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REVIEW PAPER

Efficacy of hydrotherapy, spa therapy, and balneotherapy on sleep quality: a systematic review

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Abstract

The purpose of this article was to review and assess the results obtained from human studies on the effects of hydrotherapy, balneotherapy, and spa therapy on sleep disorders. In this study, databases such as Pubmed, Embase, Web of Science, Google Scholar, Cochrane, Scopus, and sciences direct database were searched from the beginning to September 2022. All human studies that examined the effect of hydrotherapy, balneotherapy, and spa therapy on sleep disorders were published in the form of a full article in English. In the end, only 18 of the 189 articles met the criteria for analysis. Most studies have shown that balneotherapy, spa therapy, and hydrotherapy may by affecting some hormones such as histamine, serotonin, sympathetic nerves, and regulating body temperature led to increased quality and quantity of sleep. Also, the results obtained from Downs and Black show that 3 studies were rated as very good, 7 studies as good, 7 studies as fair, and 1 study as weak. The results of studies also showed that hydrotherapy leads to an improvement in the PSQI score index. Nevertheless, more clinical trials are needed to determine the mechanism of action of hydrotherapy on sleep disorders.

Keywords Hydrotherapy · Sleep disorder · Traditional medicine · Systematic review

Introduction

Sleep is one of the important physiological mechanisms of life that plays a great role in recovery and fatigue caused by body activities during the day and the growth and development of various body tissues (Li et al. 2013). The prevalence of sleep deprivation is increasing among the elderly (Amagai et al. 2010). Dissatisfaction with sleep at night occurs in 45% of people. Chronic insomnia is one of the most common sleep disorders (Qiu et al. 2011). The incidence of insomnia is estimated at 9 to 15%. The clinical significance of insomnia is determined by its negative impact on social aspects, economic performance, and human health (Qiu et al. 2011; Li et al. 2013). Defining and measuring sleep quality are difficult due to the complexity and variety of sleep in individuals (Dewald et al. 2010; Doğan et al. 2005). Quality includes quantitative features such as the latency, sleep duration, number of night awakenings, and other aspects like relaxation, sleep depth, and rest after sleep (Doğan et al. 2005). Inadequate sleep can lead to poor health, including excessive depression, high blood pressure, obesity, diabetes, non-alcoholic liver function, and associated functional limitations (Qiu et al. 2011; Li et al. 2013; Bixler et al. 2005). Several studies have shown that sleep deprivation in the elderly is related with adverse subsequences such as falls, depression, accidents, decreased reduced self-care, cognitive activity, poor health, decreased quality of life, and eventually augmented mortality. Increased levels of anxiety and napping during the day are also related to poor sleep (Li et al. 2013; Chan et al. 2010; Zilli et al. 2009). Medication is one of the most common treatments for sleep problems. The main objective is to avoid the use of sleeping pills by non-medicinal approaches which are more durable and do not present undesirable effects such as dependence to these drugs (Altena et al. 2020; Dement 1983). There is a relationship among the central body temperature, circadian rhythm

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of skin temperature, the sleep phase, and our performance in waking (Waterhouse et al. 2005; Åkerstedt and Folkard 1997). There is an inverse or negative relationship between core body temperature and the desire to sleep (Edwards and Waterhouse 2009; Krauchi and Deboer 2010). Decreased central body temperature (rectal) before and during sleep is associated with dilation of peripheral arteries and possible loss of central body heat to peripheral parts of the body (Tobaldini et al. 2017). One of the methods that help to regulate the body's vitality is hydrotherapy (Burgess et al. 1997). Hydrotherapy may increase blood flow and temperature of the peripheral parts of the body without increasing or decreasing the central body temperature and thus can facilitate the onset of sleep and improve sleep quality (Raymann and Van Someren 2008; Liao et al. 2008).

Hydrotherapy includes use of plain water (tap water) for therapy, through the external use of water and benefiting from its physical properties such as temperature, hydrostatic pressure, viscosity and electrical conductivity (Bender et al. 2005). Hydrotherapy is the use of water to revitalize, maintain, and restore health. Hydrotherapy treatments include saunas, showering, steam baths, foot baths, sitz baths, aquatic exercise, and the application of cold and hot water compresses (Bender et al. 2005; Warseno and Sukmawati 2019). During hydrotherapy, which is typically done in warm water (32 to 33 °C), sensory stimuli compete with pain-generating stimuli and interrupt the pain pathway (Pinto et al. 2019). The effects of hydrotherapy are related to relieving pain, reducing spasms, relaxing muscles, increasing range of motion, improving and increasing blood circulation by dilating blood vessels, strengthening muscles, increasing muscle strength, and improving self-esteem is also another method of hydrotherapy (Setiawan and Santjaka 2021).

