Journal of Bodywork & Movement Therapies 40 (2024) 804–815

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Effects of body-oriented intervention after stroke on cognitive function, body awareness, and quality of life: A systematic review

João Barreto [a,*], Catarina Pereira [a,b], Gabriela Almeida [a,b], Bruna Isabelinha [a], Ana Cruz-Ferreira [a,b]

[a] Department of Sport and Health, School of Health and Human Development, University of Évora, Portugal, Colégio Luís António Verney, Rua Romão Ramalho, 59, 7000-671, Évora, Portugal

[b] Comprehensive Health Research Centre (CHRC), Universidade de Évora, Portugal

ARTICLE INFO

Handling Editor: Dr Jerrilyn Cambron

Keywords:
Brain injury
Creative arts
Mind-body
Cognition
Body awareness
Psychomotricity

ABSTRACT

Background: Some cognitive functions can be affected by a stroke as it causes sensory, perceptual, and visual deficits, contributing to a loss of body awareness and changes in one's body image and leading to a decrease in the quality of life (QoL). This systematic review aims to identify and systematize scientific evidence of body-oriented intervention (BOI) effects in adult and elderly patients after a stroke on cognitive function, body awareness, and QoL.

Methods: The research was carried out in: Pubmed, Science Direct, Cochrane, Web of Science, Psycinfo, Scopus, Portal Regional da BVS, and PEDro. To assess the methodological quality of the studies, the PEDro scale was used, and best evidence synthesis (BES) was performed on the data.

Results: The study included 11 high-quality randomized controlled trials involving 590 participants. The trials investigated BOIs' effects, focusing on creative arts and mind–body and evaluating cognitive functions, body awareness, and QoL. BOIs were evidenced to induce positive effects, limited to strong ones, on several cognitive outcomes and QoL indicators, with more benefits than, or similar amounts of benefits to, other therapies.

Conclusions: BOIs have been shown to be a valid therapy in stroke recovery as there is limited to strong evidence that they improve several cognitive functions and QoL, with similar benefits to or more benefits than other therapies. In the future, it is important to study the outcomes that were not explored by the included studies or that have hardly been investigated, such as those related to body awareness.

1. Introduction

Strokes can cause damage to neurological functions, leading to changes in motor, sensory, perceptual, behavioural, and cognitive functions. The location and extent of the lesion determine the patient's clinical condition and respective losses (Martins 2006; Ojaghihaghighi et al., 2017). The changes induced by a stroke have an impact on individuals' daily life and on their relationship with the external world (Paula et al., 2008), mostly because these changes are often associated with compromised skills, such as attention, executive functions, perceptual–motor skills, memory, and language (Cumming et al., 2013; APA 2014). In turn, these are fundamental skills structuring individuals as they provide awareness of body limits, the position occupied by their limbs in space, and how the connection between them and their body is made (Van Stralen et al., 2011). Hence, a stroke frequently results in body awareness losses and a change in self-perceived body image (Shiv et al., 2005). Given this situation, it is no wonder that strokes exert a strong impact on patients' quality of life (QoL) as well as on their functional and social capacity (Bays 2001).

The term body-oriented interventions (BOI) was introduced by Probst et al. (1995) as a therapeutic method that focuses on the body and its promotion. In this context, the body occupies a central role, being not only an instrument of communication and exploration but also the target and central part of the intervention, with which bodily and emotional experiences are biologically and experientially associated (Rodrigues et al., 2022). Thus, the focus of BOIs is the body and its emotional and perceptual experiences, which are achieved through the therapeutic change in body awareness as a result of the induced adaptations in the motor, sensorial, perceptual, emotional, and cognitive dimensions

* Corresponding author. Department of Sport and Health School of Health and Human Development Colégio Luís António Verney, Rua Romão Ramalho, 59, 7000-671, Évora, Portugal.
E-mail address: barreto.joaolr@gmail.com (J. Barreto).

https://doi.org/10.1016/j.jbmt.2024.05.022
Received 4 April 2023; Received in revised form 21 April 2024; Accepted 25 May 2024
Available online 27 May 2024

Non-standard abbreviations and acronyms

BOI	Body-oriented intervention
BVS	*Biblioteca Virtual em Saúde*
BES	Best Evidence Synthesis
PEDro	Physiotherapy Evidence Database
RCT	Randomized Controlled Trial
QoL	Quality of Life
EG	Experimental group
CG	Control group

(Röhricht 2009; Röhricht et al., 2014).

