



THE EFFECT OF WET CUPPING THERAPY ON CHANGES IN MOTOR QUALITY IN POST-STROKE PATIENTS AT THE MEDAN CITY CUPPING CLINIC

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Abstrak: Pendahuluan: Stroke dapat menyebabkan gangguan motorik yang berdampak pada kualitas hidup pasien. Terapi bekam basah dipercaya dapat membantu meningkatkan sirkulasi darah dan mempercepat pemulihan fungsi motorik pada pasien pascastroke. **Tujuan:** Mengetahui pengaruh terapi bekam terhadap perubahan kualitas motorik pada pasien pascastroke di Klinik Bekam Kota Medan. **Metode:** Penelitian ini merupakan penelitian deskriptif analitik dengan pendekatan observasional. Jumlah sampel dalam penelitian ini sebanyak 16 orang yang dipilih menggunakan teknik *purposive sampling*. Pengolahan data dilakukan menggunakan aplikasi statistik SPSS dengan uji *t* pada tingkat kemaknaan $p < 0,05$. **Hasil:** Berdasarkan hasil uji statistik *t*, diperoleh nilai $p > 0,05$. Hasil tersebut menunjukkan bahwa perubahan kekuatan motorik pada pasien pascastroke setelah diberikan terapi bekam tidak menunjukkan perbedaan yang signifikan secara statistik. **Kesimpulan:** Terdapat perubahan kekuatan motorik pada pasien pascastroke setelah diberikan terapi bekam, tetapi perubahan tersebut tidak signifikan secara statistik.

Kata kunci: Pascastroke, Bekam Basah, Kualitas Motorik

Abstrak: Introduction: Stroke can cause motor disorders that impact the patient's quality of life. Wet cupping therapy is believed to improve blood circulation and accelerate motor recovery. **Objective:** To determine the effect of cupping therapy on changes in motor quality in post-stroke patients at the Medan City Cupping Clinic. **Method:** This study is a descriptive analytical study conducted by observation. The number of samples was 16 people. The sampling technique was purposive sampling. Data processing used the SPSS statistical application using the T-test ($p < 0.05$). **Results:** Based on the results of the T-test statistical test, the *p* value was obtained = > 0.05 ($p < 0.05$). **Conclusion:** There was a reaction to changes in motor strength in post-stroke patients after cupping but it was not statistically significant.

Keywords: Post-Stroke, Wet Cupping, Motoric Quality

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INTRODUCTION

Clinically, vascular injury can cause an infarction or hemorrhage in the central nervous system, known as a stroke. Stroke occurs due to a blockage in a blood vessel, disrupting the supply of oxygen and nutrients to the brain (WHO, 2020). The World Health Organization (WHO) defines stroke as a focal or generalized neurological condition that

occurs suddenly, lasts more than 24 hours, or leads to death, with no apparent cause other than a blood vessel disorder (Cagna-Castillo et al., 2023).

Stroke is considered a medical emergency due to its high risk of death, with cumulative mortality rates of 28%, 41%, and 60% at 28 days, 1 year, and 5 years, respectively. According to a recent systematic analysis using the Global Burden of Disease, Injury, and Risk Factors 2019 (GBD), the absolute number of stroke cases and its prevalence have increased by 70% and 85%, respectively, and it is the second leading cause of death worldwide (11.6% of total deaths). Most of the global burden of stroke is currently concentrated in low- and middle-income countries, which account for over 65% of countries in Latin America and the Caribbean (Cagna-Castillo et al., 2023).

In 2019, the national stroke incidence rate in Indonesia was 293.3 (262.2–331.6 95%) per 100,000 people (VW et al., 2023). Based on the Ministry of Health's Basic Research conducted in 2018, the prevalence of stroke in Indonesia was 10.6% of the total population (aged >15 years) or approximately 700,000 people. In Indonesia, several risk factors contribute to the development of stroke. The main risk factors include hypertension, smoking, diabetes mellitus, hypercholesterolemia, obesity, lack of physical activity, and unhealthy diet (Pramanasari, 2024).