Balneotherapy is a collection of treatments and activities (bathing, drinking, inhaling, etc.) that utilize medicinal mineral waters, medical peloids, and natural gases (sulfur baths, radon-carbon dioxide bath) for therapeutic reasons inside the Health Resort Medical Centers (Falkenbach et al. 2005; Kamioka et al. 2010). In addition, balneotherapy involves the use of baths with thermal mineral water from natural springs with a minimum temperature of 20 °C and a minimum mineral concentration of 1 g/l (Kamioka et al. 2010) (Pittler et al. 2006).

Hydrotherapy (HT) and spa therapy are commonly mistaken with balneotherapy. However, hydrotherapy is the use of conventional tap water for therapeutic purposes, whereas spa therapy refers to a sophisticated intervention in a spa resort employing a variety of treatment modalities, including HT and BT, frequently in conjunction with massage, exercise, physical therapy, or rehabilitation. Spa treatment usually consists of a health holiday lasting some 2–3 weeks (Gutenbrunner et al. 2010; Fioravanti et al. 2017).

This method can help treat a number of diseases including respiratory disorders, arthritis, and high blood pressure. It increases the emission of cortisol and catecholamines due to heat stress, so it has an anti-inflammatory effect (Nasermoaddeli and Kagamimori 2005; Cozzi et al. 1995; Foley et al. 2004). Different hydrotherapy methods can improve sleep disorders by regulating body temperature, and reducing pain by affecting the sympathetic system, and secreting various hormones (Lindley and Smith 2010; Mooventhan and Nivethitha 2014). Sleep is considered an important health variable that affects the quality of life and well-being of people (Eslami et al. 2014). Adequate sleep is important for rejuvenation, good brain function good appearance, energy storage, and protection against disease (Stevenson 2016). Sleep time and sleep quality have been shown to affect learning, memory, function, and the endocrine and metabolic systems (AlDabal and BaHammam 2011). Numerous studies have shown that hydrotherapy blocks heat receptors and mechanical receptors that cause pain due to the temperature of the water and the chemicals in them (Tominaga et al. 1998). In addition, warm water may increase blood flow, which is thought to help eliminate allogeneic chemicals and facilitate muscle relaxation. The hydrostatic effect may relieve pain by reducing peripheral edema and reducing the activity of the sympathetic nervous system (Latorre-Román et al. 2015). This systematic study was performed to investigate the possible effect of various balneotherapy, hydrotherapy, and spa treatments on sleep disorder.

Methods

Preferred reporting items for systematic reviews and meta-analyses (PRISMA) checklist method has been used to write this systematic review (Moher et al. 2009). The protocol for this review was registered in the PROSPERO database (CRD42022355330).

Search strategy

Authors (AMJ, RNDA) conducted online searches in several databases on articles published through September 2022. We searched Pubmed, Embase, Web of Science, Google Scholar, Cochrane, Scopus, and sciences direct database databases. The keywords used in study were as follows: "Aquatic" [ti-ab] or "hydrotherapy" [Mesh] or "spa therapy" [Mesh] or "balneotherapy" [Mesh] or "mineral water" [ti-ab] or "Thermal water" [ti-ab] or "Therapeutic waters" [ti-ab] or "aqua therapy" [ti-ab] crenotherapy" [ti-ab], crenobalneotherapy" [ti-ab], spring water" [ti-ab], "health resort medicine" [ti-ab] AND "sleep quality" [Mesh] or "sleep" [Mesh] or "insomnia" [ti-ab].

Inclusion criteria

Population, intervention, comparison, and outcome approach was used for the inclusion criteria of this systematic review. PICO questions included the following criteria: (1) all clinical trials using various forms of hydrotherapy, including, balneotherapy, spa therapy, hydrotherapy mineral, water, and thermal water; (2) patients with insomnia and sleep disorder; (3) articles published in English.

Exclusion criteria

Studies were excluded from the study due to lack of inclusion criteria include (1) the effect of hydrotherapy on studies that did not examine sleep criteria or sleep quality; (2) case studies — evidence and case reports.

Data extraction

Two authors (A.M.J and R.N.D) assessed the full-text of selected articles and screened them for data extraction. Any study's extracted data consisted of the authors name, the issue, and main conclusion of the study, A third author (M.H.A) of our study assess the accuracy and quality of the extracted data.

Downs and Black scale quality assessment

To assess the quality in this systematic review, we selected the Downs and Black scale, which has good reliability and internal consistency and is evaluated by five scales. The total score is 28. Scores for methodological quality are expressed in percentages as follows under 50% indicates weak; 50–69%, fair; 70–79%, good; and 80–100%, very good.

