HYDROTHERAPY AS A TREATMENT FOR NON-SPECIFIC LOW BACK PAIN: A SYSTEMATIC REVIEW

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ABSTRACT

Introduction: Properties of water like viscosity, buoyancy, and thermodynamics in hydrotherapy have been utilized to manage numerous musculoskeletal conditions, including non-specific low back pain (NSLBP). People with NSLBP experienced increased disability and depression. Vast of reviews regarding general management of low back pain in physical therapy was done. However, the review of the specific population of NSLBP and hydrotherapy is limited. Therefore, this study aims to systematically review randomized controlled trials on the effectiveness of hydrotherapy as management for NSLBP.

Methods: The data were searched using synonyms for "Hydrotherapy" and "NSLBP" within 2009 to 2019. The databases from the allied health science's field like Cinahl, Wiley Online Library, Taylor and Francis Online, Scopus, Science Direct, and Oxford Academic. The study selection was guided by inclusion criteria that had been justified.

Results From 214 articles, only eight articles were included. The articles were appraised and extracted by using the McMaster Critical Review Form for Quantitative Studies. The two poor methodological quality studies were excluded from the critical review due to insufficient information to assist the study. The methodological quality of the six included articles ranged from "fair" to "very good".

Conclusion There was a significant reduction in pre and post visual analog score (VAS) in the hydrotherapy group compared to no hydrotherapy group. However, the no hydrotherapy group reported a reduction of VAS but not significant. In conclusion, hydrotherapy offers a greater reduction of pain compared to no hydrotherapy group. Future research should include higher methodological quality studies to support the current finding.

Key words: hydrotherapy, back pain, disability, quality of life

INTRODUCTION

Low back pain (LBP) is a pain and discomfort between the costal margin and the inferior gluteal folds, with or without referred leg pain (Benzon et al., 2014). Some people will experience burning, throbbing, aching, sharp, or dull (Firestein, Gabriel, O'Dell, Budd, & McInnes, 2017). One will experience pain ranging from mild to severe LBP, and it can be sudden or gradual pain. LBP can be specific and nonspecific. The examples of specific LBP include Infection, tumor, cauda equina syndrome, fracture, inflammatory process, ankylosing spondylitis, radicular syndrome, or osteoporosis etc. Non-specific low back pain (NSLBP), it is defined as LBP not attributed to known specific pathology of LBP (Béatrice Duthey, 2013).

According to National Medical Care Statistics 2014 by Clinical Research Centre, Ministry of Health Malaysia, musculoskeletal symptom/complaints were the fifth most referral in primary care, while the back problem was among the top ten reasons most encounter in private clinics. This data indicates that back pain is quite a

common condition reported in Malaysia's primary care. Back muscle functions for optimal control of spinal and trunk movement. When there is pain or injury to the back muscle, it affects the structure and function of the muscle. Long term pain can cause structural and functional changes in the back muscles, such as atrophy, reduced endurance, or strength (Hodges & Danneels, 2019). It is believed that therapeutic exercise can activate back muscles and consequently reduce the pain intensity in LBP (Berry et al., 2019). One of the alternative therapeutic exercise treatment methods is hydrotherapy.

The effectiveness of hydrotherapy intervention is still debatable among researchers. Masumoto (2005) said there is a significant improvement in pain tolerance but not in muscle strength, while Gunsoo Han (2011) said there is a relevant improvement in both pain tolerance and muscle strength. This statement is also supported by Olson (2012); water has been highly considered for the rehabilitation of patients with back pain due to its seven main properties, such as buoyancy, density, and hydrostatic pressure that promising low-risk intervention in treating LBP. Regardless of various research studies, however, there is still no convincing evidence on the outcome of hydrotherapy in NSLBP. There was insufficient evidence to recommend hydrotherapy as an effective treatment for patients with LBP in physical rehabilitation management. Therefore, this research aims to systematically analyse all evidence available in the literature about the effectiveness of hydrotherapy in managing NSLBP.

NSLBP causes frustration and disability among sufferers. It is more burdening when there are recurrent episodes of LBP. It just does not affect physical wellbeing but it also affects the mental health too (Farrag, Nasar, Assaf, Ibrahim, & Al-Sheikh, 2019). This happens when NSLBP causes significant impairment in quality of life, because of which one frequently takes the medical leave, it may even be challenging to continue the studies, and even to socialize with friends. There are many causes of NSLBP; some are prolonged abnormal posture, reduced muscle strength, and endurance, muscle tightness, or even impairment in the inert structure of the spine like the posterior intervertebral disc dislocation.

Hydrotherapy may be an alternative solution to the NSLBP. Hydrotherapy uses the unique physical characteristics of water that offer pain-free exercise, natural resistance, and counterbalance gravity that can enhance the flexibility and strength of the abdominal and trunk muscles. Due to limited research previously, the current study is focussed on use of hydrotherapy in the NSLBP population. Parallel to this view, it is expected that this study can offer this population a better way to implement sufficient hydrotherapy as an alternative solution for NSLBP.

