finding.

Keywords: Berg Balance Scale; Malay massage; Motor Assessment Scale; Stroke

DOI: https://doi.org/10.21834/e-bpj.v9i28.5840

1.0 Introduction

The World Health Organization (WHO) defines stroke as an acute, focal, dysfunction of the brain, originating from vessels and lasting for a period longer than a day (WHO., 2017). Stroke is a significant global health problem, contributing to high morbidity and mortality in both developed and developing countries (Kooi et al., 2016). Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2017 showed that stroke was the third-leading cause of death and disability combined (as measured by disability-adjusted life-years [DALYs]) and the second-leading cause of death in the world in 2017 (Feigin et al., 2021). Stroke or cerebrovascular disease is Malaysia's third leading cause of death (Hwong et al., 2021). There were 47, 911 incident cases, 19,928 deaths, 443,995 prevalent cases, and 512,726 DALYs lost due to stroke in 2019 (Tan & Venketasubramanian, 2022). Based on the duration of a stroke, a person with a stroke is classified into three phases namely acute, subacute and chronic. The initial phase is called the acute phase and lasts about two weeks after stroke onset. The second phase is the subacute phase and usually lasts up to six months after the onset of the stroke, and the third phase is known as the chronic phase, referring to the duration from six months after the onset of the stroke to years. Among the three phases, the subacute stage is considered prime time for the brain to restructure its function and adjusting to the damage from a stroke. Individuals that have suffered from stroke present with various upper motor neuron syndrome, signs and symptoms, including weakness, spasticity, lack of coordination and agonist antagonist co-contraction, with up to 50% of survivors being chronically disabled

eISSN: 2398-4287 © 2024. The Authors. Published for AMER & cE-Bs by e-International Publishing House, Ltd., UK. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/). Peer–review under responsibility of AMER (Association of Malaysian Environment-Behaviour Researchers), and cE-Bs (Centre for Environment-Behaviour Studies), College of Built Environment, Universiti Teknologi MARA, Malaysia.
DOI: https://doi.org/10.21834/e-bpj.v9i28.5840

(Cabanas-Valdés et al., 2021).Spasticity and weakness (spastic paresis) are primary motor impairments after stroke and impose significant challenges for treatment and patient care (Li, 2017). It is common after stroke, with prevalence of motor impairments estimated at up to 80% in stroke survivors (Allison et al., 2016).

Stroke rehabilitation is a goal oriented, progressive process that enable a person with physical impairment to achieve optimal physical, social and functional status. Physiotherapy is an established field in stroke rehabilitation. One of the interventions in physiotherapy management is exercise therapy. It consists of passive movement, assisted movement, assisted-resisted active movement, and resisted movement. In Asian and African countries, stroke patients use complementary alternative medicine to treat stroke (Jeong et al., 2016). Massage, acupuncture and acupressure are example of the alternative treatment. Massage has been documented as one of the most frequently used alternative treatments for stroke especially in the Asian countries. There are a few types of massage such as Tui Na Massage from China, Ayurvedic Massage from India, Thai Massage from Thailand and TMM from Malaysia.

In Malaysia, although to date, substantial evidence to support benefits of TMM in stroke is limited, TMM is common among stroke patients. Only four studies have reported the effects of TMM, with two being done in populations other than stroke (past-partum women and low back pain individuals), and the other two explored qualitative experiences of stroke patients after TMM. No investigation on the effects of TMM on physical outcomes has been reported so far.

2.0 Literature Review

Stroke is a significant and increasing global health challenge. Stroke is the leading cause of acquired physical disability in adults and the second leading cause of mortality in middle-to high-income countries. According to WHO, there has been a 70% increase in stroke incidence, a 43% increase in deaths due to stroke, a 102% increase in stroke prevalence and a 143% increase in DALYs from the year 1990 to 2019.

Presentation of stroke symptoms comprised increased muscle tone, decreased muscle function and physical performance. There are a few outcomes measure to assess symptoms for a better understanding. Modified Ashworth Scale (MAS[1]) is a muscle tone assessment scale used to assess resistance experienced during passive range of motion. Motor Assessment Scale (MAS[2]) is a performance-based scale used to assess the level of impairment and everyday muscle function in patients with stroke. Berg Balance Scale (BBS) objectively determines a patient's ability or inability to safely balance during a series of predetermined tasks.

Stroke rehabilitation is an established treatment for achieving optimal physical, social, and functional levels. It is considered the standard of care for patients after stroke in both national and international clinical practice guidelines. Although not considered the standard of care, traditional Malay Massage is common among stroke patients in Malaysia. This is despite the evidence to support the beneficial effects of TMM in stroke patients is still limited.

