Meta-Analysis: Effect of Acupuncture Therapy in Lowering Frozen Shoulder Pain

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ABSTRACT

Background: Acupuncture therapy has become a popular non-drug therapy with good curative effect, convenient application, non-toxic side effects and low cost, and it has been widely used in the treatment of Frozen Shoulder. This study aims to analyze and estimate the effect of acupuncture therapy on reducing the degree of pain in Frozen Shoulder.

Subjects and Method: This study used a systematic review and meta-analysis by following PICO, Population: Frozen Shoulder patients. Intervention: acupuncture therapy. Comparation: no acupuncture therapy. Result: reduction in the degree of Frozen shoulder pain. The data used was obtained from scientific research articles from electronic databases including PubMed, Google Schoolar, Hindawi, BMC, Scopus, Science Direct Randomized Control Trial (RCT) designs from 2011 to 2022 which report effect sizes with mean and SD. The keywords used in the search for scientific articles are "Acupuncture" AND "Frozen Shoulder" AND "Frozen Shoulder Pain". The selection of articles was carried out using the PRISMA flowchart. Data were analyzed using Review Manager software version 5.4.1.

Results: A total of 9 articles with eligible RCT designs from Asia and Europe were selected for the systematic review and meta-analysis. The results of the meta-analysis, showed that patients with Frozen Shoulder who received acupuncture therapy experienced a degree of pain 0.48 units lower than without acupuncture and was statistically significant (SMD= -0.48; 95% CI= -1.14 to -0.18; p=0.15).

Conclusion: Acupuncture therapy reduces the degree of Frozen Shoulder pain.

Keywords: acupuncture, pain, frozen shoulder.

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BACKGROUND

Sleep is a complex process and not just closing your eyes. Sleep serves as a time for the recovery process for the body and brain, and sleep is a natural need that must be fulfilled every day (Mawo et al., 2019). The National Sleep Foundation in 2021, states that adults aged 18-64 years need 7-9 hours of sleep per day, while those aged 65 years need 7-8 hours of sleep per day.

The prevalence of Frozen Shoulder is ranked third in the world for Musculoskeletal complaints. Labor unions around the world say that injuries to the shoulder occur all the time (Setiyawati, 2013). A survey conducted at a community-based rheuma-

tology clinic in England said that the number of musculoskeletal pains was around 21% which was greater in women than in men, around 25% in women and 17% in men (Lumunon, 2015). The results of inspections on the implementation of occupational health in 26 provinces in Indonesia stated that the total cases of common diseases in workers ranged from 2,998,766 reports, and the total cases related to work were 428,844 cases (Ministry of Health RI, 2014). According to the 2018 Riskesda, the prevalence of joint disease in Central Java Province, including the shoulder joint, is around 6.78%. While the prevalence in Surakarta city ranges from 4.96%. Frozen Shoulder is more common in women, and the overall prevalence increases with age. Although 50% of diagnosed Frozen Shoulder pain resolves in 8 to 12 weeks. As many as 40% of all cases survive for more than 1 year with a high degree of chronicity which impacts the patient's quality of life (Mazolla, 2020).

Pharmacological efforts that can be given are analgesic effects or painkillers. Non-pharmacological efforts according to Windyasih (2016) include distraction, massage, acupuncture therapy and moxibustion. According to Mahandaru (2022) and Noer (2022) the efforts made are Hypnotherapy, Ultrasound and TENS, while according to Indana (2021) and Hasanah (2021) they include isometric relaxation, laser acupuncture, aromatherapy and music therapy.

Several studies report that acupuncture is effective in reducing the degree of pain in patients with Frozen Shoulder. Research conducted by Shi et al. (2018) stated that acupuncture combined with motion exercises can reduce the intensity of pain in Frozen Shoulder. Meanwhile, the research by J.C Rueda Garrido et al (2016) showed that if the use of acupuncture to treat the syndrome appears to be safe and reliable,

the technique achieves clinically significant results and can be implemented in the treatment options offered in health services.