The aim of the current systematic review was to know the effects of hydrotherapy on the management of acute or chronic NSLBP. The aim of study was to systematically review the effect of hydrotherapy on pain intensity among patients with NSLBP.

Further, this study aims to promote people to participate in exercises actively and to keep up with a healthy lifestyle regardless of their underlying comorbidities.

The findings from this study will provide information regarding the outcome of hydrotherapy treatment on LBP. Besides, hydrotherapy can be alternative management for patients with NSLBP. Besides that, it also may add valuable information on the effectiveness of hydrotherapy on NSLBP and simultaneously provide an improvement to the quality of healthcare service especially in LBP. From this systematic review, the limitation of the study will be taken as an improvement in further research.

There are many alternatives to treating low back pain; some are laser, acupuncture, tai chi, yoga, and hydrotherapy. Each of these interventions has its benefits as well. Hydrotherapy offers benefits due to the unique properties of water, like the density and specific gravity, hydrostatic pressure, buoyancy, viscosity, and thermodynamics (Becker, 2009). People with LBP frequently complain of difficulty in doing exercises on land. Because of gravity and high impact on land there is elevated pain intensity accompanied by fear-avoidance behaviour or lack of motor control (Becker, 2009).

Buoyancy of water that causes the body to offload the immersed joints named buoyancy. It relaxes the muscles, and the limbs are more comfortable to move and offload the immersed joints (Lorrez-Ronda Alcazar, 2014). Therefore, due to buoyancy property, an individual will have less impact and simultaneously offer a more pain-free exercise.

The property of density water will exert higher force to the human body and caused the human body to float (Lorrez-Ronda & Alcazar, 2014).

When there is motion in the fluid, it faces the resistances, which are shape, wave, and friction resistance due to viscosity (Lorrez-Ronda & Alcazar, 2014). All this type of resistance acts as natural resistance to the body in water. Different temperature setting offers a different therapeutic effect. For example, 37.5- 41ºC gives relaxation effect to the participant since water transfer heat 25 times faster than air (Lorrez-Ronda & Alcazar, 2014).

Han et al. (2011) designed aquatic therapy in 19 elderly subjects with LBP and found that, aquatic exercise significantly reduced pain and improved muscle strength. The viscosity can provide natural resistance during exercise; therefore, there is a significant improvement in muscle power.

Baena-Beato et al. (2015) found that eight weeks of intensive hydrotherapy program of high-frequency (five times/week) decreases back pain intensity and disability, improves the quality of life and improves body composition and health-related fitness in sedentary adults with chronic LBP.

Rakhi (2019) performed an experimental study comparing conventional physiotherapy and hydrotherapy-based exercise for chronic NSLBP. They found that there is a significant improvement of pain between the two groups; however, no significant difference in the range of motion, muscle power, and Modified Oswestry Low Back Pain Disability Index. Rakhi (2019) mentioned that exercise in water takes the weight off a painful joint while also providing resistance,

improved muscle strength, greater flexibility, and range of motion of the spine. Hydrotherapy based exercise able to reduced stress in the back pain and keeps the body in a neutral spine position during exercises.

Bello et al. (2010), in their experiment regarding the management of chronic LBP pain using land-based versus hydrotherapy, measure the spine mobility and pain score. They found that the pain and trunk extensor endurance has a significant improvement compared to the initial measurement. This result confirms hydrotherapy as a treatment of choice for exercise performance. The buoyancy effect reduces gravitational force acting on the musculoskeletal system, thereby granting a difficult-free movement and conservation of energy.

METHODOLOGY/ METHODS

This study used Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines as a method to assist in reporting the findings. The result of the systematic review on the effects of an intervention from the randomized controlled trials or other types of study was reported by PRISMA (Brooks & Mcneely, 2013).
The PRISMA flow chart has verified the number of studies identified, screened, eligible, and finally included (Brooks & Mcneely, 2013). Figure 1 shows the guideline of PRISMA (Moher et al., 2009).

INCLUSION CRITERIA

Before the data collection process commenced, a list of inclusion criteria was constructed. It was established to ensure the data collection process corresponded with the aim of the study. The inclusion criteria was defined using the PICOS (Population, Intervention, Comparison, Outcome, and Study Design) model as described in Table 1. Those studies that do not fit the inclusion criteria were excluded and recorded with reasons. The articles that were should be published in the English language and in full-text version to assist in assessing the methodological quality.

EXCLUSION CRITERIA

Conditions other than NSLBP, date of publication before 2009 and studies not published in English

Table 1: Component of PICOS and its Description

Component	Justification
P: Aged above 18-60 years old / Female / Male with NSLBP	To obtain heterogeneity across the studies.

I: Hydrotherapy / Aquatic Therapy / Aquatic Exercises	Focus on intervention provided in ordinary water without a mixture of any remedy like in balneotherapy and spa therapy.
C: Land exercises / Control / No intervention	A comparison should be with any no hydrotherapy group to achieve a robust comparison between hydrotherapy and no hydrotherapy treatment.
O: Any appropriate pain assessment tool	To measure the pain intensity in pre and post-treatment.
S: Randomised Controlled Trial (RCT)	RCT offers the best study design in evaluating treatment effectiveness (Hariton & Locascio, 2018).