In Malaysia, traditional healing among the Malay society has been recorded since the 19th century through the *Kitab Tib* manuscript; at times, TMM practitioner uses traditional healing as part of their practice whereby it uses a diversity of practices, approaches, knowledge and beliefs incorporating plants, animal, and mineral-based medicine (Esa et al., 2018). The Ministry of Health (MOH) formally recognised the importance and contribution of Traditional and Complementary Medicine T&CM by establishing three integrated MOH hospitals in 2007. These hospitals have established a (T&CM) Unit comprising acupuncture, herbal medicine for patients with cancer, and TMM. The massage is introduced primarily to help in the rehabilitation of poststroke patients. Massage, to date, has been accepted by the community, especially in Asian communities such as Thailand, China, Indonesia, and India. Nowadays, stroke patients find alternative treatments for stroke, such as massage. Massage has been shown to improve circulation, relieve many everyday muscle aches and pains, boost immunity, and promote overall well-being. Massage is administrated as a complementary to other therapies, such as medical or rehabilitation therapy.

TMM is the standard alternative treatment for stroke, but the evidence is limited. To date, on four studies that investigated the effect of TMM, one was done in postpartum stroke, and one was done in the low back pain patients, which the result cannot apply to determine the effect of massage in the stroke patients. The remaining two other studies were qualitative studies with no objective assessment to support the benefits of the effect TMM for stroke patients. However, the two qualitative studies found that the TMM can restore body function, improve quality of life, and affect daily living activities. However, there are no evidence studies to support that TMM is a very useful alternative treatment for stroke patients.

3.0 Methodology

3.1 Study design and ethical consideration

This is a historically controlled quasi-experimental study with data for participants in the control group (CG) collected from the medical records of patients attending stroke rehabilitation at Hospital Al-Sultan Abdullah, UiTM Puncak Alam, while patients in the intervention group (IG) were either stroke patients attending outpatient physiotherapy services at Klinik Fisioterapi UiTM Puncak Alam and KPJ Rawang Specialist Hospital or receiving physiotherapy services in the home setting. Eligibility criteria, duration for treatment (i.e., three times per week for two weeks) and outcome assessment were recorded at the first session, and six sessions (i.e., MAS[1], MAS[2] and BBS) were similar for both groups. This study design was chosen because the comparison arm (i.e., CG) in the present study referred to those receiving standard care. This study was approved by the Human Research Ethics Committee of Universiti Teknologi MARA REC/04/2023 (PG/MR/144), and all participants gave written informed consent.

3.2 Participants

Inclusion criteria include (i) age between 40 and 60 years old, subacute stroke (i.e., < 6 months of stroke), (iii) Mini-Cog Test with 1-2 recalled words and normal Clock Drawing Test, (iv) moderate spasticity (i.e., grade ≤1 using the Modified Ashworth Scale), (v) Functional Ambulation category ≥4 and (vi) able to communicate in either Malay or English. Exclusion criteria include (i) acute inflammation such as gout and rheumatoid arthritis and (ii) history of botulinum toxin injection within the last 6 months.

3.3 Traditional Malay Massage (IG)

Participants in the IG were asked to stop any other treatment and anti-spasticity medication for two weeks. The TMM was provided for 45 minutes on the affected lower limb with the participants either in a supine or prone position (depending on protocol requirement). The PI (RR), trained and certified under the Akademi Warisan Urut, Malaysia, performed TMM as per the protocol (Barakhbah, 2009). There were between six and eight massage points where a static pressure of between 10 and 20 was applied on each point according to sequence from thigh to toe. This sequence was then repeated three times for each toe. Fig 1 illustrates the protocol of TMM for the lower limb.