Several studies on the effect of acupuncture to reduce the degree of pain in Frozen Shoulder show different results. Comprehensive research is needed from various primary studies that discuss the effect of acupuncture as a pain treatment for Frozen Shoulder. Meta-analysis is a statistical technique that combines more than one result of previous research and then obtains the latest quantitative data (Nindrea, 2016). This study aims to analyze and estimate the magnitude of the effect of acupuncture therapy on reducing the degree of pain in Frozen Shoulder with a meta-analysis of primary studies conducted by previous researchers.

SUBJECTS AND METHOD

1. Study Design
This research is a systematic review and This study used a systematic review and meta-analysis method. The data used comes from searching primary articles from databases such as Google Scholar, Science Direct, Hindawi, BMC and Pubmed from 2011 to 2022. The search was carried out using the keywords "Acupuncture" AND "Frozen Shoulder" AND "Frozen Shoulder Pain".

2. Steps of Meta-Analysis
Meta analysis was carried out in 5 steps as follows:
1) Formulate research questions in PICO format (Population, Intervention, Control/Comparisons, Outcomes).
2) Search for articles from various databases PubMed, Embase, Web of Science, ScienceDirect, Google Scholar.
3) Screening and conducting critical appraisal on primary studies with the Critical Appraisal Checklist for Randomized Controlled Trials from the Critical Appraisal Skills Program (CASP).

4) Perform data extraction and enter the effect size of each primary study into the RevMan 5.3 application.
5) Interpret the results of the research analysis and draw conclusions.

3. Inclusion Criteria

The inclusion criteria in this study were full text articles using the Randomized Controlled Trial (RCT) research method from 2001 to 2022 which used acupuncture interventions and analyzed outcomes to reduce the degree of pain in Frozen Shoulder reported by Mean and Standard deviation (SD).

4. Exclusion Criteria

Exclusion criteria in this study were studies prior to 2011 and using languages other than Indonesian and English.

5. Operational Definition of Variables

Acupuncture therapy belongs to Traditional Chinese Medicine (TCM) based on the principle of: stimulation of acupoints across the meridians through a wide range of modalities such as needle acupuncture, laser acupuncture, acupressure, electroacupuncture, moxibustion, etc. approach has been used for centuries and is proven to be safe and convenient.

The reduction in Frozen Shoulder pain is the reduction in the degree of pain in the Frozen Shoulder after the patient performs acupuncture therapy.

6. Study Instruments

The research was guided by the PRISMA flowchart and the research quality in this study was conducted based on the Center for Evidence-Based Medicine (CEBM) worksheets.

7. Data Analysis

Data analysis was performed using Review Manager software version 5.4.1. The odds ratio with 95% CI is calculated from the adjusted Mean and SD. The Forest Plot was used to describe effect sizes and the Funnel Plot to describe publication bias. The analysis was carried out by looking for the heterogeneity consistency value (I2) of the research results used.

<div style="text-align: center;">

RESULTS

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The data used comes from searching primary articles from databases such as Google Scholar, Science Direct, Pubmed, Hindawi and BMC from 2001 to 2022. The search was carried out using the keywords "Acupuncture" AND "Frozen Shoulder" AND "Frozen Shoulder Pain". The process of selecting and reviewing articles is carried out using the PRISMA flow chart.