Risk of bias assessment

Two researchers (HRNDA, ARNDA) assessed the degree risk of bias for articles that met the inclusion criteria. The degree risk of bias was assessed based on the Cochrane bias (ROB) risk assessment tool (Higgins et al. 2011). These tools contained 7 domains, including reporting bias, attrition bias, allocation concealment, detection bias, random sequence generation, performance bias, and other bias sources. Each domain was given a "high risk" score if the study comprised methodological imperfection that may have affected its findings, a "low risk" score if there was no imperfection for that domain, and an "unclear risk" score if the information was not adequate to determine the impact. Each domain was given a "high risk" score if the study comprised methodological imperfection that may have affected its findings, a "low risk" score if there was no imperfection for that domain, and an "unclear risk" score if the information was not adequate to determine the impact.

Results

Selected articles

Eventually, 269 articles were identified in databases, including 38 from Scopus, 43 from ScienceDirect, 58 from Embase, 26 from PubMed, 63 from Web of Science, 26 from Google Scholar, and 15 from Cochrane; after review, 151 duplicate articles were removed, and 118 articles were evaluated and analyzed in terms of title and summary. After primary screening, 62 articles, including 11 reviews, 7 notes, 5 conference abstracts, and 2 editorial and 37 unrelated articles were removed. Finally, 18 articles after critical assessment included in the analysis (Fig. 1).

Out of the 18 studies included in this systematic review, four were on fibromyalgia, three were on healthy people, one was on elder people, one was on diabetic patient, two were on osteoarthritis, one was on obesity, one was on hypertension, one was on pregnant women, one was on cyclists, one was on chronic musculoskeletal pain, one was on sleep impairment, and one was on children with autism. All the details related to the study design, type of intervention, number of participants, type of hydrotherapy, duration of treatment, the temperature of the pool water, and conclusion are shown in Table 1. In terms of design, a variety of studies were included in this systematic review, such as five clinical trial (before–after), three randomized crossover, seven randomized controlled clinical trials, a quasi-experimental study, and a randomized controlled single blind study. The interventions that were included in this study based on the inclusion criteria are the following: in 3 studies, balneotherapy; in 3 studies, spa therapy; and in 12 study, hydrotherapy. The duration of intervention in the hydrotherapy studies, the study period was 3 days to 5 months, in the BT studies was between 12 days to 5 months, and in the spa; therapy studies between 10 days and 3 weeks. The number of participants and the age of participants in the BT study ranged from 52 to 362 and the age between 18 and 70 years, and the spa therapy study ranged from 55 to 199 and the age between 50 and 85 years and in the hydrotherapy ranged from 8 to 134 and the age between 8 and 70 years. The water temperature used in these studies was diverse, in the BT studies from 36 to 42 °C, in the spa therapy from 38 to 39 °C, and in the hydrotherapy from 11 to 42 °C (but in four studies, the water temperature was not specified).