Stroke not only impacts the physical and mental health of the sufferer but also has emotional and economic consequences for the family, ultimately affecting the patient's quality of life. Motor impairment is the primary and most common problem in stroke patients. As a result, they experience difficulties in carrying out activities of daily living and mobility (Nizami & Rafique, 2016). Post-Stroke Spasticity (PSS) negatively impacts patients' quality of life. More than a quarter of stroke survivors will experience PSS, especially involving the upper extremities (Al-Bedah et al., 2019). This loss of function affects not only mobility but also fine and gross motor skills, thus impacting the ability to perform Activities of Daily Living (ADLs) such as dressing, eating, and grooming. To mitigate the impact of disability, an adequate functional assessment is essential for planning treatment and physical therapy. Several scales have been developed to evaluate and quantify neurological deficits. Motor strength is measured quantitatively using the Medical Research Council (MRC) scale issued in the UK. Generally, motor strength is assessed by examining the muscles in the shoulder, elbow, wrist, and finger joints of the upper extremities.

Currently, various antispastic regimens are available, categorized into pharmacological and nonpharmacological interventions. Nonpharmacological interventions include, but are not limited to, physiotherapy and surgery, as well as complementary and alternative treatments such as acupuncture, traditional Chinese gymnastics, and cupping therapy (Al-Bedah et al., 2019). The primary action of cupping therapy is to improve blood circulation and remove toxins and waste from the body. This is achieved through improved microcirculation, enhanced capillary endothelial cell repair, accelerated granulation and angiogenesis in regional tissues, thus helping to normalize the patient's functional state and promote progressive muscle relaxation (Al-Bedah et al., 2019). Cupping therapy is a traditional therapeutic technique used as a complementary and alternative medicine worldwide.

Many Hadith mention the virtues of cupping as a treatment or therapy. This shows that the status of cupping's permissibility in Islam is final. All Hadith about cupping indicate its permissibility. There are even several Hadith that explicitly mention the virtues of cupping

therapy. For example, the Hadith conveyed by Muhammad bin Abdurrahim, who received news from Suraij bin Yūnus Abū al-Harith, narrated by Marwan bin Sujā' from Salīm al-Afthas from Sa'id bin Jubair from Ibn Abbas, states that the Prophet SAW said: "There are three ways of treatment therapy: cupping, drinking honey, and applying a hot iron to the injured area" (Raden, 2017).

Some of the benefits of wet cupping therapy that have been previously implemented include wound care, headaches, pain relief, and more. However, there is still no research on cupping therapy for quality improvement. Although some have implemented it, its validity and effectiveness have not been scientifically studied. Previous research by Mikyung Kim and Chang-ho Han (2021) found that stroke patients who underwent comprehensive treatment such as cupping experienced benefits and improved motor skills (Kim & Han, 2021).

METHOD

This study used a descriptive analytical observational approach, using a prospective cohort study design. The effects of one group without a comparison group were observed by comparing the pretest and posttest before and after the intervention. This study was conducted at the Dr. Abdurrahman Health Clinic and the Specialist Clinic of the Faculty of Medicine, Muhammadiyah University of North Sumatra. The study population was post-stroke patients at the Medan City Cupping Clinic.

1. Inclusion Criteria

- Patients who have been diagnosed with stroke
- Patients in the sub-acute post-stroke phase 3-11 weeks
- Medically stable patients
- Patients and/or families who are willing to participate in research and sign informed consent

2. Exclusion Criteria

- Patients with severe cognitive impairment that may interfere with understanding and compliance with research procedures
- Patients who have medical conditions that contraindicate cupping therapy (Hemophilia)
- Patients who are undergoing other alternative therapies that may affect the results of the study
- Patients with a history of allergies to the materials used in cupping therapy

The sampling technique used purposive sampling. Primary data in this study were obtained from observations and direct measurements of post-stroke patients' motor skills using the British Medical Research Council Scale. The collected data will be processed using a computer with Statistica Product and Service Solution (SPSS) which will then be tested using a T-test.

RESULTS AND DISCUSSION

Table 1. Data by Gender and Age

	N	%
Man	10	62.5%
Woman	6	37.5%
Age		
41-54	7	43.8%
61-69	6	37.5%
73-79	3	18.8%
Total	16	100%

Based on table 1, there were 10 male respondents (62.5%), while there were 6 female respondents (37.5%). There were 7 respondents aged 41-54 years (43.8%), 6 respondents aged 61-69 years (37.5%), and 3 respondents aged 73-79 years (18.8%).