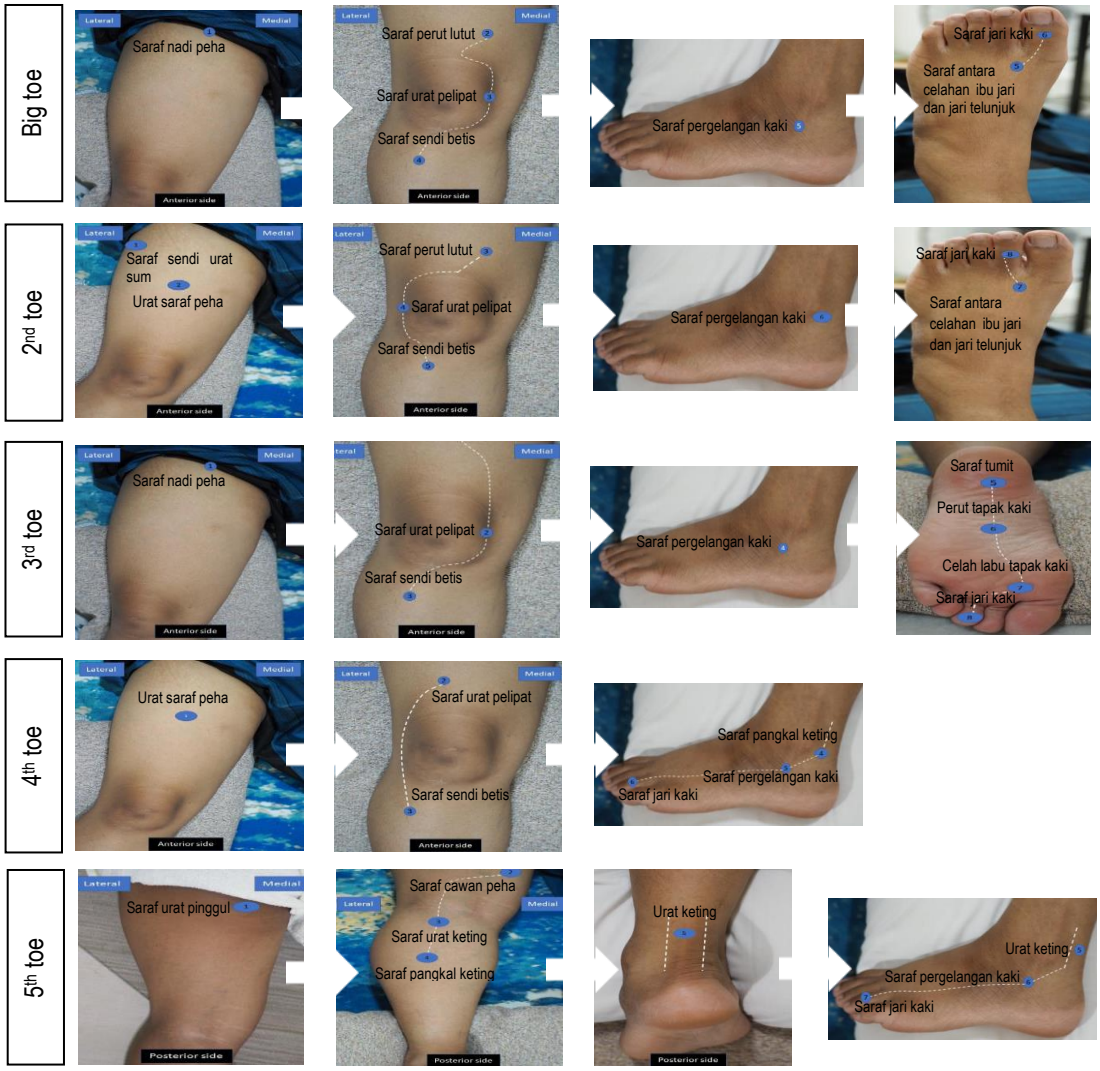

Fig 1. Massage points for lower limb (Barakhbah 2009)

3.4 Stroke rehabilitation (CG)

Participant in the CG received treatment by a physiotherapist for six sessions in two weeks for 45 minutes. Treatment delivered passive movement to maintain or increase joint mobility, proprioceptive neuromuscular facilitation (PNF) for maintain trunk control, gait and balance and gait training for improve functional ambulation.

3.5 Measurements

Demographic data of age, gender, and ethnicity were collected from the participants at the first session (t_1). Muscle tone (MAS[1]), Muscle function (MAS[2]) and Physical Performance (BBS) were measured two times at t_1 and t_2.

The muscle tone of the lower limb was measured by using the Modified Ashworth Scale (MAS[1]). The scale is the most universally accepted to measure the muscle tone increase. The MAS[1] has a 4 points numerical scale that graded spasticity from 0 to 4.'0' indicate no increase in muscle tone, '1' indicate slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the ROM when the affected part(s) is moved in flexion or extension, '1+' indicate slight increase in muscle tone, manifested by a catch, followed by minimal resistance throughout the remainder (less than half) of the ROM, '2' indicate more marked increase in muscle tone throughout most of the ROM, but affected part(s) were still easily moved, '3' indicate considerable increase in muscle tone with difficult passive movement and '4' indicate affected part(s) rigid in flexion or extension.

The Motor Assessment Scale (MAS[2]) was developed to assess and describe muscle function of stroke patients (Aamodt et al., 2006). The MAS[2] has nine items. It included eight times representing eight areas of motor function and one item related to muscle tone on the affected side. The motor functions tested include 1) supine to side lying onto intact side, 2) supine to sitting over side of bed, 3) balanced sitting, 4) sitting to standing, 5) walking, 6) upper arm function, 7) hand movements, 8) advanced hand activities and 9) general tonus. The total score of MAS2 is 54 and uses a 6-point scale from 1-6. A score of 6 indicates optimal motor behavior. The higher the score, the higher functioning on the affected side.