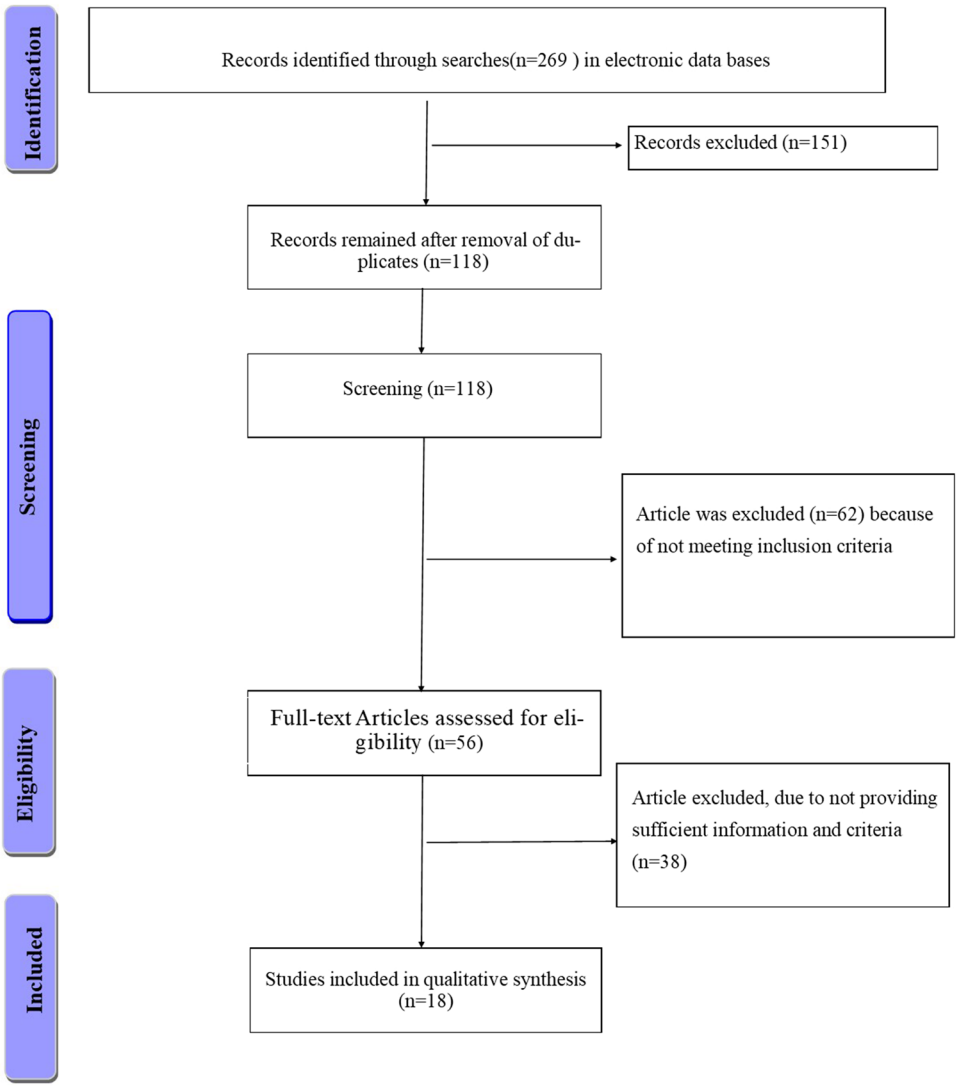

Fig. 1 Flowchart of study

Hydrotherapy

Hydrotherapy is mainly used in different countries to treat various disorders such as low back pain, chronic rhino sinusitis or osteoarthritis (Green et al. 1993). Chen et al. (2016) assessed that HT daily, 29–30 °C for 60 min daily for 8 weeks, significantly reduced time on sleep onset latency, and increase sleep efficiency, but they show that hydrotherapy has an effect on wake after sleep onset, total sleep time, and number and length of awakenings rather than the control group. In another study conducted by Iamonti et al. (2018) on patients with systemic arterial hypertension, they found that HT treatment for 60 min for 5 months improved the quality of life of and decreased snoring during sleep, daytime sleepiness, and its frequency and intensity and level of anxiety. Also, HT has not significantly change to sleep quality compared to control group.

Silva et al. (2012) investigated the quality of sleep based on the Pittsburgh sleep quality index (PSQI); the results of this study showed that hydrotherapy with a temperature of 32 °C for 6 weeks has led to an improvement in the quality of sleep and decrease daytime sleepiness in these people.

Also in another study conducted by Delevatti et al. (2018) on patient with type 2 diabetes, they observed that running or walking in deep water, for 45 min, three time weekly and for 12 weeks led to improve PSQI score and quality of life (fibromyalgia impact questionnaire (FIQ) score), but no significantly differences depressive symptoms between groups. In another study conducted by Lastella et al. (2019), they found that hydrotherapy with cold water 11–12 °C for 8 days decreased the sleep latency but no significant differences on the quality and amount of sleep, sleep/wake (PSQI score), and behaviors between groups. Other studies included in Table 1.

Table 1 Characteristics of studies

Author/Ref	Type of study	Type of subjects	Number of subjects	Age/gender	Duration of in intervention	Water type	Duration	Type of intervention	Outcomes
(Silva et al. 2012)	Self-controlled prospective study (before–after)	Fibromyalgia syndrome	$N=30$	35–65/ F	2 months	Hydrotherapy water, 32 °C	Twice a week, 60 min	Warm pool/fully immersed in water in 4 step: warm-up, muscle stretching, free active exercises, relaxation	**Improved**: sleep quality ($P<0.0001$) and physical function **Decreased**: daytime sleepiness during eight daily activities daytime sleepiness ($P=0.0003$)
(Warseno and Sukmawati 2019)	Quasi-experimental study	Older people	$N=66$	50 > F + M	7 days	Hydrotherapy 40–43 °C	10 min daily	Feet in warm water**,** and then a bath using with warm water,	**Increased**: sleep quality ($P<0.05$) **Decreased**: sleep deficiency and use of medicines after intervention
(Ansari et al. 2021)	Semi-experimental study	Autism	$N=40$	6–14/M	10 weeks	Hydrotherapy water	2 time weekly, 60 min	Physical therapy in in the swimming pool (27–29 °C) in 5 stages: warm-up, orientation training, basic swimming skills, free swim, cool down	**Improved:** sleep quality **Increased:** sleep duration, faster falling asleep **Decreased:** serum levels of IL-1B and TNF-a compared to control group
(Erkan et al. 2016)	Clinical trial (before–after)	Osteoarthritis (M + F)	$N=199$	50–85/F + M	3 weeks	Spa therapy water low mineral density, 39 °C	20 min	Thermo-low mineral density water (39 °C) pools and 15 sessions PT (ultrasound, hot pack, transcutaneous electrical nerve stimulation, and mud pack)	**Improved**: sleep quality **Decreased**:daytime dysfunction ($P=0.016$) and nocturnal pain **Increased**: habitual sleep efficiency ($P=0.002$) and subjective sleep quality($P<0.001$) after intervention

Table 1 (continued)

