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Meta-analysis

Meta-Analysis Effectiveness of Massage on Spasticity in Children with Cerebral Palsy

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ABSTRACT

Background: Children with spastic cerebral palsy generally experience spasticity in the upper and lower extremities. Spasticity is stiffness that occurs due to damage to the central nervous system caused during the child's growth and development from prenatal to postnatal. Spasticity can be controlled with intervention. The purpose of this study is to analyze, and estimate the effectiveness of massage for spasticity in children with cerebral palsy.
Subjects and Method: This study uses a meta-analysis study design with PICO as follows: P= children with cerebral palsy, I= massage, C= non massage, O= Modified Ashworth Scale (MAS). The article search process was carried out between 2000-2020 using databases from PubMed, Google Scholar, PEDro, NCBI. Based on the database, there were 9 articles that met the inclusion criteria. This study involved 817 articles. The analysis was performed using Review Manager software (RevMan 5.3).
Results A total of 9 Randomized Control Trial (RCT) studies from Europe, America, Asia and Africa were selected for systematic review and meta-analysis. COVID-19 patients receiving Ivermectin therapy decreased the duration of hospital stay by 1.52 units compared to standard therapy and this result was statistically significant (SMD= -1.52; 95% CI= -2.34 to -0.70; p= 0.003).
Conclusion: Ivermectin can reduce the duration of hospital stay for COVID-19 patients.

Keywords: Massage, cerebral palsy, Modified Ashworth Scale, meta analisis

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BACKGROUND

Cerebral palsy is brain damage or brain paralysis that occurs during non-progressive growth and development that occurs at pre-natal, natal and postnatal periods (Khandaker et al., 2019). Cerebral palsy is associated with permanent disturbances in muscle tone and movement that result in limitation of activity (Oskoui et al., 2013). Cerebral palsy is a disorder of posture, movement control, muscle strength disorders accompanied by neurological disorders in the form of spastic, balance disorders and mental retardation.

The American Academy for Cerebral Palsy classifies the clinical features of cerebral palsy as follows: neuromotor classification, namely spastic, athetosis, rigidity, ataxia, tremor, and mixed; Based on the affected body part, it is divided into hemiplegic, diplegic and quadriplegious (Miller and Bachrach, 2012).

Over the last 5 decades there has been an improvement by obstetric and neonatal nurses and a decrease in the number of deaths in the United States and other countries, especially premature and low birth weight infants (Richards and Malouin, 2013). Cerebral palsy is the leading cause of disability in children with a prevalence of about 2 in 1,000 live births. Globally an estimated 17 million people suffer from cerebral palsy (Khandaker et al., 2019). In Indonesia, the incidence of cerebral palsy is 60 per 1,000 population aged <14 years due to malaria and tuberculosis which causes encephalitis and eventually causes disability in children (Jahan et al., 2020).

In a study conducted by Malila (2015) that giving traditional massage interventions can effectively control spasticity and does not have significant losses for parents. In addition to massage combined with functional skills by their parents (Mahmood et al., 2020). Other studies such as thai massage can control the temporary spasticity of children with cerebral palsy. From several studies on the problem of cerebral palsy, it is deemed necessary to conduct an in-depth study to deal with the existing problems.

Physiotherapy plays an important role in cases of cerebral palsy, namely the treatment of spasticity in the upper and lower limbs, trunk, and muscle tone abnormalities. One of the modalities used is massage. This modality is usually used for infants or adults with an approach to the management of spasticity in cerebral palsy (Mahmood et al., 2020).

Various studies on the effectiveness of massage in children with spastic cerebral palsy have been carried out but there are no consistent results, so it is deemed necessary to conduct a meta-analysis.

On the effectiveness of massage in children with cerebral palsy. The approach taken using has been systematic on relevant studies to clearly determine the effectiveness of massage on children with spastic cerebral palsy. The purpose of the study was to analyze, and estimate the effectiveness of massage for spasticity in children with cerebral palsy.