The Berg Balance Scale (BBS) was used to assess functional balance. The BBS has 1) sitting to standing, 2) standing unsupported, 3) sitting with back unsupported but feet supported on the floor or a stool, 4) standing to sit, 5) transfers, 6) standing unsupported with eyes closed, 7) standing unsupported with feet together, 8) reaching forward with the outstretched arm while standing, 9) pick up an object from the floor from a standing position, 10) turning to look behind over left and right shoulders while standing, 11) turn 360 degrees, 12) placing alternate foot on step or stool while standing unsupported, 13) standing unsupported one foot in front and 14) standing on one leg. The total score of BBS is 56 and uses a 5-point scale from 0-4. Scores of 0 to 20 represent balance impairment, 21 to 40 represent acceptable balance, and 41 to 56 represent good balance.

3.6 Data Analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences software (SPSS version 26). An independent t-test was used to measure MAS[1], MAS[2] and BBS difference between TMM and CG at baseline. The paired t-test was used to measure MAS[1], MAS[2] and BBS change from t_1 to t_2 in each group. Finally, an independent t-test was used to compare changes in MAS[1], MAS[2] and BBS from t_1 to t_2 between groups (CG vs. IG).

4.0 Findings

4.1 Study population

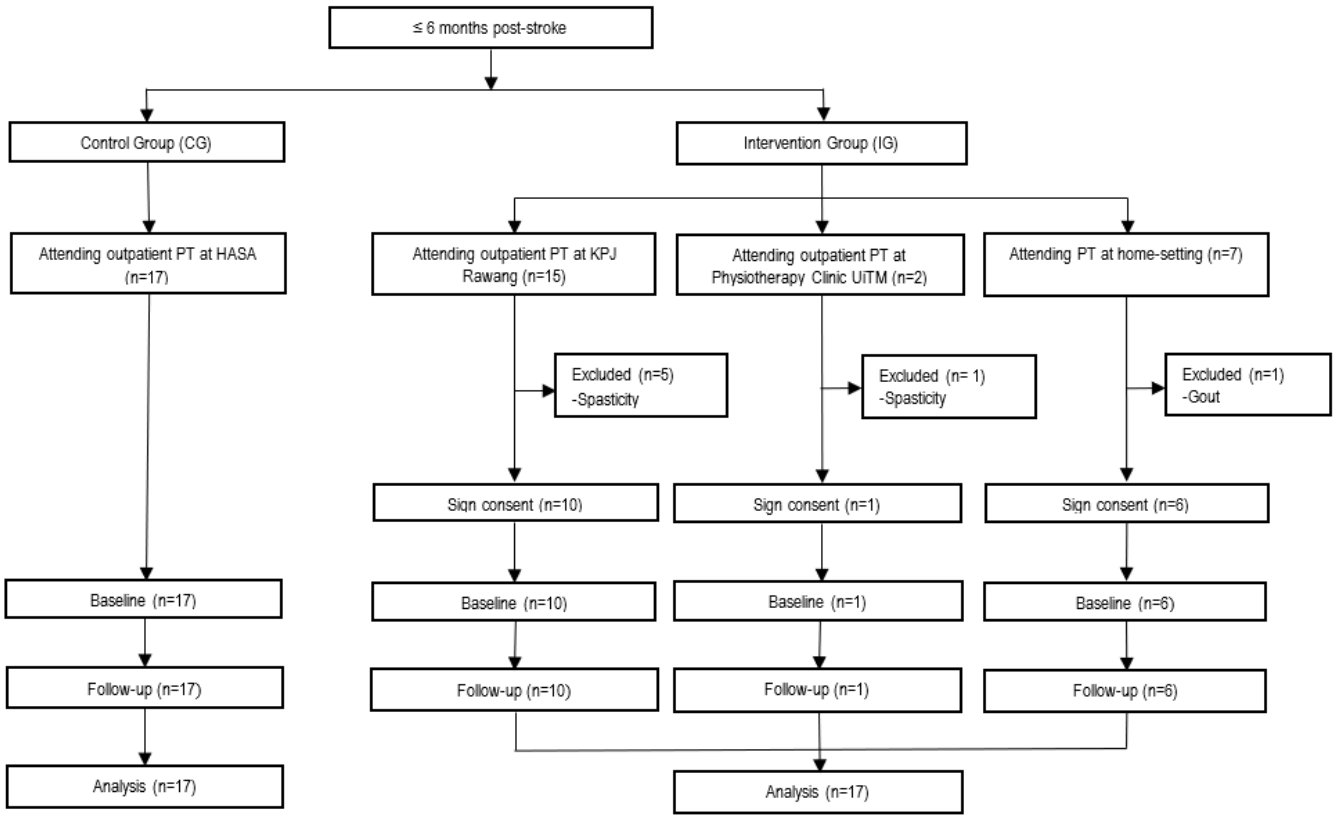

Fig 2. Flow of the recruitment participant

34 participants (17 in CG and 17 in IG) were recruited between December 2022 and October 2023. For the CG, data of patients attending outpatient Physiotherapy services at HASA with complete baseline data for MAS1 and MAS2 and BBS received three times physiotherapy within a week for two consecutive weeks and completed reassessment after two weeks were collected from the Hospital Medical records. For the IG, a total of 15 (63%), 2 (8%) and 7 (29%) were screened for study eligibility from outpatient physiotherapy services at KPJ Rawang, outpatient physiotherapy services at Physiotherapy Clinic UiTM and at-home setting, respectively. A total of 7 (29.2%) patients were excluded for reasons such as muscle tone >1 on MAS[1] and gout. A total of 17 participants consented, completed the intervention and attended both assessment sessions (t_1 and t_2). The flow of the participants in the study is summarized in Fig 2. Of the 34 participants, 25 (74%) were male, and the Mean ± SD of their age was 51±5 years. Age, muscle tone (MAS[1]) and physical performance (BBS) in CG and IG were comparable at baseline (p>0.05). Details of the study participants are presented in Table 1.