IDENTIFICATION

There are two steps in identification that were used in this study, which seek articles through databases and additional through other sources. The health-based databases searching were the PubMed, IIUM Library database, PEDro (Physiotherapy Evidence Database), Medline (Bibliographic Medical Database), Cochrane Library, SPORTDiscus, and EMBASE, Cumulative Index to Nursing and Allied Health Science (CINAHL) database. The year for the study were ranging from 2009-2019. Besides the databases, another additional source like Google Scholar was used. The above-mentioned databases were used as they are health-based databases and published RCT studies.

The identification process used the following combination of terms; "non-specific low back pain", "non-specific lower back pain", "non-specific low backache", "non-specific lower backache", "recurrent non-specific low back pain", "mechanical low back pain", "postural low back pain" in combination with "hydrotherapy", "aquatic therapy", "aquatic exercise", "hydro exercises", "water exercises" and "water therapy". The boolean operator like "OR" and "AND" also were utilized in this process. The bibliographies from the previous systematic review and the selected articles hat related to the study were review to identify any additional studies.

SCREENING

All the collected studies were screened to sort out any duplicates. The remaining studies were screened by the title and abstract related to the research question and objectives. The study that is irrelevant, inappropriate, or does not meet the one or more inclusion criteria were excluded and recorded with reasons.

ELIGIBILITY

The full texts of the included studies were obtained, and further screening process was done according to the inclusion criteria. The eligibility of the screened studies was reviewed, as stated in the PICOS model mentioned above model. Those studies that do not fit the inclusion criteria were excluded and recorded with reasons. The articles

that fulfilled the inclusion criteria and the eligibility criteria were included in the study.

METHODOLOGICAL QUALITY ASSESSMENT

McMaster Critical Review Form for Quantitative Studies was used to assess the methodological quality of the included studies. The form was composed of 17 items. The study's purpose, study design, sample, outcome measure, intervention, results, and the conclusion are the components that were assessed to qualify the methodological quality of each study. This assessment is guided by The Guidelines for Critical Review Form for Quantitative Studies.

For the scoring system, each item is scored as "one" when it fulfilled the criteria and "zero" if it did not fulfil the criteria. The quality of methodology was categorized by the total score added from each item. The study that scored from "0 to 8" was categories as poor, "9 to 10" as fair, "11 to 12" as good, "13 to 14" as very good, and "15 to 16" as excellent methodological quality (Wells, Kolt, Marshall, Hill, & Bialocerkowski, 2014). As this review only selected RCT study design; therefore, item 3 is not applicable to be scored. Table 3.2 shows the item and description of the item used in assessing methodological quality.

Table 2: Item and Description in the McMaster Critical Review Form for Quantitative Studies

Item	Description
1. Purpose	Was the purpose stated clearly?
2. Literature review	Was relevant background literature reviewed?
3. Study Design	What is the study design?
4. Sample Size Justification	Was the sample justified?
5. Sample Size	Was the sample described in detail?
6. Reliability of Outcome Measure	Were the outcome measures reliable?
7. Validity of Outcome Measure	Were the outcome measures valid?
8. Intervention Described in Detail	Intervention was described in detail?
9. Contamination	Contamination was avoided?
10. Co-intervention	Co-intervention was avoided?
11. Statistically Significant	Results were reported in terms of statistical significance?

12. Statistical Analysis	Were the analysis method(s) appropriate?
13. Clinical Importance	Clinical importance was reported?
14. Drop-Outs	Drop-outs were reported?
15. Conclusion	Was the conclusion appropriate given study methods and results?
16. Clinical Implications	Were the implications of these results for practice reported?
17. Study Limitations	Were the main limitations or biases in the study reported?

RESULTS

The data was collected from seven databases which are Cinahl, Wiley Online Library, Taylor and Francis Online, Scopus, PeDro, Proquest, Oxford Academic, and Science Direct. In the identification process, a total of 207 articles were collected from the databases and seven articles from the additional sources. Articles from the additional sources were acquired from Google Scholar and the bibliography of other studies.

From the total number of articles, 188 duplicate articles were excluded in the screening process. Then the titles and abstracts from the collected articles were further inspected. 167 articles were excluded at the end of the screening process. The articles were excluded due to not published in the English language, not evaluating the effects of hydrotherapy, and not focusing in population with NSLBP.

In the eligibility process, the full-texts of the screened articles were obtained. Fifteen articles were excluded because not focusing on people with NSLBP and not comparing hydrotherapy group with non-hydrotherapy group like control group or land-based exercise group. In the final process, eight included articles were selected for the systematic review. Figure 2 presents the processes of identification, screening, eligibility and included by using PRISMA guideline.