Author/Ref	Type of study	Type of subjects	Number of subjects	Age/gender	Duration of in intervention	Water type	Duration	Type of intervention	Outcomes
(Karabulut et al. 2018)	A randomized controlled single blind study	Fibromyalgia syndrome	$N=55$	30 > F	2 weeks	Spa therapy	For 20 min daily and 5 days weekly	Thermal waters bath (38 °C), and mudpack treatment on back region at 45 °C	**Improved**: TPC, HAQ, ISI, and FIQ at the end of treatment and compared in control group **Increased**: leptin level
(Latorre-Román et al. 2015)	Clinical trial (before–after)	Healthy elderly people	$N=52$	65–70/F + M	12 days	Balneotherapy	15–20 min	Hot thermal mineral water of medium mineralization, (36–38 °C) bath, bubble bath, hot tub bath, thermal jet with pressure, thermal shower upper and lower body, morning and afternoon	**Improved**: sleep, in the total sample ($P<0.05$)

Table 1 (continued)

Author/Ref	Type of study	Type of subjects	Number of subjects	Age/gender	Duration of in intervention	Water type	Duration	Type of intervention	Outcomes
(Yang et al. 2018)	Randomized controlled trial	Healthy people	$N=362$	18–65/F + M	5 months	Balneotherapy	30 min, at least one to three times weekly	A head-out immersion bath in thermal mineral water (36–42 °C)	**Decreased**: sleep disorder (difficulty in falling asleep ($P=0.017$), dreaminess, nightmare suffering, and restless sleep ($P=0.013$); easy awakening ($P=0.003$) and difficulty in falling into sleep again after awakening ($P=0.016$) in the intervention group as compared to the control group **Improved**: sleep quality in old-age group than in young-aged in intervention group ($P<0.05$). **NS:** side effects
(Koçak et al. 2020)	Before–after	Obesity (BMI > 40 kg/m2)	$N=54$	18–70/ F	3 weeks	Balneotherapy	20 min, 5 days weekly	Whole-body bath in the thermos mineral (42 ± 1 °C) water pool	**Improved**: PSQI ($P < 0.001$) and sleep quality and NH quality of life ($P < 0.001$) after intervention **Decreased**: blood glucose, leptin, and visfatin **Increased**: adiponectin

Table 1 (continued)

Author/Ref	Type of study	Type of subjects	Number of subjects	Age/gender	Duration of in intervention	Water type	Duration	Type of intervention	Outcomes
(Chen et al. 2016)	Randomized controlled trial	Older adults with mild sleep impairment	$N=67$	55–70/F + M	8 weeks	Hydrotherapy water 29–30 °C	Twice weekly at 60 min:	Aquatic exercise, indoor swimming pools in 5 stage warm-up, aerobic and strength exercise, stretching and cooling down	**Decreased**: time on sleep onset latency ($P=.011$) **Increased**: sleep efficiency ($P<.001$) **NS:** total sleep time, wake after sleep onset, activity counts, or number and length of awakenings as compared to the control group
(Iamonti et al. 2018)	Prospective study (before–after)	Hypertension	$N=40$	60–70/F + M	5 months	Hydrotherapy water at 31 °C	Two weekly session, 60 min	Aquatic exercise in warm water in four stages: warm-up, global stretching, aerobic activities, relaxation	**Improved:** quality of life ($p=0.002$) **Decreased**: daytime sleepiness ($P=0.0048$), snoring during sleep and its frequency and intensity ($P=0.001$), and level of anxiety ($p=0.012$) **Increased**: number of hours of sleep per night ($P=0.04$) **NS**: sleep quality compared after the aquatic therapy

Table 1 (continued)

Author/Ref	Type of study	Type of subjects	Number of subjects	Age/gender	Duration of in intervention	Water type	Duration	Type of intervention	Outcomes
(Rodriguez-Blanque et al. 2018)	Randomized controlled trial	Pregnant women	$N=134$	21–43/F	17 weeks	Hydrotherapy water	3 times weekly, 60 min	Water exercise in 4 stages: warming up, aerobic exercise, stretching, and relaxation	**Improved:** sleep quality in the third trimester **Increased**: sleep duration **Decreased**: women with "poor sleepers" 44 (65.67%) as versus 62 (92.54%) in the control group and sleep latency ($P<0.05$)
(Delevatti et al. 2018)	Randomized controlled trial	Type 2 diabetes	$N=35$	> 30/F + M	12 weeks	Hydrotherapy water	45 min, three time weekly	Walking or running in deep water in 3 stages: warm-up, training, cool down, control group dry-land aerobic	**Improved**: sleep quality and quality of life in two groups after intervention ($P<0.05$) but no differences between groups **NS:** depressive symptoms and side effects in two groups
(Lastella et al. 2019)	Randomized cross over	Cyclists	$N=10$	20–22/M	8 days	Hydrotherapy	10 min	Cold water 11–12 °C, immersion	**NS:** the amount and quality of sleep between two groups. Sleep/wake behaviors were similar between the cold-water immersion and placebo conditions ($P>0.05$) **Decreased**: sleep latency in the cold-water immersion compared to the placebo groups ($P=0.03$)