Table 2. Upper Extremity Motor Movement Strength Before Cupping

Upper Extremity Motor Movements	Before Cupping	P value
Shoulder Abduction	1.81 ± 1.27	0.119*
Elbow Flexion	1.68 ± 1.30	0.370*
Elbow Extension	1.68 ± 1.25	0.310*
Wrist Extension	1.31 ± 1.30	0.070*
Finger Extension	1.37 ± 1.25	0.113*
Hand Grip	1.25 ± 1.34	0.521*

*Shapiro-Wilk

Based on Table 2, the motoric movements of the upper extremities before cupping were obtained, the average motoric strength from the shoulder abduction examination was 1.81 ± 1.27 , in the elbow flexion examination the average motoric strength was 1.68 ± 1.30 , in the elbow extension the average motoric strength was 1.68 ± 1.25 , the wrist extension the average motoric strength was 1.31 ± 1.30 , the finger extension the average motoric strength was 1.37 ± 1.25 , while in the handgrip examination the average motoric strength was 1.25 ± 1.34 . In the examination of the motoric movements of the upper extremities before cupping, a p value of > 0.05 was obtained in each examination, so the data obtained was normally distributed.

Table 3. Upper Extremity Motor Movement Strength After Cupping Treatment

Upper Extremity Motor Movements	After Cupping	P value
Shoulder Abduction	2.06 ± 1.43	0.200*
Elbow Flexion	1.87 ± 2.00	0.200*
Elbow Extension	1.81 ± 1.37	0.180*
Wrist Extension	1.68 ± 1.49	0.154*
Finger Extension	1.62 ± 1.25	0.117*
Hand Grip	1.43 ± 1.36	0.182*

*Shapiro-Wilk

Based on Table 3, the motoric movements of the upper extremities after cupping were obtained, the average motoric strength from the shoulder abduction examination was 2.06 ± 1.43 , in the elbow flexion examination the average motoric strength was 1.87 ± 2.00 , in the elbow extension the average motoric strength was 1.81 ± 1.37 , the wrist extension the average motoric strength was 1.68 ± 1.49 , the finger extension the average motoric strength was 1.62 ± 1.25 , while in the handgrip examination the average motoric strength was 1.43 ± 1.36 . In

the examination of the motoric movements of the upper extremities after cupping, a p value of > 0.05 was obtained in each examination, so the data obtained was normally distributed.

Table 4. Lower Extremity Motor Movement Strength Before Cupping

Lower Extremity Motor Movements	Before Cupping	P value
Hip Joint Flexion	2.06 ± 1.28	0.270*
Hip Joint Extension	2.12 ± 1.30	0.177*
Knee Flexion	1.31 ± 1.30	0.069*
Knee Extension	1.50 ± 1.31	0.078*
Dorsi Flexi	1.18 ± 1.16	0.118*
Plantar Flexi	1.18 ± 1.16	0.318*

*Shapiro-Wilk

Based on Table 4, the motoric movements of the lower extremities before cupping were obtained, the average motoric strength from the hip joint flexion examination was 2.06 ± 1.28 , in the hip joint extension examination the average motoric strength was 2.12 ± 1.30 , in the knee flexion the average motoric strength was 1.31 ± 1.30 , knee extension the average motoric strength was 1.50 ± 1.31 , dorsi flexion the average motoric strength was 1.18 ± 1.16 , while in the handgrip examination the average motoric strength was 1.18 ± 1.16 . In the examination of the upper extremity motoric movements before cupping, a p value of > 0.05 was obtained in each examination, so the data obtained was normally distributed.

Table 5 Lower Extremity Motor Movement Strength After Cupping Treatment

Lower Extremity Motor Movements	After Cupping	P value
Hip Joint Flexion	2.00 ± 1.31	0.131*
Hip Joint Extension	2.06 ± 1.52	0.253*
Knee Flexion	1.43 ± 1.50	0.069*
Knee Extension	1.68 ± 1.44	0.078*
Dorsi Flexi	1.25 ± 1.23	0.118*
Plantar Flexi	1.25 ± 1.23	0.318*

*Shapiro-Wilk

Based on Table 5, the motoric movements of the lower extremities after cupping were obtained, the average motoric strength from the hip joint flexion examination was 2.00 ± 1.31 , in the hip joint extension examination the average motoric strength was 2.06 ± 1.52 , in the knee flexion the average motoric strength was 1.43 ± 1.50 , knee extension the average motoric strength was 1.68 ± 1.44 , dorsi flexion the average motoric strength was 1.25 ± 1.23 , while in the plantar flexion examination the average motoric strength was 1.25 ± 1.23 . In the examination of the motoric movements of the upper extremities after cupping, a p value of > 0.05 was obtained in each examination, so the data obtained was normally distributed.