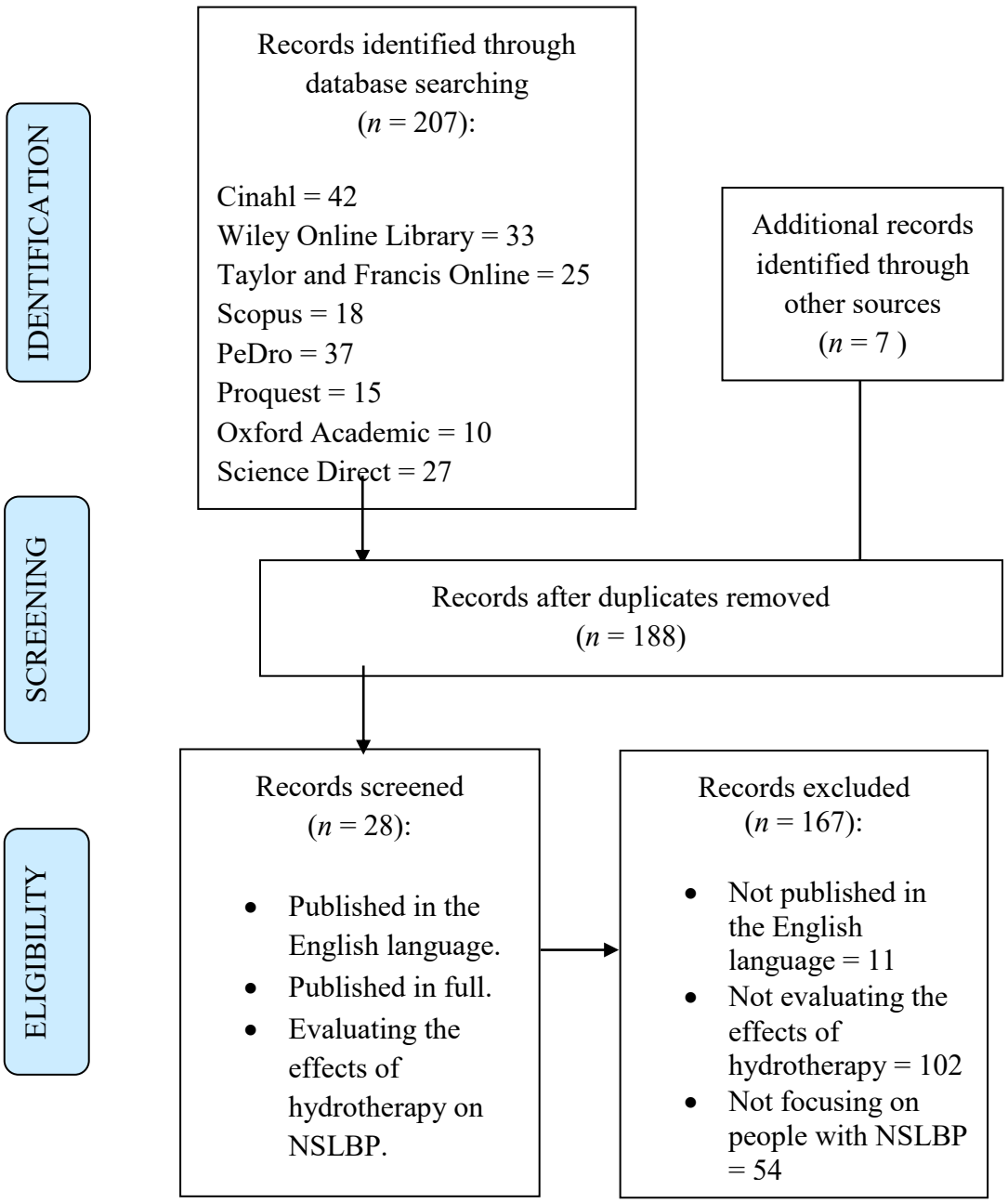

Figure 1. The Processes of Identification, Screening, Eligibility and Included by using PRISMA Guideline