Table 1 (continued)

Author/Ref	Type of study	Type of subjects	Number of subjects	Age/gender	Duration of in intervention	Water type	Duration	Type of intervention	Outcomes
(Matsushita et al. 2016)	Randomized cross over	Health people	$N=10$	33–38/M	3 days	Hydrotherapy water 42 °C	-Water pillar shower bathing, 10 min, dried off and put on sleep wear 20 min, rest period 40 min, moved to a bed and eyes closed 60 min	-Normal bathing -Normal Shower bathing	**Improved**: fall asleep in water pillar shower bathing than the normal shower bathing group **Decreased**: sleep onset latency in water pillar shower bathing compared to in the other two groups **Increased:** skin temperatures in water pillar shower bathing group than in the normal shower bathing group
(So et al. 2021)	Quasi-experimental study	Chronic musculoskeletal pain	$N=30$	54/F + M	6 weeks	Hydrotherapy water 32–35 °C	60 min, two time weekly	Moderate-intensity aquatic exercise an indoor heated pool3 stages: warm-up, training, cool down	**Increased:** true sleep time (by 27.6 min, P = 0.006); sleep efficiency (+3.01%, P = .005) **Decreased**: less pain (-1.33/10, P = .026)
(Kanupka et al. 2018)	Randomized cross-over	Children with autism	$N=8$	8/F + M	8 weeks	Hydrotherapy water	Warm-up (5 min), (2) stretching (6 min in the beginning and in the end), (3) aerobic exercises (30 min,and (4) relaxation (13 min)		**Improved:** sleep duration, child's sleep, time to fall asleep **NS:** side effects

Table 1 (continued)

Author/Ref	Type of study	Type of subjects	Number of subjects	Age/gender	Duration of in intervention	Water type	Duration	Type of intervention	Outcomes
(de Melo Vitorino et al. 2006)	Randomized clinical trial	Fibromyalgia patients	$N=47$	30–60/F + M	3 weeks	Hydrotherapy water	Two time weekly, 1 h	Aquatic exercise on the swimming pool in 4 stags: warm up, specific exercises, free swim, cool-dow	**Increased:** total sleep time **Decreased:** total nap time
(Maindet et al. 2021)	An open, randomized multicenter trial	Fibromyalgia patients	$N=189$	40–60/ F	3 weeks	spa therapy	6 days/week, 18 days total	1. Hydromassage baths 2. Hydro-mineral mud applications 3. Body jet showers with adjustment of the intensity of jets 4. Water affusion massages 5. Collective exercise in a mineral water pool under supervision of a state-registered physiotherapist	**Unchanged: sleep quality**

NS Not significant, increase (↑); decrease (↓).*PSQI* Pittsburgh sleep quality index, *PT* physical therapy, *BT* balneotherapy, *VAS* visual analog scale, *TPC* tender point count, *FIQ* fibromyalgia impact questionnaire, *HAQ* health assessment questionnaire, *ISI* insomnia severity index, *PSG* polysomnography, *NHP* Nottingham Health Profile

Balneotherapy

Balneotherapy (BT) includes treatment with natural mineral water, as well as the use of other methods such as sludge therapy, exercise, and physiotherapy (Wang et al. 2020; Verhagen et al. 2012). Studies have shown that BT can be effective in many diseases, such as sleep disorders. In this systematic review, we examine the effects of BT, spa therapy, and hydrotherapy on sleep disorder disease.

Latorre-Román et al. (2015) conducted a study on sleep of healthy elderly people. Participants used BT with mineral water of medium mineralization (36–38 °C) 15–20 min a day for 12 days. The results of their study showed that 12 days BT has a positive effect sleep quality (PSQI score) of healthy older people. In another study by Yang et al. (2018), they have shown that BT treatment at 36–42° C for 5 months significantly reduced sleep disorder (difficulty in falling asleep(, restless sleep, nightmare suffering, dreaminess, and easy awakening and difficulty in falling into sleep again after awakening in the intervention group compared to the control group. They also concluded that BT groups leads to increase sleep quality (PSQI score) in old-aged group than in young-aged in intervention group. Koçak et al. (2020) conducted a study on sleep disturbances in women with morbid obesity. Patients used whole-body bath in the thermomineral water pool at 42 °C for 20 min, 5 days weekly for 3 weeks. The results of study indicated that the PSQI, NHP quality of life, and sleep quality (PSQI score) after intervention were improved in patients treated with BT. Also, BT treatment significantly decreased leptin, blood glucose, and visfatin. Moreover, this method caused an increase in adiponectin level.