SUBJECTS AND METHOD

1. Study Design

This study uses a systematic review and meta-analysis study design using PRISMA diagram guidelines. The article search process was carried out between 2000-2020 using databases from PubMed, Google Scholar, PEDro, NCBI. Some of the keywords used: “massage and cerebral palsy” , “massage and spasticity”, “thai massage and cerebral palsy”, “Swedish massage and cerebral palsy”, “traditional massage and cerebral palsy”.

2. Inclusion Criteria

The inclusion criteria in this article is a full paper article with a randomized controlled trails (RCT) study design, using massage intervention, subjects with children with cerebral palsy aged 0-18 years and the outcome Modified Ashworth Scale (MAS).

3. Exclusion Criteria

The exclusion criteria for this research article are articles that do not use English or Indonesian, published before 2000, articles are not full text.

4. PICO formula

The formulation of the problem in the study was carried out by considering the feasibility criteria described using the PICO (Population, Intervention, Control/ Comparison, Outcomes) model. The PICO in this study are:

Population : Child of cerebral palsy
Intervention : Massage
Control : Non Massage
Outcomes : Modified Ashworth Scale

5. Variable Operational Definition

Massage is one of the physiotherapy modalities in the form of manipulation of the body's soft tissues to optimize these tissues, one of which is spasticity. Research instrument with random. Continuous measuring scale.

Spasticity is stiffness that occurs in the upper or lower extremities due to disturbances in the upper motor neurons in the central nervous system. The instrument used is the Sword scale. Continuous measurement scale.

6. Instrument Study

The study was conducted using the PRISMA flow diagram guidelines and the assessment of the quality of research articles using the Critical Appraisal Checklist for RCT Study tools (CEBM, 2014).

7. Data Analysis

The data in this study were analyzed using the Review Manager application (RevMan 5.3), to calculate the effect size and heterogeneity of the study. The results of data processing are presented in the form of forest plots and funnel plots.

RESULTS

The article search process is carried out through several journal databases, including PubMed, Google Scholar, PEDro, NCBI. The review process for related articles can be seen in the PRISMA flow chart in Figure 1. Research related to the effectiveness of massage for spasticity in children with cerebral palsy consists of 9 articles from the initial search process returned 817 articles, after the deletion process publish articles with 98 requirements for more full text.

A total of 9 articles that meet the quality are included in the quantitative synthesis using a meta-analysis. The article review process was carried out using the PRISMA flow chart, which can be seen in Figure 1. The total articles obtained were 9 articles. Distribution of articles with details 7 from South Asia, 1 from Eurasia and 1 from Southeast Asia.