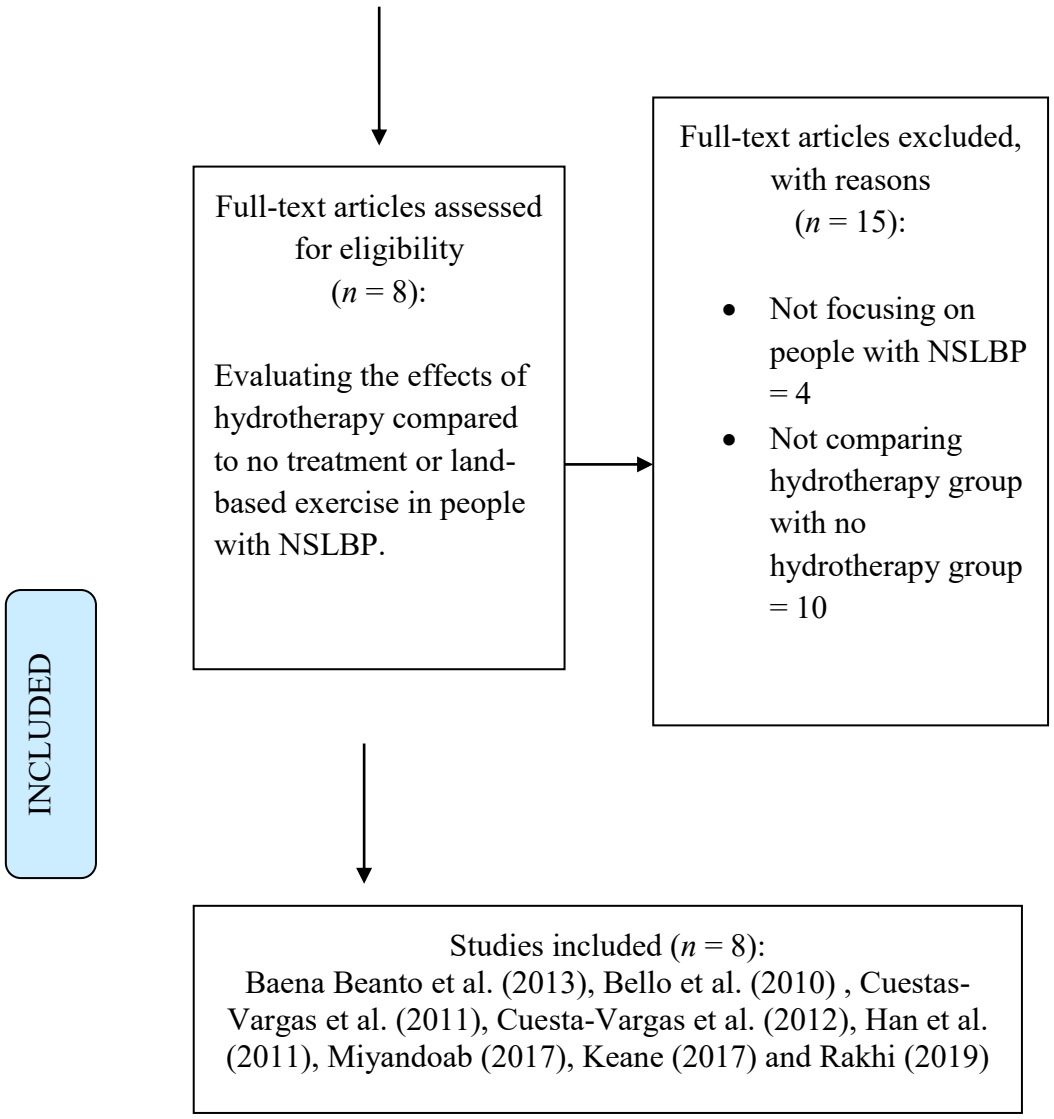

Figure 2. The Processes of Identification, Screening, Eligibility and Included by using PRISMA Guideline- Continued

METHODOLOGICAL QUALITY

A total of 17 items in this methodological quality assessment form were assessed. From the identification, screening, and eligibility processes, only eight studies were included to be assessed. The methodological quality was assessed by two reviews using the McMaster Critical Review Form for Quantitative Studies. The scoring

system for this assessment form was adapted from the McMaster Critical appraisal form for Quantities study, which has been used by a study from Wells, Kolt, Marshall, Hill, and Bialocerkowski (2014). Table 3 presents the methodological quality of the included studies using the McMaster Critical Review Form for Quantitative Studies.

Table 3. The Methodological Quality of the Included Studies using the McMaster Critical Review Form for Quantitative Studies

Individual Item	Study							
	Baena-Beanto et al. (2013)	Miyandoab (2017)	Bello et al. (2010)	Cuesta-Vargas et al. (2011)	Cuesta-Vargas et al. (2012)	Han et al. (2011)	Rakhi (2019)	Keane (2017)
1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1
3	NA	NA	NA	NA	NA	NA	NA	NA
4	0	0	0	0	0	0	0	0
5	0	0	1	1	1	0	1	1
6	1	0	0	0	1	0	0	0
7	0	0	1	0	0	0	1	1
8	1	0	1	1	1	0	0	1
9	1	0	1	1	1	0	0	0
10	1	0	1	1	1	0	0	1
11	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1
13	1	1	1	1	1	0	0	0
14	1	0	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	0	1
Total (/16)	13	8	14	13	14	8	9	12
Qualitative Descriptor	Very Good	Poor	Very Good	Very Good	Very Good	Poor	Fair	Good

Two reviewers reviewed the eight selected studies. The agreement for the quality of assessment score was achieved from the discussion between both reviewers. The methodological quality of studies ranged from 6 to 14, representing "poor" to "very good" methodological quality. Baena-Beanto (2013), Bello (2010), Cuesta-Vargas (2011), and Cuesta-Vargas (2012) were the studies that were representing very good methodological quality. They were scored as very good quality because they described the sample size, justified the selected sample size, reported the reliability and validity of each outcome measures used, and described the procedure in detail that was able for replication in practice. Keane (2016) and Rakhi (2019) were categorized as good and fair.