In this meta-analysis, a number of articles with RCT research designs will be used. The initial search results obtained a number of 561 articles from a predetermined database as well as from various other searches. After removing duplicate articles, 380 articles were obtained. At the screening stage, 31 articles were obtained by removing 361 articles because these articles did not meet the criteria on the grounds that they were irrelevant, not RCT, not full-text and not in English or Indonesian. The researcher reviewed the 31 articles that had been obtained and found 9 articles that met the criteria. 22 articles were excluded because the outcome was not pain in Frozen Shoulder, the intervention was not acupuncture and the articles did not have a Mean and SD. There were 9 articles included in the qualitative synthesis, then 9 articles that met the criteria were selected again. In these 9 articles a quantitative synthesis of the meta-analyses will be carried out (Figure 1).
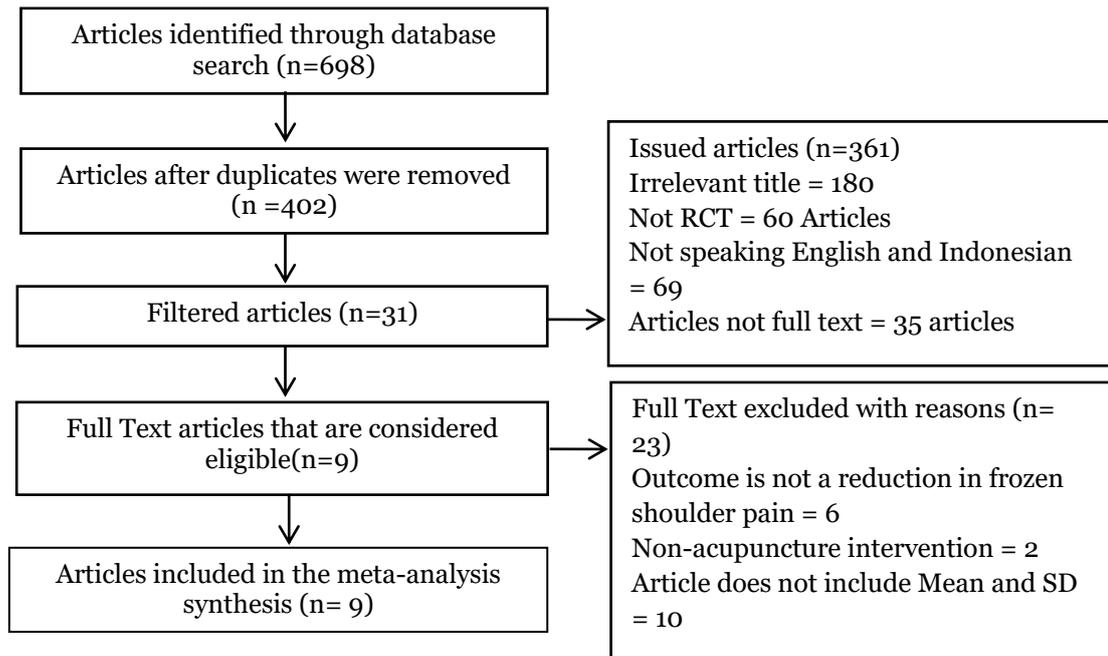
Figure 1. PRISMA flowchart diagram of Acupuncture Therapy in Lowering Frozen Shoulder Pain

Figure 2. Map of the distribution of research on Effect of Acupuncture Therapy in Lowering Frozen Shoulder Pain

This research related to the effect of acupuncture therapy on reducing the degree of pain in Frozen Shoulder consists of 9 studies originating from 2 continents including Asia and Europe. A total of 8 studies from the Asian continent including 5 studies came from China, 2 studies came from Hong Kong, 1 study came from Taiwan and the last one from the European continent, namely 1 study came from Spain. The distribution of the description of the study area is depicted on the map (Figure 2).

Tabel 1. Critical appraisal checklist for randomized controlled trial studies on the effect of acupuncture therapy on reducing the degree of pain in Frozen Shoulder

Primary Study	Criteria of Question												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Hu et al. (2019)	1	1	1	1	1	1	1	1	1	1	1	1	12
Fu et al. (2014)	1	1	1	1	1	0	1	1	1	1	1	1	11
Cheing et al. (2008)	1	1	1	1	1	1	1	1	1	1	1	1	12
Shi et al. (2018)	1	1	1	1	1	1	1	1	1	1	1	1	12
Bai et al. (2020)	1	1	1	1	1	1	1	0	1	0	1	1	10
Garrido et al. (2016)	1	1	1	1	1	1	1	1	1	1	1	0	11
Zhang et al. (2016)	1	1	1	1	1	1	1	1	1	1	1	1	12
Lo et al. (2019)	1	1	1	1	1	1	1	1	0	1	1	1	11
Sun et al. (2001)	1	1	1	1	1	1	1	1	1	1	1	1	12