Table 1. Description of the study participants (n=34).

Characteristics		All (n=34)	CG (n=17)	IG (n=17)	*P*-value
Age, yr		51.4±5.4*	50.5±5.8*	52.2±4.9*	0.582
Gender	Male	25 (73.5)	12 (70.6)	13 (76.5)	
	Female	9 (26.5)	5 (29.4)	4 (23.5)	
Ethnicity	Malay	32 (94.1)	17 (100)	15 (88.2)	
	Chinese	2 (5.9)	-	2 (11.8)	
	Indian	-	-	-	
Muscle tone (MAS[1])					
0		18 (52.9)	10 (58.8)	8 (47.1)	
1		16 (47.1)	7 (41.2)	9 (52.9)	
Muscle function (MAS[2])					
Total score 0-54		43.0±10.0*	35.5±10.5*	43.5±6.9*	0.032
Physical performance (BBS)					
Total score 0-56		49.8±7.1*	44.4±10.4*	43.9±5.4*	0.116

Data are presented as mean ± standard deviation (SD)* and n (%).
Abbreviations: BBS, Berg Balance Scale; MAS[1] Modified Ashworth scale; MAS[2], Motor Assessment Scale; yr, year

4.2 Effect of TMM on MAS[1], MAS[2] and BBS

A total of two weeks of TMM (three times per week) improved MAS[2] and BBS performance (both p< 0.05). There was no change observed in MAS[1]. Table 2 shows the changes in each item in MAS[1], MAS[2] and BBS following TMM. For MAS[2], the mean ± SD scores increased by 1 point in 6 (67%) items and remained the same in the other 3 (33%) items. The total score for MAS[2] increased from 43.5±6.9 to 49.2±3.9 (p=0.000). For BBS, the scores increased by 1 point in 9 (64%) items and remained the same in the other 5 (36%) items. Total score for BBS also increased from 43.9±5.4 to 52.4±2.3 (p=0.000).

Table 2. Effect of TMM on MAS[1], MAS[2] and BBS

Outcome measure	TMM		*P*-value
	t_1	t_2	
Muscle tone (MAS[1])			
0	8 (47.1)	8 (47.1)	
1	9 (52.9)	9 (52.9)	
Muscle function (MAS[2])			
1. Supine to side- lying onto intact side	5±1	5±1	
2. Supine to sitting over side of bed	5±1	6±1	
3. Balance sitting	5±1	6±1	
4. Sitting to standing	5±1	5±1	
5. Walking	4±1	5±1	
6. Upper arm function	5±1	6±1	
7. Hand movements	5±1	6±1	
8. Advanced hand activities	5±1	6±1	
9. General tonus	6±0	6±0	
TOTAL SCORE (0-54)	43.5±6.9	49.2±3.9	0.000
Physical performance (BBS)			

1. Sit to stand	4±1	4±0	
2. Stand unsupported	4±1	4±0	
3. Sit unsupported	4±0	4±0	
4. Stand to sit	4±1	4±0	
5. Transfers	3±1	4±0	
6. Stand with eyes closed	4±1	4±0	
7. Stand with feet together	3±1	4±0	
8. Reach forward with an outstretched arm	2±1	3±1	
9. Pick up object from the floor	3±1	4±1	
10. Turn to look behind	3±1	4±0	
11. Turn 360 degrees	3±1	4±1	
12. Place alternate foot on stool	3±1	4±1	
13. Stand with one foot in front	2±0	3±0	
14. Stand on one leg	3±1	4±1	
TOTAL SCORE (0-56)	43.9±5.4	52.4±2.3	0.000