However, two studies scored poor methodological qualities, Han et al. (2011) and Miyandoab (2017). They were categorized as a study with poor methodological quality due to lack of sample size description and justification, did not report the reliability and validity of the outcome measures used. These failed to describe intervention conducted in detailed and did not state any report on how they control the contamination, co-intervention, and managed drop-outs. The poor methodological quality studies were excluded from the assessed studies as they were unable to provide sufficient information for this review.

Therefore, the included studies were Beana-Beanto et al. (2013), Bello et al. (2010), Cuesta-Vargas et al. (2011), Cuesta-Vargas et al. (2012), Keane (2017), and Rakhi (2019). Keane (2017) and Rakhi (2019) were the two additional studies that have not been reviewed by the previous systematic review studies.

DESCRIPTION OF INCLUDED STUDIES

From the six included articles, the number of subjects who participated in the study ranged from 12 to 58. The ages were ranged from 18 to 60 years old. The statistical analysis reported the mean difference of post-intervention VAS between the groups, pre and post-intervention VAS between the groups, and pre and post-intervention VAS within the group. The significant level of all studies was set at $p < 0.05$. The population, intervention, comparison, and outcome measures for each included article were tabulated in Table 4.

Table 4. The Study, Methodological Quality, Score, Population, Intervention, Comparison, Outcome Measures and Results for each Included Articles

Study **[Methodological Quality, Score]**	**Population**	**Intervention and Comparison**	**Outcome Measures** **[Timing]**	**Result**
Baena-Beanto et al. (2013) **[Very Good, 13/16]**	49 self-reported nonspecific chronic LBP	Aquatic therapy (n = 24): In a 29 ± 1°C of pool water temperature, done 10 minutes of warm-up, 15–20 minutes of resistance exercise, 20–25 minutes of aerobic exercise, and 10 minutes of cool-down supervised session per week. Equipment used is noodle and cuff. No exercise (n = 25)	Visual Analog Score (VAS) [2 months, 40 sessions 5 days per week]	Significant reduction of the pre and post-treatment VAS in the aquatic therapy group compared to no exercise group ($p < 0.001$).

Table 4. The Study, Methodological Quality, Score, Population, Intervention, Comparison, Outcome Measures and Results for each Included Articles- Continued

Bello et al. (2010) **[Very Good, 14/16]**	12 mechanical chronic low back pain	Hydrotherapy (n = 6): In 32 to 34 °C pool water temperature, done warm-up and stretching phase, main exercise phase, and cool-down phase 45-60 minutes supervised session per week. Land-based (n = 6): Same as hydrotherapy but on land 45-60 minutes supervised session per week.	Visual Analog Score [6 weeks]	No significant reduction of the post-intervention VAS between hydrotherapy and land-based group (p = 0.532). Significant decrease of the post treatment VAS within each group. Hydrotherapy group reported p = 0.024 while the land-based group with p = 0.025.
Cuesta-Vargas et al. (2011) **[Very Good, 13/16]**	46 non-specific chronic low back pain	20 minutes deep water running (DWR) + Multimodal physical therapy program (MMPTP) (n = 25): Manual therapy, education and exercises 15 minutes of mobility exercises, 15 minutes of motor control activities, 30 minutes of resistance and muscle strengthening exercises supervised session per week. MMPTP (n = 24): Received the same manual therapy and education supervised session per week.	Visual Analog Score [15 weeks, 3 times per week]	No significant reduction of the post-intervention VAS between DWR and MMPTP with MMPTP alone ($p > 0.05$). Significant decrease of the post-treatment VAS within each group ($p < 0.05$).

Table 4. The Study, Methodological Quality, Score, Population, Intervention, Comparison, Outcome Measures and Results for each Included Articles- Continued

Cuesta-Vargas et al. (2012) **[Very Good, 14/16]**	58 nonspecific chronic low back pain	DWR and general practice (GP) (n = 25): 30 minutes of DWR equipped with flotation belts supervised session per week. General practice (GP) which participants were given consultation and educational booklet. GP (n = 24): Participants were given consultation and educational booklet.	Visual Analog Score [4 months, 3 times per week, 6 months, 12 months]	Significant reduction of the post-treatment VAS in the GP and DWR group compared to GP alone (p = 0.049).
Rakhi (2019) **[Fair, 9/16]**	30 nonspecific chronic low back pain	Hydrotherapy (n = 15): Stretching exercises for hip and lower back, 13 strengthening exercises for abdominals, glutei, trunk, lumbar and lower limb and walking forward and backward supervised session. Conventional therapy (n = 15): Hot packs for 15 min, supervised session of static back exercises, Stretching, strengthening exercises with ergonomic advice.	Visual Analog Score [NA]	Significant reduction of the post-treatment VAS in the hydrotherapy group compared to the conventional therapy group (p = 0.018). Significant decrease in the post-treatment VAS within each group (p < 0.05).
Keane (2017) **[Good, 12/16]**	29 nonspecific chronic low back pain	Aqua stretch (n = 10): In 30°C of pool water temperature, done 30-minute aqua stretch sessions with pool temperature of 30°C. Procedure of play, freeze, pressure and move. Stretch with wall hang procedure and one leg standing weighted procedure supervised session per week. Land-based (n = 10): Static and dynamic	Visual Analog Score [12 weeks, 2 times per week]	Significant reduction of the pre and post-treatment VAS within the aqua stretch group (p = 0.006). The land-based and control group reported a no significant reduction of the pre and post-treatment VAS within the group.