Description of the question criteria:

1 = Does the research address a clearly focused statement/problem?
2 = Is the randomized controlled trial research method appropriate to answer the research question?
3 = Are there enough subjects in the study to establish that the findings did not occur by chance?
4 = Were subjects randomly allocated to the experimental and control groups? If not, could this introduce bias?
5 = Were inclusion/exclusion criteria used?
6 = Were the two groups comparable at study entry?
7 = Were objective, unbiased outcome criteria used?
8 = Are objective and validated measurement methods used to measure the results? If not, were the results assessed by someone who was not aware of the group assignment (i.e. was the assessment blinded)?
9 = Is the effect size practically relevant?
10 = How precise is the estimated effect? Are there confidence intervals?
11 = Could there be confounding factors that haven't been taken into account?
12 = Can the results be applied to your research?

Description of the answer score:

0 = No
1 = Yes

Table 2. Summary of randomized controlled trial (RCT) primary study articles with each PICO (N=479)

Author (Year)	Country	Sample Size	P	I	C	O
Hu et al. (2019)	China	38	Frozen Shoulder patient above 6 months	Distal point acupuncture therapy	Analgesic	Reduction of pain in Frozen Shoulder
Fu et al. (2014)	China	37	Frozen Shoulder patient above 2 months	Local and distal point acupuncture therapy	Pharmacology	Reduction of pain in Frozen Shoulder

Author (Year)	Country	Sample Size	P	I	C	O
Cheing et al. (2018)	Hongkong	46	Frozen Shoulder patient less than 6 months old	Acupuncture and electroacupuncture therapy	Pharmacology	Reduction of pain recurrence in Frozen Shoulder
Shi et al. (2018)	China	82	Frozen Shoulder patient above 2 months	Local point acupuncture therapy	Physiotherapy	Reduction of pain in Frozen Shoulder
Sun et al. (2001)	Hongkong	35	Frozen Shoulder patient above 1 month	Local point acupuncture therapy	Usual treatment	Reduction of pain in Frozen Shoulder
Bai et al. (2020)	China	72	Frozen Shoulder patient above 3 months	Manual acupuncture therapy	Physiotherapy	Pain Reduction in Frozen Shoulder
Garrido et al. (2016)	Spain	68	Frozen Shoulder patient above 1 month	Acupuncture therapy	Physiotherapy	Reduction of pain in Frozen Shoulder
Zhang et al. (2016)	China	80	Frozen Shoulder patient above 2 months	Manual acupuncture therapy	Sham acupuncture	Reduction of pain in Frozen Shoulder
Lo et al. (2017)	Taiwan	21	Frozen Shoulder patient above 3 months	Acupuncture therapy with electroacupuncture	Sham acupuncture	Reduction of pain in Frozen Shoulder

Table 3. Effect estimates (Mean SD) of all primary studies performed in the meta-analysis (N=479)

Author (Year)	Acupuncture		Non- acupuncture	
	Mean	SD	Mean	SD
Hu *et al.* (2019)	11.1	3.4	21.3	6.7
Fu et al. (2014)	6.5	2.6	8.1	4.9
Cheing *et al.* (2008)	6.71	6.5	8.26	7.94
Shi et al. (2018)	70.4	13.4	71.6	12
Sun *et al.* (2001)	5.5	1.6	7.1	3.9
Bai *et al.* (2020)	4.7	1	3.5	1
Garrido et al. (2016)	19.85	15.1	43.18	23.2
Zhang *et al.* (2016)	39.2	13.4	58.6	8.7
Lo *et al.* (2019)	60.8	5.1	58.3	7.1