Spa therapy

Spa therapy is one of the treatment methods that reduce the complications of many diseases skin disease such as psoriasis and sleep disorders, which includes a varied range of treatments including hydrotherapy, BT, physiotherapy, and exercise. This method is use din many European countries (such as Italy) and Asia (such as China and Iran) in traditional medicine as adjunctive therapy have a beneficial effect in reducing complications in various diseases such as rheumatoid arthritis, weight loss, psoriasis, and sleep disorders (Sukenik et al. 1999; Bender et al. 2005). Erkan et al. (2016) conducted a study on sleep quality (PSQI score) in patients with osteoarthritis. Patients used a spa therapy with water low mineral density, for 3 weeks. The results of study indicated that, spa therapy lead to improve PSQI score, habitual sleep efficiency, remarkably decrease daytime dysfunction, and nocturnal paining in the treatment group. Karabulut et al. (2018) also found that spa therapy with thermal waters, 38–42 °C for 20 min for 2 weeks, causes a significant enhanced in leptin level and improves tender point count (TPC), health assessment questionnaire (HAQ), insomnia severity index (ISI), and fibromyalgia impact questionnaire (FIQ) at the end of intervention rather than control group.

Downs and Black score

The Downs and Black Scale categorized fourteen studies. Three of the 18 studies were rated as 3 studies as very good, 7 studies as good, 7 studies as fair, and 1 study as weak. The mean score of all studies was 12 to 21, and the maximum score was 27 (Table 2).

Findings from the quality assessments

In human studies, the sequence generation method was reported in 18 studies. Ten studies adequately explain the nature of the method to allocation concealment. The blinding of participants and researchers were unclear in most studies. The blinding of outcome assessment was unclear in 6 studies, low risk in 11studies, and 1 study high risk. Incomplete outcome data were accurately reported in most studies, leading to a low risk of bias for these articles. The selective reporting was low risk for all 17 studies. Results on other parts of risk of bias are summarized in Table 3.

Discussion

Traditional medicine recommends hydrotherapy, spa therapy, and balneotherapy as an adjunctive treatment method in many diseases, including rheumatoid arthritis, skin diseases, and sleep disorders (Kasron and Susilawati 2017). Reducing sleep time can lead to obesity by upsetting the hormonal balance (Chokroverty 2017). Insomnia induces a hormonal imbalance that encourages overeating and weight gain. Leptin and ghrelin are appetite-regulating hormones, and when you do not get enough sleep, the synthesis of these hormones is changed in a manner that causes greater hunger (Patel and Hu 2008). Both growth hormone insufficiency and increased cortisol levels have been related to obesity, and both are connected with sleep deprivation. Insufficient sleep may also impact the metabolism of meals. Unfortunately, the consequences of sleep deprivation on weight are not restricted to hormonal changes. It has been shown that sleep restriction increases the propensity to choose high-calorie foods (Patel and Hu 2008). Consuming calories late at night increases the likelihood of weight gain (Golley et al. 2013). In addition, persons who do not receive enough sleep engage in less physical activity than those who do, probably because sleep deprivation produces daytime drowsiness and tiredness (Golley et al. 2013). Due to the negative impact of low sleep quality on mental health and its relationship

Table 2 Down and Black assessment

Author (year), country	Reporting (0–11)	External validity (0–3)	Bias (0–7)	Confounding (0–6)	Power (0–1)	Total (0–28)	Percentage (%)	Classification
(Silva et al. 2012)	7	2	4	3	1	17	60	Fair
(Warseno and Sukmawati 2019)	8	2	4	4	1	19	67	Fair
(Ansari et al. 2021)	7	2	5	4	1	19	67	Fair
(Erkan et al. 2016)	9	2	5	3	1	20	71	Good
(Karabulut et al. 2018)	7	2	4	1	1	15	57	Fair
(Latorre-Román et al. 2015)	9	2	5	4	1	21	75	Good
(Yang et al. 2018)	9	3	6	5	1	24	86	Very good
(Koçak et al. 2020)	8	3	6	4	1	22	79	Very good
(Chen et al. 2016)	8	2	5	4	1	20	71	Good
(Iamonti et al. 2018)	5	1	3	2	1	12	43	Weak
(Rodriguez-Blanque et al. 2018)	8	2	5	4	1	20	71	Good
(Delevatti et al. 2018)	8	2	5	5	1	21	75	Good
(Lastella et al. 2019)	6	2	3	3	1	15	53	Fair
(Matsushita et al. 2016)	8	2	5	5	1	21	75	Good
(So et al. 2021)	9	3	5	5	1	23	82	Very good
(Kanupka et al. 2018)	6	2	3	3	1	15	53	Fair
(de Melo Vitorino et al. 2006)	7	2	3	3	1	16	57	Fair
(Maindet et al. 2021)	8	3	4	5	1	21	75	Good