Table 4. The Study, Methodological Quality, Score, Population, Intervention, Comparison, Outcome Measures and Results for each Included Articles- Continued

	stretching for lumbo-pelvic-hip complex and upper body supervised session per week. Control (n = 9): maintained any pre-trial treatment and/or exercise program unsupervised session.	

SUBJECTS CHARACTERISTICS

A total of 224 subjects with non-specific chronic LBP, and mechanical chronic LBP were randomly assigned in the hydrotherapy and no hydrotherapy group. Table 4 listed more detailed patient characteristics of the included studies.

INTERVENTION

From the six included studies, four studies divided the subjects into the experimental and control groups. However, Keane (2017) randomly assigned the subjects into three groups which were the aqua stretch group, land stretch group, and control group.

The hydrotherapy group received water-based therapeutic exercises, aqua stretch, deep water running, multimodal physiotherapy intervention, and general practice. The non hydrotherapy group received the land-based therapeutic exercises, multimodal physiotherapy intervention, general practice, and no exercise. Beana-Beanto et al. (2013) and Keane (2017) are only studies that kept the control group from any exercises or general practice.

The water-based therapeutic exercises were the strengthening and stretching exercises. It included rectus abdominal, erector spinae, glutes, and hamstrings stretching and strengthening exercises. Some of the exercises were squatting, hip flexion, hip abduction, and lunges. The land-based therapeutic exercises were the same as the exercises mentioned above, but it was done on land.

The deepwater running is one of high-intensity aerobic exercise, it was conducted by running in the water for 20 to 30 minutes with flotation belts, which were provided to the participant. Multimodal physiotherapy programs included mobility exercises, motor control activities, manual therapy, resistance exercises, and patient education. Conventional therapy used hot packs, stretching and strengthening exercises, and ergonomic advice. Aqua stretch consisted of stretch with wall hang procedure and one-leg standing weighted procedure. For general practice, the subjects were given consultation and educational booklets. Table 4 listed the more specific intervention used in the included studies.

DURATION OF ASSESSMENT

The duration of intervention ranged from 30 to 60 minutes, two to five times per week. Rakhi (2019) conducted the least duration of the assessment, which was only one session only, Cuesta-Vargas et al. (2012) made up the highest follow-up which was up to 12 months while the other assessed ranged from six to eight weeks. Table 4 listed more details duration of the assessment conducted in the included studies.

Visual Analog Score was used by the six included studies to rate pain intensity. All studies used 10cm VAS except Cuesta-Vargas et al. (2011) and Cuesta-Vargas et al. (2012) that used 100mm for the pain score. Table 4 listed the more specific outcome measure used, baseline, and post-intervention mean (SD) VAS in the included studies.

From the data extracted, only Baena-Beanto et al. (2013) reported the mean difference of VAS in the pre- and post-intervention between the hydrotherapy and no exercise group. Bello et al. (2010), Cuesta-Vargas et al. (2011), Cuesta Vargas et al. (2012), and Rakhi (2019) reported a mean difference of VAS in the post-intervention between the hydrotherapy and no exercise group while Keane (2017) only reported the mean difference of VAS in the pre- and post-treatment within the group.

From the tabulated results, Bello et al. (2010) and Cuesta-Vargas et al. (2011) reported that there was no significant difference in the post-intervention VAS reduction between the hydrotherapy group and no hydrotherapy group. Nevertheless, the hydrotherapy group reported more pain reduction compared to no hydrotherapy group.

On the contrary, Cuesta-Vargas et al. (2012) and Rakhi (2019) recorded a significant difference in the post-intervention VAS in the hydrotherapy group compared to no hydrotherapy group. Keane (2017) also noted a significant VAS reduction in the pre- and post-intervention within the intervention group. This finding was parallel with Beana-Beanto et al. (2013), where they found that there was a significant decrease of VAS in pre and post hydrotherapy sessions compared to no exercise group. From the study, there was a significant reduction of the post-intervention VAS in the hydrotherapy group compared to no exercise group. Table 4 listed the detailed results in the included studies.

DISCUSSION

From the six studies, only four (Baena-Beanto et al., 2013; Bello et al., 2010; Cuesta-Vargas et al., 2011; & Cuesta-Vargas et al., 2012), reported as very good methodological studies and the remaining categorized as good (Keane, 2017) and fair (Rakhi, 2019). Out of four very good methodological quality studies, only two studies (Baena-Beanto et al., 2011 & Cuesta-Vargas et al., 2012), one good methodological quality study (Keane, 2017) and a fair methodological quality study (Rakhi, 2019) reported there was a significant reduction of VAS after the hydrotherapy session compared to no hydrotherapy session.