1. Forest Plot

Study or Subgroup	acupuncture Mean	SD	Total	non acupuncture Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Bai 2020	4.7	1	36	3.5	1	36	11.5%	1.19 [0.68, 1.69]
Fu 2014	6.5	2.6	14	8.1	4.9	23	11.0%	-0.37 [-1.04, 0.30]
G.L.Y . Cheng 2008	6.71	6.5	23	8.26	7.94	23	11.3%	-0.21 [-0.79, 0.37]
J.C. Rueda Garrido 2016	19.85	15.1	35	43.18	23.2	33	11.5%	-1.19 [-1.70, -0.67]
Lo 2019	60.8	5.1	11	58.3	7.1	10	10.2%	0.39 [-0.47, 1.26]
S.Hu 2019	11.1	3.4	19	21.3	6.7	19	10.5%	-1.88 [-2.66, -1.10]
Shi 2018	70.4	13.4	41	71.6	12	41	11.7%	-0.09 [-0.53, 0.34]
Sun 2001	5.5	1.6	13	7.1	3.9	22	10.9%	-0.48 [-1.18, 0.22]
Zhang 2016	39.2	13.4	38	58.6	8.7	42	11.5%	-1.72 [-2.24, -1.20]
Total (95% CI)			230			249	100.0%	-0.48 [-1.14, 0.18]

Heterogeneity: Tau² = 0.92; Chi² = 91.48, df = 8 (P < 0.00001); I² = 91%
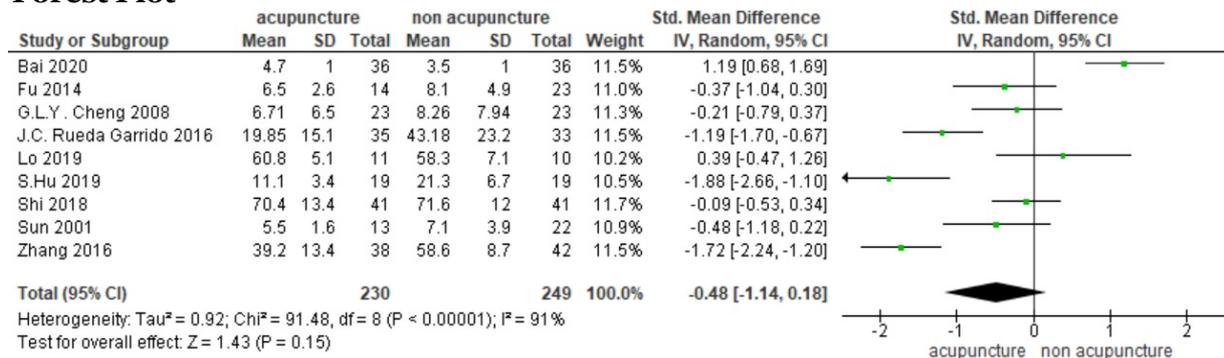Test for overall effect: Z = 1.43 (P = 0.15)