with mortality, one of the important consequences of BP is improving sleep quality (Cole and Dendukuri 2003). Another study, both women and men recovered from insomnia, a finding that approves the results of previous studies. Studies showed that balneotherapy along with mineral water providing psychological benefits, like enhanced relaxation chronic pain and relief from sleep disorders in pilots with mood states (Xu et al. 2013). Liao (2002) It has been shown that insomnia in the elderly is related to changes in circadian body temperature rhythms, manipulating body temperature before sleep may improve sleep beginning, quality in the elderly. For example, a hot bath in the afternoon aids nighttime sleep for healthy elderly subjects with insomnia. The beneficial effects of hydrotherapy may increase sleep hours in every 24 h as well as improve sleep quality (da Cunha and Caromano 2003). However in the aqueous environment, the body releases a series of reactions that tend to reduce the activation of the sympathetic nervous system, leading to relaxation (Yang et al. 2018; Iamonti et al. 2018).

Although hydrotherapy augmented rectal temperature throughout the bathing period, this enhance was not preserved during sleep (Matsushita et al. 2016). In addition, in a clinical study that monitored rectal and skin temperatures in the range of nocturnal fluctuations, sleep began faster when skin temperature rose. (Raymann et al. 2005) However, delayed onset of sleep is not affected by an increase in core body temperature (Raymann et al. 2005). So, increasing skin temperature, but not core body temperature, is necessary to shorten sleep latency (Raymann et al. 2005; Ichiba et al. 2020). At the cellular level, skin warming is associated with activation in the formation of networks in the hypothalamus, midbrain reticular formation, and cortex (Van Someren et al. 2016). In an in vivo study, skin warming was shown to induce nerve firing patterns similar to sleep patterns in the periapical region of the anterior hypothalamus (Alam et al. 2014). In addition, a human neuroimaging study showed that warming activates the skin of the abdominal hypothalamus (Egan et al. 2005). Changes in skin temperature alter the firing properties of heat-sensitive neurons in these areas of the brain that are all related to sleep regulation. Thus, warming of the skin can help sleep to begin more quickly (Matsushita et al. 2016). This suggests that sleep disturbance may not be caused directly by the effects of pain, but rather by stimulation of the sympathetic nervous system and the hypothalamic–pituitary–adrenal axis (Matsushita et al. 2016). Also, the weaker the sleep at night, the more severe the pain and the greater the sensitivity of the pain during the day (Warseno and Sukmawati 2019). Two pathways may lead to increased pain sensitivity (Ito et al. 2020). In the peripheral pathway, the secretion of neurotransmitters such as histamine and serotonin can sensitize pain receptors (Ito et al. 2020). Hydrotherapy affects the levels of the serotonin and histamine and calms people, thereby reducing sleep deprivation (Warseno and Sukmawati 2019). Hydrotherapy along with exercise (aquatic exercise) can also reduce pain and as a result improve sleep quality (So et al. 2021); this process may reduce the activity of neurons in the dorsal horns

Table 3 Results of risk of bias assessment for human studies

Each domain was scored as "−" if it contained methodological flaws that may have affected the results, "+" if the flaw was deemed inconsequential, and "?" if information was insufficient to determine. If a study got "+" for all domains, it considered as a high quality study with totally low

of the spine and reduce pain by modulating the activity of serotonin and histamine meninges. Therefore, by reducing pain, the quality of sleep or going to sleep earlier is done (So et al. 2021; Vgontzas et al. 1998; Roehrs and Roth 2005). Due to the increasing pressures of living, working, and studying, an increasing number of people are experiencing sleeping difficulties; consequently, the findings of this study will be beneficial to them. Strauss-Blasche et al. (2000) discovered that a 3-month balneotherapy program was helpful in raising feelings of enjoyment, enhancing emotional status, and reducing general health concerns in middle-aged individuals. The study by Rapolienė et al. (2016) shows that balneotherapy is superior than music or no therapy for reducing tension and weariness. Accordingly, the heat influence of spa therapy and balneotherapy can promote blood circulation and reduce convulsions, so promoting physical comfort and sleep. Among the main limitations of this systematic review are the lack of double-blind studies, the uncertainty of water temperature and pH in some studies, the different types of disease, and the small number of participants in some experiments. Also, one of the limitations of this study includes the major heterogeneity of interventions such as water therapy or spa therapy, and it prevents us from having certainties and precise recommendations. In addition, the age of the participants was not mentioned in some studies. We tried to avoid errors in the report by examining the risk of bias.

Conclusion

Despite the fact that a number of studies have shown that various hydrotherapy, BT, and spa therapy approaches enhance sleep issues However, in order to strengthen the accuracy of results, it is suggested to use several hydrotherapy techniques to a particular ailment, such as (diabetic and obese patients). To decrease bias in the findings, clinical research should be conducted with a control group, varying intervention duration, and measuring sleep markers that affect sleep, such as stones.

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Data availability The data that support the findings of this study are available on request from the corresponding author.

Declarations

Conflict of interest The authors declare no competing interests.

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