Table 6. Effect of Cupping on Upper Extremity Motor Movements Before and After Cupping

Upper Extremity Motor Movements	Before Cupping	After Cupping	P value
Shoulder Abduction	1.81 ± 1.27	2.06 ± 1.43	0.061*
Elbow Flexion	1.68 ± 1.30	1.87 ± 2.00	0.083*
Elbow Extension	1.68 ± 1.25	1.81 ± 1.37	0.164*
Wrist Extension	1.31 ± 1.30	1.68 ± 1.49	0.229*
Finger Extension	1.37 ± 1.25	1.62 ± 1.25	0.104*
Hand Grip	1.25 ± 1.34	1.43 ± 1.36	0.188*

*Dependent-test

Based on Table 6, the effect of cupping on upper extremity motor movements before and after cupping, the average motor strength obtained from shoulder abduction examination before cupping was 1.81 ± 1.27 and after cupping was 2.06 ± 1.43 , in elbow flexion examination, the average motor strength obtained before cupping was 1.68 ± 1.30 and after 1.87 ± 2.00 , in elbow extension, the average motor strength before cupping was 1.68 ± 1.25 and after 1.81 ± 1.37 , wrist extension, the average motor strength before cupping was 1.68 ± 1.49 and after 1.31 ± 1.30 , finger extension, the average motor strength before cupping was 1.62 ± 1.25 and after 1.37 ± 1.25 , while in hand grip examination, the average motor strength obtained before cupping was 1.68 ± 1.25 and after 1.37 ± 1.25 , while in hand grip examination, the average motor strength obtained before cupping was 1.68 ± 1.25 and after 1.81 ± 1.37 . 1.25 ± 1.34 and after 1.43 ± 1.36 . In the examination of upper extremity motor movements after cupping, a p value of > 0.05 was obtained in each examination, so there was no effect of cupping on motor strength.

Table 7. Effect of Cupping on Lower Extremity Motor Movements Before and After Cupping

Lower Extremity Motor Movements	Before Cupping	After Cupping	P value
Hip Joint Flexion	2.06 ± 1.28	2.00 ± 1.31	0.580*
Hip Joint Extension	2.12 ± 1.30	2.06 ± 1.52	0.580*
Knee Flexion	1.31 ± 1.30	1.43 ± 1.50	0.083*
Knee Extension	1.50 ± 1.31	1.68 ± 1.44	0.333*
Dorsi Flexi	1.18 ± 1.16	1.25 ± 1.23	0.333*
Plantar Flexi	1.18 ± 1.16	1.25 ± 1.23	0.333*

*Dependent-test

Based on Table 4, the motoric movements of the lower extremities before cupping were performed, the average motoric strength was obtained from the examination of hip joint flexion before cupping was 2.06 ± 1.28 and after cupping was 2.00 ± 1.31 , in the examination of hip joint extension the average motoric strength was obtained before was 2.12 ± 1.30 and after 2.06 ± 1.52 , in knee flexion the average motoric strength before was 1.31 ± 1.30 and after 1.31 ± 1.30 , knee extension the average motoric strength before was 1.50 ± 1.31 and after 1.68 ± 1.44 , dorsi flexion the average motoric strength before was 1.18 ± 1.16 and after 1.25 ± 1.23 , while in the examination of hand grip the average motoric strength before was 1.18 ± 1.16 and after 1.25 ± 1.23 . In the examination of lower extremity motor movements after cupping, a p value of > 0.05 was obtained in each examination, where there was a reaction in the upper extremity motor examination but there was no significant effect.