Figure 3. Forest plot of Acupuncture to reduce Frozen Shoulder pain

The forest plot in Figure 3 shows the effect of acupuncture therapy on reducing the degree of pain in Frozen Shoulder, and this effect is statistically significant. Patients with Frozen Shoulder who received acupuncture therapy experienced a degree of pain in Frozen Shoulder 0.48 units lower than without acu-puncture and was statistically significant (SMD= -0.48; 95% CI= -1.14 to 0.18; p=0.15). The forest plot also showed high heterogeneity of effect estimates between studies (I2=91%; p<0.001). Thus, the calculation of the average effect estimate uses the random effect model approach.
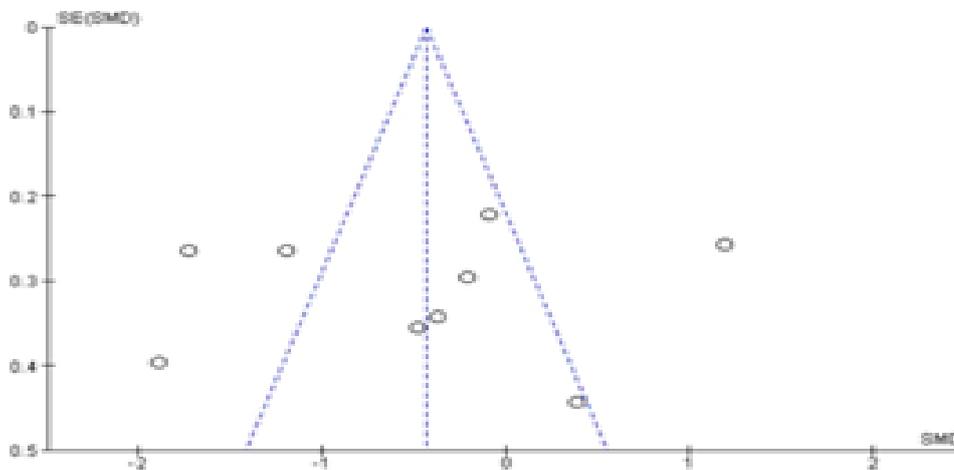
2. Funnel Plot

Figure 4. Acupuncture funnel plot to reduce Frozen Shoulder pain

The funnel plot in Figure 4 shows a more or less symmetrical distribution of effect estimates between studies to the right and left of the vertical mean estimate line. Thus, this funnel plot shows no publication bias in the meta-analysis.

DISCUSSION

Frozen Shoulder is pain that appears in the shoulder area. Frozen Shoulder starts from the ligaments or tendons and joints that make up the shoulder. Frozen Shoulder usually gets worse if there is excessive acti-vity in the shoulder area (Mandala, 2016). The risk factors that influence the onset of

pain are age and too much activity which results in very weak tendons and trauma and pain in the shoulder joint more easily. According to Walker (2014) Frozen Shoulder can hinder daily activities such as working, eating, dressing and personal hygiene. Frozen Shoulder is often associated with sleep disturbances, especially difficulties in positioning during sleep.

Pharmacological efforts that can be given are analgesic effects or painkillers. Non-pharmacological efforts according to Windyasih (2016) include distraction, massage, acupuncture therapy and moxibustion. According to Mahandaru (2022) and Noer (2022) the efforts made are Hypnotherapy, Ultrasound and TENS, while according to Indana (2021) and Hasanah (2021) they include isometric relaxation, laser acupuncture, aromatherapy and music therapy.

In recent years, acupuncture has become a popular non-drug therapy with good curative effect, convenient application, non-toxic side effects and low cost, and it has been widely used in the treatment of frozen shoulder. The efficacy of acupuncture and moxibustion treatment for Frozen Sholder has been reported in well-reported randomized repeated controlled studies, and the curative effect of acupuncture treatment on Frozen Shoulder is also being recognized in stages. Acupuncture is a traditional Chinese medicine therapy that aims to treat diseases by inserting special needles that are thin in size at points on the body.

Acupuncture is recognized and widely accepted as an alternative therapeutic approach in clinical practice. Therapeutic acupuncture belongs to Traditional Chinese Medicine (TCM) based on the principle: stimulation of acupoints across the meridians through a wide range of modalities such as needle acupuncture, laser acupuncture, acupressure, electroacupuncture, moxibustion, etc. approach has been used for centuries

and is proven to be safe and convenient (Zidan et al., 2019). Based on the results of the analysis of 9 primary studies that were carried out systematic review and meta-analysis showed that there was high heterogeneity between experiments (I^2 = 91%; p <0.001) so that the analysis used the Random Effect Model (REM).

High heterogeneity is based on the variation or diversity between populations as seen from the different number of samples between the experimental group and the control group, the frequency of reduced degrees of pain in Frozen Shoulder which has different ranges, and the number of times the treatment is given varies.