Data are presented as mean ± standard deviation (SD) and n (%).
Abbreviations: BBS, Berg Balance Scale; MAS[1] Modified Ashworth scale; MAS[2], Motor Assessment Scale; TMM, Traditional Malay Massage; t_1, assessment at pre-intervention; t_2, assessment at post-intervention

4.3 Effects of TMM versus usual care on MAS[2] and BBS

The within- and between-group differences in MAS[2] and BBS at t_1 and t_2 are shown in Table 3. The MAS[2] increased by 0.4; 2.1 in CG and 4.0;7.5 in IG. The difference in the changes between CG and IG at t_1 and t_2 for MAS[2] was 12.6; 6.9 to 18.2. The BBS increased by 0.9; 4.6 in CG and 6.6;10.4 in IG. The difference in the changes between CG and IG at t_1 and t_2 for BBS was 5.2; 0.3 to 10.0. Fig 3 shows the changes in a) MAS[2] and b) BBS in both CG and IG from t_1 and t_2.

Table 3. Muscle Function and Physical Performance within group and between group

	IG			CG			Between-group differences
Variables	**t_1**	**t_2**	**Within-group differences**	**t_1**	**t_2**	**Within-group differences**	
MAS[2]	43.5±6.9	49.2±3.9	4.0;7.5	35.5±10.5	36.7±10.5	0.4; 2.1	12.6; 6.9 to 18.2
BBS	43.9±5.4	52.4±2.3	6.6;10.4	44.4±10.4	47.2±9.2	0.9; 4.6	5.2; 0.3 to 10.0

Data are presented as mean ± standard deviation (SD)
Within group analyses paired t-test, between group analyses independent t-test
Abbreviations: BBS, Berg Balance Scale; CG, Control Group; IG; Intervention Group; MAS[2], Motor Assessment Scale; t_1, assessment at pre-intervention; t_2, assessment at post-intervention

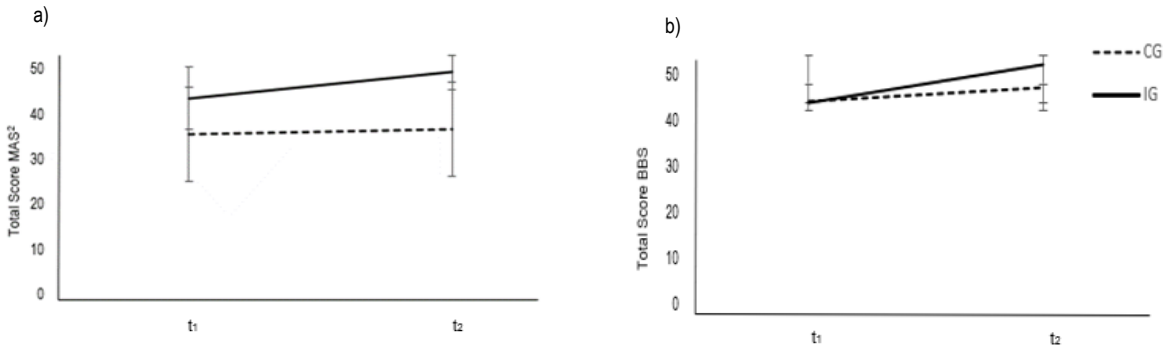

Fig 3. Time effect plots showing the pre (t_1) and post (t_2) measurements for a) MAS[2] and b) BBS between CG and IG
Data are presented as Mean±SD at t_1 and t_2 for both MAS[2] and BBS.
Abbreviations: BBS, Berg Balance Scale; CG, Control Group; IG; Intervention Group; MAS[2], Motor Assessment Scale; t_1, assessment at pre-intervention; t_2, assessment at post-intervention

5.0 Discussion

The present study found that two weeks of outpatient physiotherapy services and two weeks of TMM improved muscle function and physical performance of subacute stroke patients. The post-intervention changes in both MAS[2] and BBS were, in fact, more significant in the TMM group (p<0.05). However, the findings of the present study, especially on MAS[2], need to be interpreted with caution given that participants in the IG group had a higher MAS[2] score at baseline when compared to the MAS[2] score in CG (43.5±6.9 vs. 35.5±10.5; p=0.032). The baseline assessment could have been different due to the present study's design. Although a historical cohort study is commonly used when investigating a sample of rare diseases, the present study used a historical cohort design because we want to compare TMM with standard care of similar dosage (i.e., three times per week for two weeks). The stroke rehabilitation program at HASA was provided three times a week – similar to the TMM protocol used in the present study. We acknowledge the possible disadvantages of this study design, such as the selection bias. However, it is important to note that we compare the changes in the

variable to determine the effects of TMM, not the post-intervention assessment that could have been higher because of a higher baseline score (e.g., in MAS^2).