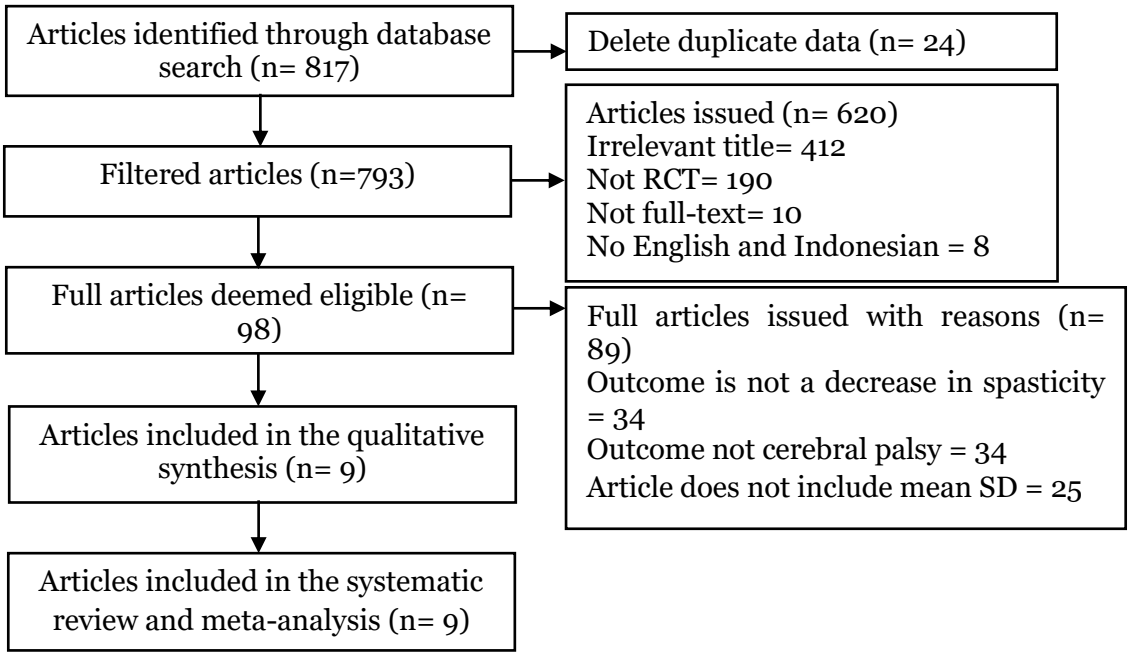

Figure 1. PRISMA flow diagram

Table 1. Description of the primary studies included in the meta-analysis of the effectiveness of massage on the spasticity of children with cerebral palsy

Author (Year)	Country	Study Design	Sample	P (Population)	I (Intervention)	C (Comparison)	O (Outcome)	Massage		Control	
								Mean	SD	Mean	SD
Mahmood et al. (2019)	Pakistan	RCT	75	Spastic cerebral palsy	Traditional massage	Physiotherapy	MAS, GMFM, GMFCS	0.36	0.32	0.57	0.43
Ibrahim et al. (2014)	Cairo	RCT	30	diplegia spastic cerebral plasty	Whole body vibration	Physiotherapy	MAS, GMFM	1.17	0.29	1.33	0.58
Rasool et al. (2017)	Pakistan	RCT	60	diplegia spastic cerebral plasty	Deep cross friction massage	Physiotherapy	MAS	2.87	0.74	3.73	1.22
Bhalara (2014)	India	RCT	18	Spastic cerebral palsy	Myofascial realease dan stretching	Stretching	MAS, MTS	1.50	0.35	1.61	0.22
Kumar dan Vaidya (2014)	India	RCT	38	diplegia spastic cerebral plasty	Myofascial realease	Passive stretching	MAS, MTS, GMFM	1.13	0.22	1.43	0.41
Malila et al. (2019)	Thailand	RCT	15	Spastic cerebral palsy	Traditional Thai massage	Passive static stretching	MAS, 1MWT	1.50	0.41	1.50	0.29
Mahmood et al. (2020)	Pakistan	RCT	86	Spastic cerebral palsy	Massage 30 minutes before physiotherapy	Physiotherapy	MAS	0.72	0.69	1.19	0.90
Bingöl (2018)	Turkey	RCT	20	Spastic cerebral palsy	Massage fungsional	Physiotherapy	MAS, GMFM, GMFCS	2.50	0.70	2.50	0.50
Alizad (2009)	Iran	RCT	27	Spastic cerebral palsy	Swedish massage	Occupational therapy	MAS	2.38	1.07	2.29	0.95

Table 2. Results of Quality Assessment of RCT Studies on the the effectiveness of massage on the spasticity of children with cerebral palsy