While the other two very good methodological quality studies (Bello et al., 2010 & Cuesta-Vargas et al., 2011) stated that both groups reported a reduction of VAS. However, there was no significant difference between the groups reported. It can be concluded that there was a significant reduction of pain post hydrotherapy session on NSLBP. This result is consistent with a systematic review done by Shi et al. (2017). They found that hydrotherapy showed statistically significantly reduce pain among LBP. Besides that, the other systematic review (Olson, 2011) supported that the aquatic exercise group is more effective than no exercise group.

The study involved hydrotherapy in managing rheumatoid arthritis also reported a positive outcome in pain management (Al-Qubaeissy, Fatoye, Goodwin, & Yohannes, 2012). Besides that, Corvillo et al. (2019) also stated that a significant reduction of neck pain after the aquatic therapy sessions compared to no treatment or other treatment. It is in line with Neira, Marques, Pérez, Cervantes, and Costa (2017) that pain among subjects with fibromyalgia was significantly improved after the aquatic therapy sessions. A six-week aquatic therapy session on

persistent knee pain patients also reported a significant reduction of pain compared to usual medical care and adjunctive therapies. (Mcilroy, Sayliss, Browning, & Bearne, 2017)

However, no hydrotherapy group like land-based, MMPTP etc has proven to manage low back pain. It is proven that exercises in any medium can improve physical function. Beana-Beanto et al. (2013) reported the land-based therapeutic exercises had the same pain reduction as the hydrotherapy group. This finding was supported by (Moon et al., 2013) that strengthening exercise on land also provide significant reduction of VAS among chronic LBP participants. Olson (2011) compared aquatic exercise with land-based exercise and found that there were no significant differences in VAS between the two sessions.

Hydrotherapy can reduce pain among LBP sufferers by counterbalancing the effect of gravity. The counterbalancing gravity effect will reduce the impact on the joints; thus, it is beneficial for those with pain or overweight (Torres-Ronda & Alcázar, 2014). Keane (2017) was able to reduce the pain from 5.7 to 2.6 post-intervention compared to the land based stretching exercise. This is because the gravity limits stretching exercise on land while in water, joints can move freely in all directions.

Apart from that, the strengthening exercises done in the hydrotherapy group as reported by Beana Beanto et al. (2013), Bello et al. (2010), and Rakhi (2019) also resulted in a reduction of pain. Becker (2009) stated that the viscosity of water will provide resistance to the body. This will be used to get the benefits of strengthening exercises.

The DWR also significantly reduce pain as this exercise give valuable effects in improving the physical function as mobility, and muscle endurance. Nava, Tozim, Morcelli, and Navega (2018) mentioned that there is an association between low back pain and the reduction of trunk muscle endurance. Thus DWR will benefit patients with NSLBP.

Beana-Beanto et al. (2013), Cuesta-Vargas et al. (2012), Keane (2017), and Rakhi (2019) concluded the duration for each hydrotherapy session was 30 to 60 minutes. And those studies reported a significant reduction of pain in the hydrotherapy group compared to no hydrotherapy group. Thus, it justifies that 30 to 60 minute of the intervention was effective in treating pain.

Besides that, the studies, as mentioned earlier, also proved that short-term hydrotherapy sessions effectively manage NSLBP. The duration of assessment across the studies was ranging between six weeks to 15 weeks. Only Cuesta-Vargas et al. (2012) reported the duration of assessment up to 1 year of follow-up. More long-term studies are needed to support the effectiveness of hydrotherapy.

IMPLICATIONS AND CONCLUSION

It can be concluded that there was a significant reduction of pain post hydrotherapy session compared to no hydrotherapy session among NSLBP patients. This reflected that hydrotherapy was effective as the alternative approach in managing NSLBP compared to no hydrotherapy approach like land-based therapeutic therapy, multimodal physiotherapy program, and general practice.

Hydrotherapy could be the treatment of choice and proven to be effective than any other intervention. Regardless of their comorbidity, people can always stay active while receiving the indirect benefits of exercises in reducing their pain and simultaneously improving their quality of life. Water-based therapeutic exercises, aqua stretch, and DRW are the example of hydrotherapy intervention. The uniqueness of hydrotherapy that not limit their intervention in one approach only can give people a flexible choice to choose their preferred mode of exercise.

This finding can be as the added value in improving the quality of healthcare system. It fulfilled World Health Organization's goal in achieving high-quality system, which is customer-centered (WHO, 2015). By offering the effective treatment to the patient, it contributes patient satisfaction to the healthcare service provided.

However, no hydrotherapy approach like land-based therapeutic exercise and MMPTP also reported a decrease in VAS. It is upon one's preference whether he or she prefers to be in a traditional exercise way or trying something new that can help them with their current concern like NSLBP.

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