Although the prevalence of stroke in Malaysia is high, the PI required a total of six months (May 2023 to October 2023) to recruit as small as 17 sub-acute stroke patients. Reasons such as (i) those with ≥ 1 on MAS^1 were excluded from participation and (ii) rejection from patients or caregivers to replace standard physiotherapy with TMM for two weeks, knowing that TMM is not the standard of care for stroke patients could, in part explain the delays in data collection. An increase in muscle tone is common, especially in the first 3 months after a stroke. Muscle tone increases due to damage to nerve pathways within the brain or spinal cord that control movement and stretch reflexes. Thus, it is more common to see stroke patients with an increase in muscle tone rather than a muscle tone of MAS^1 ≤1.

TMM changes the score in MAS^2 and BBS but not in MAS^1. MAS^1 is the most universally accepted clinical tool used to measure muscle tone increase. As mentioned earlier, early post-stroke spasticity management may not reduce these complications but may improve function and increase independence in patients with spasticity (Kuo & Hu, 2018). One earlier study used Traditional Thai Massage for 6 weeks and found that the MAS^1 score decreased by at least one grade after the 6 weeks of treatment. Thus, we concluded that the non-significant difference in MAS^1 in the present study could be due to i) the TMM treatment provided in the present study was short (i.e., only for two weeks) and ii) the selection of patients limited to MAS^1 ≤1 may suggest that the spasticity in this sample was just mild or none for changes to be significant. Despite TMM having no positive change on MAS^1, it is also important to note that TMM did not worsen spasticity.

Baseline scores of patients in the CG were 35.5±10.5 and 44.4±10.4 in MAS^2 and BBS, indicating good motor function and balance. Baseline scores for the IG group were 43.5±6.9 and 43.9±5.4 in MAS^2 and BBS, indicating good motor function and balance. Participants in both groups improved significantly in MAS^2, indicating that stroke rehabilitation and TMM were effective at improving muscle function. Changes in MAS^2 in the TMM group were higher, and this could be due to massage, which can increase muscle mass temperature and blood flow, which might help increase muscle compliance and minimize muscle stiffness (Gasibat & Suwehli, 2017). Similarly, participants in both groups improved significantly in BBS, indicating that stroke rehabilitation and TMM effectively improved physical performance. Changes in BBS in the TMM group were 6.6 and 10.4. For early subacute stroke patients who require assistance to walk, a 5-point improvement in BBS score is a valuable indicator for reducing the amount of assistance (Tamura et al., 2021). Stroke patients can often result in increased levels of stress and anxiety. Massage therapy has been shown to help with decreasing levels of stress and anxiety by increasing levels of serotonin (feel-good hormones) and decreasing levels of cortisol (stress response hormones) Field (Hernandez-Reif(Hernandez-reif & Kuhn, 2005). The improvements in mental well-being may also positively impact physical health and recovery by improving mood, motivation and initiation.

6.0 Conclusion & Recommendations

Although TMM improved motor function and physical performance better than standard physiotherapy in the present study, we recommended stroke patients receive both interventions given that TMM more changes in physiology well-being and standard care more to physical well-being. Both of these restore body to its optimal health and function. Despite variations in technique, these treatments can be combined to provide patients with a full-service approach to rehabilitation and muscle relaxation. Future studies with larger sample sizes, prospective designs, and randomized studies are warranted to validate the present study's findings. We also acknowledged the fact that this study only recruited subacute stroke patients. Thus, the findings may not be able to be generalized to acute or chronic stroke patients.

Acknowledgement

The authors would like to acknowledge Rehabilitation Department Hospital Al-Sultan Abdullah, UiTM Puncak Alam, Physiotherapy Clinic UiTM Puncak Alam, KPJ Rawang Specialist Hospital and all stroke patients involved in the study.

Paper Contribution to Related Field of Study

The findings of the proposal study on whether TMM provides a superior or non-inferior effect than the usual therapy would facilitate clinical decision-making. Specifically, the study's findings can inform healthcare practitioners of new knowledge about the effect of TMM on stroke patients. TMM can be used by therapists or healthcare professionals in stroke rehabilitation. ii) Guide stroke patients to use TMM as an alternative for stroke treatment. The patients do TMM three per week for two weeks. The patients can see improvement before and after the TMM; iii) Inform family members of stroke patients that TMM is a beneficial treatment for stroke. TMM may speed up the recovery process for motor function and physical performance for stroke.