The results of a meta-analysis of 9 articles related to the effect of acupuncture therapy on reducing the degree of pain in Frozen Shoulder showed that acupuncture therapy experienced a degree of pain 0.48 units lower than without acupuncture and was statistically significant (SMD = -0.48; 95% CI = -1.14 to 0.18; p=0.15) There are 3 primary research articles that show significant value in acupuncture therapy studies for reducing the degree of pain in Frozen Shoulder marked by not touching the horizontal line of each study with the vertical line in the forest plot. This significance value is influenced by several factors, including in the 5 articles the number of samples between the control group and the intervention group is the same so that the number of proportions for both is balanced.

Acupuncture therapy is a special needle which is also called a filiform needle inserted at certain points on the human body or also called acupoints and manipulated in such a way as to form stimulation to achieve healing (Zhao et al., 2017). Acupuncture can be considered as a balance in the body, this balance is used to activate the body's meridians and acupuncture points using manipulation techniques according to com-

plaints. Currently, acupuncture has been widely used for pain cases, one of which is Frozen Shoulder.

Several studies have shown the effect of acupuncture therapy on reducing the degree of pain in Frozen Shoulder, one of which is a study conducted by Shi (2018) which examined providing acupuncture therapy and motion exercises to Frozen Shoulder patients with a total of 82 study subjects with a diagnosis of Frozen Shoulder. Acupuncture treatment therapy was administered with Outcomes assessed at baseline and at 6, 10, and 18 weeks after randomization. The degree of pain before the acupuncture intervention (Mean= 70.4; SD=13.4), was higher than after the acupuncture intervention (Mean= 35.3; SD=25.7).

A theory of acupuncture based on the premise that there is a flow of energy (Qi) through the body that is essential for health. Disruption of this flow is believed to be the cause of a disease. The insertion of acupuncture needles into acupuncture points or acupoints results in the release of endogenous opioids by stimulating the nerve endings of pain receptors which are known to be involved in pain control. Neurotransmitters involved in the analgesic system such as beta-endorphins, serotonin and enkephalins play a very important role in this mechanism (Sahin et al., 2015).

So far, sticking acupuncture needles into the body is aimed at restoring balance (Saputra, 2017), as well as reducing pain with the principle of activating inhibitory neurotransmitters (β-endorphins, dynorphins, enkephalins, serotonin, nor-adrenaline) and preventing pain from reaching the brain (Wignyomartono, 2012). Acupuncture can produce and release endogenous opioids, which bind to opiate receptors in the brain and mediate analgesia through the descending pain inhibitory system (Vijayalakshmi et al., 2014).

The mechanism of acupuncture analgesia is nerve stimulation with an acupuncture needle stabbed in the muscle tissue and then a reaction occurs sending messages from the nerve impulses to the spinal cord, then forwarded to the spinal cord, mesencephalon, pituitary hypothalamus complex, stimulation in that area can release neurotransmitters (endorphins and monoamines) which inhibits pain messages from coming (Kawakita and Okada, 2014).

Meta-analysis was conducted on 9 primary randomized control trials conducted from 2 continents, namely Asia and Europe with a total sample of 479. Patients with Frozen Shoulder who received acupuncture therapy experienced a degree of pain 0.48 units lower than without acupuncture and significantly statistically significant (SMD= -0.48; 95% CI= -1.14 to 0.18; p=0.15). The results also showed high heterogeneity in effect estimates between studies (I^2=91 %; p<0.001). The results of the distribution of effect estimates between studies were more or less symmetrical to the right and left of the vertical mean estimate line indicating that there was no publication bias in this meta-analytic study. The limitation of this research is that it only uses 4 databases, namely PubMed, Google Scholar, Hindawi, and BMC, thus ignoring other database sources. In addition, this research also has limitations in translating languages so that it only uses articles published in Indonesian and English and then ignores articles published in other languages.

AUTHORS CONTRIBUTION

Mehdya Vikia Murti is the main researcher who selects topics, searches for and collects research data. Hanung Prasetya and Rita Benya Adriani analyzed the data and reviewed research documents.

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