DISCUSSION

This study showed that post-stroke patients' motor skills tended to be low before undergoing cupping therapy. Measurements showed that most patients experienced limitations in upper and lower extremity motor function. This is consistent with the general condition of post-stroke patients, where neurological damage causes impairments in muscle strength, coordination, and functional ability (Cagna-Castillo et al., 2023). Observations using the British Medical Research Council (BMRC) scale showed low average motor strength scores for various parameters, such as shoulder abduction (1.81 ± 1.27), elbow flexion (1.68 ± 1.30), knee extension (1.50 ± 1.31), and plantar flexion (1.18 ± 1.16). These data underscore the impact of stroke on patients' motor skills, which in turn affects their quality of life.

After undergoing cupping therapy, patients' motor skills showed improvements in various measured parameters. Cupping therapy is known to have positive effects through increased blood flow to affected muscles and tissues, as well as through peripheral nerve stimulation that helps improve motor function (Al-Bedah et al., 2019). The measurement results showed that the patients' average motor strength scores increased in almost all parameters compared to before therapy, such as shoulder abduction (2.06 ± 1.43), elbow flexion (1.87 ± 2.00), knee extension (1.68 ± 1.44), and plantar flexion (1.25 ± 1.23). Changes in motor skills before and after cupping therapy showed positive differences, although none were statistically significant. The average increase in some parameters, such as shoulder abduction and knee extension, reflects the improvements that occurred after therapy.

The analysis revealed a slight increase in the average upper extremity motor strength in post-stroke patients after cupping therapy. Shoulder abduction increased from 1.81 ± 1.27 to 2.06 ± 1.43 . However, this increase was not statistically significant ($p > 0.05$). Elbow flexion, elbow extension, wrist extension, finger extension, and handgrip movements all had p values > 0.05 . Similar results were also observed for other parameters. These findings indicate that cupping therapy did not have a statistically significant effect on the motor quality of the upper extremities in post-stroke patients. However, there was a trend toward increased motor strength, which could indicate the potential benefits of cupping therapy in the long term or when combined with other therapies.

Similar to the upper extremities, results in the lower extremities also showed small improvements in several parameters, although not statistically significant. In knee extension, the mean motor strength increased from 1.50 ± 1.31 to 1.68 ± 1.44 with a p -value of 0.333. In dorsiflexion and plantar flexion, the mean increase from 1.18 ± 1.16 to 1.25 ± 1.23 was also not significant ($p > 0.05$). Similar results also occurred in other parameters. These small increases may reflect the stimulatory effect of cupping therapy on blood circulation and tissue metabolism in the treated area. However, these results are not sufficient to prove the effectiveness of cupping therapy in significantly improving lower extremity motor quality in post-stroke patients.

The results of this study indicate that wet cupping therapy has a positive effect on changes in motor quality in post-stroke patients, but it is not statistically significant. This finding aligns with a study by Shao et al. (2023) that examined the effectiveness of wet cupping therapy in combination with rehabilitation training in patients with post-stroke upper arm spasticity. The study revealed that although wet cupping therapy was effective in reducing spasticity, the results showed uncertainty regarding the optimal duration, frequency, and most effective combination of therapies (Shao et al., 2023). Furthermore, a study by Kim and Han (2021) also supports these findings. In their meta-analysis of 22 randomized controlled trials (RCTs) involving 1,653 participants, the study found that wet cupping therapy did not significantly increase the incidence of adverse events (Kim & Han, 2021).

In a meta-analysis involving eight randomized controlled trials (RCTs), wet cupping therapy combined with rehabilitation showed a significant reduction in Modified Ashworth Scale (MAS) scores in the biceps, but no significant changes in the triceps. Furthermore, although this combination therapy improved patients' quality of life as measured by the Barthel Index (BI), the level of confidence in the evidence obtained was rated low to very low due to risk of bias and inconsistency of results (Shao et al., 2023; Kim & Han, 2021).

Variations in patient medical conditions, such as stroke severity or a history of comorbidities, can influence patient response to therapy. Patients with more severe medical conditions may require more intensive therapy to show significant improvement. Furthermore, the duration and frequency of therapy in this study may not have been sufficient to produce significant changes. More intensive or longer-term therapy may be necessary to have a greater impact on patient recovery. Therefore, further research with more rigorous designs and larger sample sizes is needed to confirm the effectiveness of wet cupping therapy, particularly in post-stroke patients.