References

Allison, R., Shenton, L., Bamforth, K., Kilbride, C., & Richards, D. (2016). *Incidence , Time Course and Predictors of Impairments Relating to Caring for the Profoundly Affected arm After Stroke : A Systematic Review*. *21*, 210–227. https://doi.org/10.1002/pri.1634

Barakhbah, S.M. (2009). Teknik Asas Urutan Tradisional Melayu. Kuala Lumpur, Malaysia:Malay Massage Academy

Cabanas-Valdés, R., Calvo-Sanz, J., Serra-Llobet, P., Alcoba-Kait, J., González-Rueda, V., & Rodríguez-Rubio, P. R. (2021). The effectiveness of massage therapy for improving sequelae in post-stroke survivors. A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, *18*(9).https://doi.org/10.3390/ijerph18094424

Esa, N., Lah, S. C., & Hakimi, S. M. (2018). *Knowledge transfer and management among Malay traditional massage practitioners in the north of Malaysia*. *05005*, 1–5.

Feigin, V. L., Stark, B. A., Johnson, C. O., Roth, G. A., Bisignano, C., Abady, G. G., Abbasifard, M., Abbasi-Kangevari, M., Abd-Allah, F., Abedi, V., Abualhasan, A., Abu-Rmeileh, N. M. E., Abushouk, A. I., Adebayo, O. M., Agarwal, G., Agasthi, P., Ahinkorah, B. O., Ahmad, S., Ahmadi, S., … Murray, C. J. L. (2021). Global, regional, and national burden of stroke and its risk factors, 1990-2019: A systematic analysis for the Global Burden of Disease Study 2019. *The Lancet Neurology*, *20*(10), 1–26. https://doi.org/10.1016/S1474-4422(21)00252-0

Gasibat, Q., & Suwehli, W. (2017). *Determining the Benefits of Massage Mechanisms : A Review of Literature Determining the Benefits of Massage Mechanisms : A Review of Literature*. *2*(3), 56–67. https://doi.org/10.11648/j.rs.20170203.12

Hernandez-reif, M., & Kuhn, C. (2005). *Cortisol decreases and serotonin increases following massage therapy CORTISOL DECREASES AND SEROTONIN AND DOPAMINE INCREASE FOLLOWING MASSAGE THERAPY Department of Pharmacology*. *August*. https://doi.org/10.1080/00207450590956459

Hwong, W. Y., Ang, S. H., Bots, M. L., & Sivasampu, S. (2021). *Trends of Stroke Incidence and 28-Day All-Cause Mortality after a Stroke in Malaysia : A Linkage of National Data Sources*. *16*(1).

Jeong, M., Lee, H., Lim, J., & Yun, Y. (2016). Current utilization and influencing factors of complementary and alternative medicine among children with neuropsychiatric disease : a cross-sectional survey in Korea. *BMC Complementary and Alternative Medicine*, 1–8. https://doi.org/10.1186/s12906-016-1066-4

Kooi, C. W., Peng, H. C., Aziz, Z. A., & Looi, I. (2016). A review of stroke research in Malaysia from 2000 – 2014. *Medical Journal of Malaysia*, *71*(June), 58–69.

Kuo, C., & Hu, G. (2018). Post-stroke Spasticity : A Review of Epidemiology , Pathophysiology , and Treatments. *International Journal of Gerontology*, *12*(4), 280–284. https://doi.org/10.1016/j.ijge.2018.05.005

Li, S. (2017). Spasticity , Motor Recovery , and Neural Plasticity after Stroke. 8(April), 1–8. https://doi.org/10.3389/fneur.2017.00120

Ming, L., Sejari, N., & Kamaruddin, K. (2014). The effectiveness of traditional Malay massage: A narrative review. *Archives of Pharmacy Practice*, *5*(4), 144. https://doi.org/10.4103/2045-080x.142048

Tamura, S., Miyata, K., Kobayashi, S., & Takeda, R. (2021). Topics in Stroke Rehabilitation The minimal clinically important difference in Berg Balance Scale scores among patients with early subacute stroke : a multicenter , retrospective , observational study The minimal clinically important difference in Berg Balance Scale scores among patients with early subacute stroke : a multicenter , retrospective , observational. *Topics in Stroke Rehabilitation*, *00*(00), 1–7. https://doi.org/10.1080/10749357.2021.1943800

Tan, K. S., & Venketasubramanian, N. (2022). Stroke Burden in Malaysia. Cerebrovascular Diseases Extra, 12(2), 58–62. https://doi.org/10.1159/000524271

World health Organization(2017): The WHO STEPwise approach to stroke surveillance, version 2.1. Available at: http://www.who.int/ncd_surveillance/en/steps_stroke_manual_v1.2.pdf.