No	Questions	Publication (Authors and Year)								
		Mahmood et al. (2019)	Bingol (2018)	Rasool et al. (2017)	Kumar (2014)	Mahmood et al. (2020)	Bhalara (2014)	Alizad (2009)	Ibrahim et al. (2014)	Malila et al. (2015)
1	Does this study address a clear research focus?	1	1	1	1	1	1	1	1	1
2	Is the Randomized Controlled Trial research method appropriate to answer the research question?	1	1	1	1	1	1	1	1	1
3	Are there enough subjects in the study to establish that the findings did not occur by chance?	1	0	1	0	1	0	0	1	0
4	Were subjects randomly allocated to the experimental and control groups? If not, could this be biased?	1	1	1	1	1	1	1	1	1
5	Are inclusion/exclusion criteria used?	1	1	1	1	1	1	1	1	1
6	Were the two groups comparable at the start of the study?	1	1	1	1	1	1	1	0	1
7	Were objective and unbiased outcome criteria used?	1	1	1	1	1	1	1	1	1
8	Are objective and validated measurement methods used in measuring the results? If not, were results judged by someone who did not know the group assignment (ie was the assessment blinded)?	1	1	1	1	1	1	1	1	1
9	Is effect size practically relevant?	1	1	1	1	1	1	0	1	1
10	How precise is the estimate of the effect? Is there a confidence interval?	1	1	1	1	1	1	1	1	1
11	Could there be confounding factors that have not been taken into account?	0	0	0	0	0	0	0	0	0
12	Are the results applicable to your research?	1	1	1	1	1	1	1	1	1
	Total of Score	11	10	11	10	11	10	10	10	10

Answer 1 = Yes; 2 = No

Figure 2. Map of research areas on the effectiveness of massage for spasticity in children with cerebral palsy

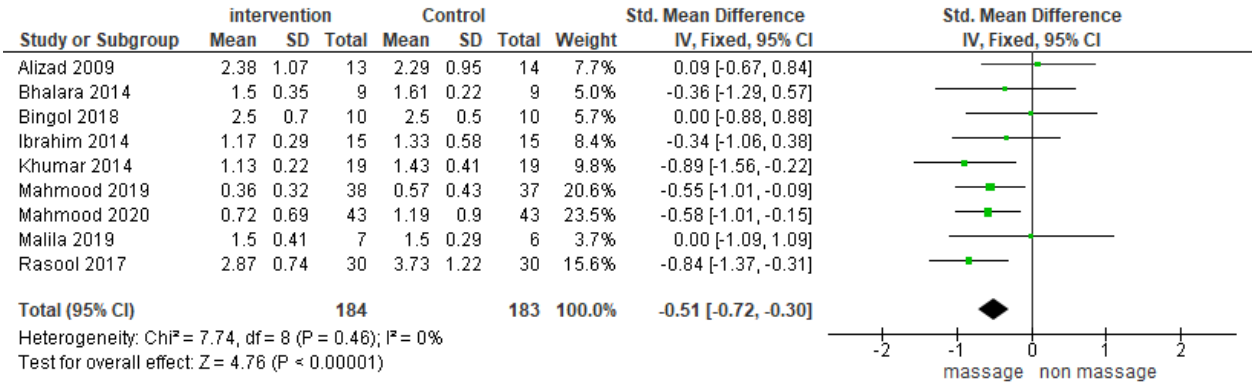

Figure 3. Forest plot of the effectiveness of massage on spasticity in children with cerebral palsy

1. Forest Plot

The forest plot in Figure 3 shows that massage is effective in reducing spasticity in children with cerebral palsy. Children with cerebral palsy who received massage experienced spasticity 0.51 units lower than those who did not receive massage and this effect was statistically significant (SMD = -0.51; 95% CI -0.72 to -0.30; p <0.001). The heterogeneity of estimates between studies in this meta-analysis was low with I^2=0%. Thus, the synthesis of the overall effect estimation of the primary study was carried out by using a fixed effect model approach.

2. Funnel plot

The funnel plot in Figure 4 shows that the distribution of the estimated effects is located to the right of the average vertical line of the estimate than to the left. Therefore, the funnel plot indicates that there is publication bias. Because the direction of the bias is also to the right of the null hypothesis vertical line as opposed to the average diamond shape of the effect estimate which is to the left of the null hypothesis vertical line, publication bias reduces the true effect (underestimate).