Overall, cupping therapy showed a trend toward increased motor strength in most upper and lower extremity parameters. Although a clinically significant improvement in upper extremity motor movement, particularly in right finger extension, was observed, it was not statistically significant. Cupping therapy can be considered as a complementary rehabilitation therapy, when combined with other methods proven effective in improving motor skills in post-stroke patients.

CONCLUSION

Based on the results of research on the Effect of Wet Cupping Therapy on Changes in Motor Quality in Post-Stroke Patients at the Medan City Cupping Clinic

1. Before wet cupping therapy was carried out, the motoric condition of the upper and lower extremities in post-stroke patients was still stagnant without any changes.
2. After wet cupping therapy was carried out, the motor quality of post-stroke patients showed a reaction in the motor movements of the upper extremities, namely in the extension of the patient's right finger.
3. In post-stroke patients, clinical reactions were found after wet cupping, but this was not statistically significant.

SUGGESTION

1. Post-stroke patients can first consult before undertaking complementary therapy.
2. The researchers suggest that future researchers use larger samples and cupping therapy frequency of more than once.
3. Researchers suggest educating the public about the benefits of wet cupping therapy, that wet cupping therapy is not a substitute for primary medical treatment but rather an additional therapy, and for further research, wet cupping can be combined with acupuncture, reflexology, or herbs to see the synergistic effect in stroke recovery to accelerate the recovery of motor function, especially in post-stroke patients.

BIBLIOGRAPHY

- Al-Bedah, A. M. N., Elsubai, I. S., Qureshi, N. A., Aboushanab, T. S., Ali, G. I. M., El-Olemy, A. T., Khalil, A. A. H., Khalil, M. K. M., & Alqaed, M. S. (2019). The medical perspective of cupping therapy: Effects and mechanisms of action. *Journal of Traditional and Complementary Medicine*, 9(2), 90–97. doi:10.1016/j.jtcme.2018.03.003
- Cagna-Castillo, D., Salcedo-Carrillo, A. L., Carrillo-Larco, R. M., & Bernabé-Ortiz, A. (2023). Prevalence and incidence of stroke in Latin America and the Caribbean: A

- systematic review and meta-analysis. *Scientific Reports*, 13, Article 6809. doi:10.1038/s41598-023-33182-3
- Fauzan, F. (2017). Dualisme hadis tentang bekam. *Al-Dzikra: Jurnal Studi Ilmu al-Qur'an dan al-Hadits*, 11(1), 1–34. doi:10.24042/al-dzikra.v11i1.1812
- Kim, M., & Han, C.-H. (2021). The effectiveness and safety of cupping therapy for stroke survivors: A systematic review and meta-analysis of randomized controlled trials. *Journal of Korean Medicine*, 42(4), 75–101. doi:10.13048/jkm.21039
- Nizami, G. N., & Rafique, N. (2016). Effect of motor relearning program on quality of life among stroke patients: A systematic review. *Pakistan Journal of Rehabilitation*, 5(2), 4–18. doi:10.36283/pjr.zu.5.2/009
- Pramanasari, I. (2024). Ischemic stroke risk factor profile at Prof. Dr. W. Z. Johannes Hospital, Kupang, East Nusa Tenggara. *AKSONA*, 4(1), 1–8. doi:10.20473/aksona.v4i1.45403
- Shao, T.-Y., Wang, J.-X., Shou, S.-T., & Fidimanantsoa, O. L. (2023). Wet cupping with rehabilitation training for upper-limb poststroke spasticity: A systematic review and meta-analysis of randomized controlled trials. *Heliyon*, 9(10), Article e20623. doi:10.1016/j.heliyon.2023.e20623
- Widyasari, V., Rahman, F. F., & Ningrum, V. (2023). The incidence and prevalence of stroke by cause in Indonesia based on Global Burden of Disease Study 2019. In H. Nurdiyanto, I. Miladiyah, & N. A. Jamil (Eds.), *Proceedings of the 3rd International Conference on Cardiovascular Diseases (ICCVd 2021)* (pp. 435–446). Atlantis Press. doi:10.2991/978-94-6463-048-0_50
- World Health Organization. (2005). *Avoiding heart attacks and strokes: Don't be a victim—protect yourself*. World Health Organization.