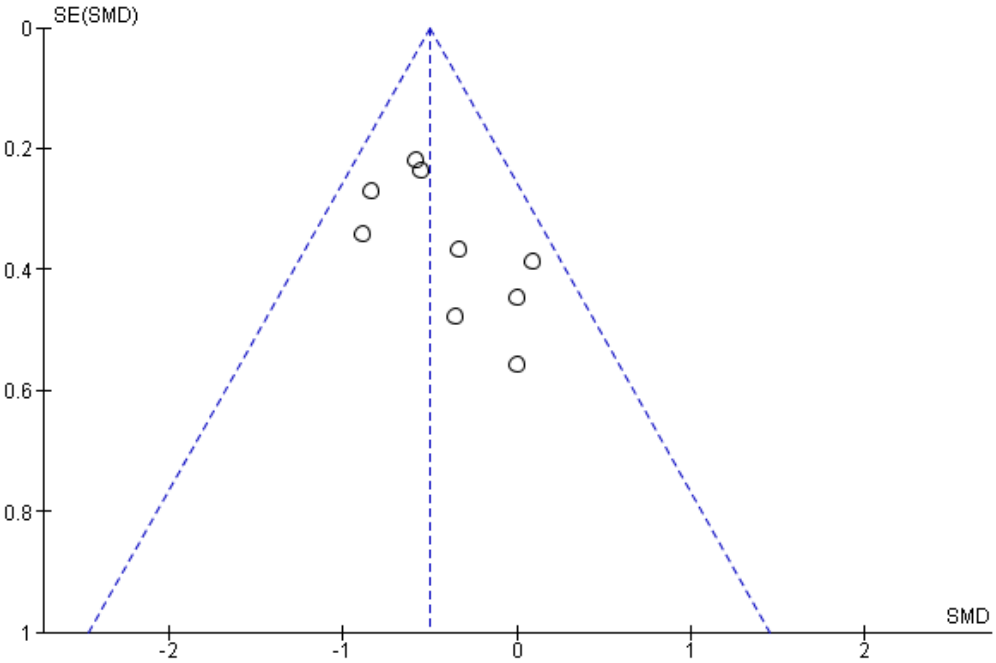

Figure 4. Funnel plot of the effectiveness of massage on spasticity in children with cerebral palsy

DISCUSSION

Cerebral palsy is brain damage that occurs during the process of brain development in children. Cerebral palsy can cause various disorders including motor disorders, muscle tone, movement coordination and spasticity (Güçhan and Mutlu, 2017). Spasticity is known as a motor disorder characterized by an increase in muscle stretch reflexes and excessive tendon stretches (Mewada, 2021).

Children with cerebral palsy experience spasticity in their upper and lower extremities (Oskoui et al., 2013). So, it is difficult to carry out daily activities such as school toileting, dressing and daily living activities. In children with cerebral palsy, limitations due to spasticity are the main obstacle. Spasticity will complicate gross motor and fine motor activities such as grasping, writing and writing (Saçaklıdır et al., 2019).

Giving therapy or physiotherapy modalities in the form of massage in spastic cerebral palsy children will be an alternative to control spasticity that occurs in the upper and lower extremities. At the time of touch on the surface of the skin manually will stimulate afferent receptors which will be processed to the spinal cord and forwarded to the cortical level. at that time relaxation occurs (Kumar and Vaidya 2014).

There are many studies on giving various massages that can be applied to children with cerebral palsy to control spasticity. Such as giving Swedish massage techniques, Thai massage and traditional massage, the results of which can reduce spasticity in children with cerebral palsy. This study uses a systematic review and meta-analysis study design with the aim of obtaining accurate conclusions from various similar studies and previous studies that tested the application of massage to children with cerebral palsy from various countries, races and techniques.

The research results are in the form of funnel plots and forest plots. The funnel plot shows an effect size that makes it possible to evaluate the occurrence of publication bias in the form of a symmetrical triangle in

which all research data is contained. While the forest plot shows the effect size and confident interval (CI 95%) and displays the results of the meta-analysis (Woodall and Montgomery, 2014).

In this study, using a meta-analysis study, there were 9 articles that described giving massage to control spasticity in children with cerebral palsy. The primary data obtained was processed using the Review Manager application (RevMan 5.3) so that the analysis obtained was low heterogeneity between experiments (I^2=0%, p<0.001) so the analysis used fixed effects (FE). Children with cerebral palsy who received massage experienced spasticity 0.51 units lower than those who did not. The results were statistically significant (SMD = -0.51; 95% CI -0.72 to -0.30; p <0.001).

The results of this study are supported by research conducted by Bingol and Yilmaz (2018) that spasticity is an increase in muscle resistance to passive movement. Massage provides a mechanism to reduce spasticity by stretching the tendons and stimulates the Golgi tendon organ (GTO) to inhibit alpha motor neurons and reduce spasms. Massage also strengthens sensory stimulation and activates gamma efferent fibers from muscle stretch which make receptors more sensitive to muscle stretch. (Malila et al., 2015).

In this study, massage is a simple, inexpensive and on invasive therapeutic approach, besides that, it is combined with physiotherapy exercise with the method of decreasing muscle tone or spasticity. Meanwhile, research from Malila et al., (2015) also activates the Golgi tendon organ and provides touch and applies thumb pressure which will have a relaxing effect. In the results of research from Bhalara and Talsaniya (2014) that giving myofascial release reduces spasticity in the short term in mild cases and shows an increase in motor function in moderate to severe spastic children.

In addition, research by Mahmood et al., (2020) showed that research by applying traditional massage for 30 minutes by adding baby oil to the treated area from proximal to distal. The conclusion of this study was that spasticity decreased in the upper extremity for 6 weeks of treatment and for the lower extremity for 12 weeks of treatment. Between the extremities is different due to the distribution of muscle tone. Meanwhile, in left-handed children with cerebral palsy, it is easier to control spasticity because of the cortical output, as well as the strengthening of motor function. So, left-handers are easier to fix on the unused hand.

Subsequent research was conducted by Rasool el al. (2017) there were 2 groups, namely the intervention group with deep massage and physiotherapy while the control group was given bobath, stretching. In the intervention group, it can control spasticity because it improves blood circulation, lymphatic flow, strengthens elasticity in muscles and connective tissue and plays a role in pain reduction mechanisms and induces relaxation. The provision of tactile stimuli varies from a soft touch, moderate and deep emphasis. This study uses a circular motion using the thumb (deep friction). This deep friction movement will cause stretch in the muscle, so that the sarcomere will be more optimally elongated. As a result of this stretching, there will be relaxation in the muscles that experience spasticity. In addition to physiologically in this study, intervention for 8 weeks and carried out routinely will result in psychological changes in children. For example, research conducted by Mewada (2021) on the provision of myofascial release and physiotherapy treatment in children with

spastic conditions is better than physiotherapy treatment alone.

Research conducted by Mahmood (2019) by giving traditional massage can reduce spasticity. In this study, parents play an important role in providing massage. Parents can do massage at home which aims to provide spastic management to their children which has an impact on long term management of spastic cerebral palsy. But in Mahmood's research (2019), it has a weakness, namely massage carried out by parents cannot be monitored related to its frequency, intensity. This massage has a positive effect, namely the reduction of saptisity but not for the gross motor function.

Traditional massage that is done without certification, supervision and training (performed by parents at home) has a less than optimal impact on children with cerebral palsy when compared to massages performed by professionals.

AUTHOR CONTRIBUTION

Salma Muazarroh is the main researcher who selects the topic, searches and collects research data. Agus Kristiyanto and Hanung Prasetya analyzed data and reviewed research documents.

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CONFLICT OF INTEREST

There is no conflict of interest in this study.

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