Currently, BOIs are a relevant topic as scientific evidence has highlighted them as a useful therapeutic process (Younge et al., 2015), which is relatively easy to apply and involves low monetary and human resource costs (Zou et al., 2018). BOIs include a set of methodologies and practices, such as embodiment, creative arts, mind–body, body psychotherapy, and psychomotricity (Cozzolino et al., 2022; Probst et al., 2010; Stuckey and Nobel 2010; Isabelinha et al., 2022). These methodologies and practices are considered to be effective in post-stroke rehabilitation, particularly regarding cognitive functions, body awareness, and QoL.

Only a few systematic reviews targeting BOIs and stroke were found, and they addressed just some of the outcomes under investigation in this review, such as the studies focused on achieving i) mind-body interventions (Love et al., 2019; Zou et al. 2018, 2019) and ii) creative art interventions (Lo et al., 2019). However, these studies differ from the present review as they addressed the BOIs individually, while this review intended to compare the scientific evidence on the effects of BOIs with other therapies simultaneously. Besides, the aforementioned reviews only addressed single outcomes, particularly QoL. Thus, the aim of this systematic review was to identify and systematize the scientific evidence on the effects of BOIs in adult and elderly stroke patients on cognitive functions, body awareness, and QoL.

2. Methods

The systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). The study protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO), with the ID CRD42021224396.

2.1. Eligibility criteria

The present study involved studies published from 2000 to 2021 in Portuguese, English, Spanish, and French. The following inclusion criteria were used for the review: studies must (1) include a sample composed of stroke patients aged ≥18 years; (2) include a BOI experimental study group; (3) assess at least (i) one cognitive outcome, namely cognitive function, complex attention, executive functions, learning and memory, perceptual–motor skill, and social cognition, (ii) one of the two following psychomotor outcomes: body consciousness and body image, or (iii) one QoL outcome; and (4) be published in journals that have been peer reviewed, designed to be a randomized controlled trial (RCT), quasi-experimental, or experimental study, including a control group and one or more experimental groups, but they must not be pilot or preliminary studies.

2.2. Search strategy

A systematic search was conducted on June 30, 2021, in the following electronic databases: Pubmed, Science Direct, Cochrane, Web of Science, PsycInfo, Scopus, Portal Regional da BVS, and PEDro. The search terms included both natural language and controlled vocabulary. The terms were separated with the Boolean operator OR within each concept (population, cognitive, body awareness outcomes, QoL, and BOI terms) and with the Boolean operator AND between the concepts. The search terms were:

''Stroke''

AND

''Adults'' OR ''Elderly'' OR ''Older people'' OR ''Older adult'' OR ''Elders''

AND

''Cognitive function'' OR ''Cognition'' OR ''Executive function'' OR ''Planning'' OR ''Problem solving'' OR ''Attention'' OR ''Processing speed'' OR ''Memory'' OR ''Perceptual Motor Skills'' OR ''Visuospatial ability'' OR ''Social cognition''

AND

''Body awareness'' OR ''Body scheme'' OR ''Body image'' OR ''Body satisfaction'' OR ''Self-concept'' OR ''self-esteem''

AND

''Quality of life''

AND

''Body-oriented therapy'' OR ''Psychomotor therapy'' OR ''Embodiment'' OR ''Body awareness therapies'' OR ''Embodied therapies'' OR ''Mental practice'' OR ''Focusing'' OR ''Dance'' OR ''Movement therapy'' OR ''Music therapy'' OR ''Drama therapy'' OR ''Art therapy'' OR ''Mind-body therapies'' OR ''Tai-chi'' OR ''Qigong'' OR ''Baduanjin'' OR ''Yoga'' OR ''Pilates'' OR ''Mindfulness'' OR ''Meditation'' OR ''Relaxation therapy'' OR ''Body psychotherapy''. No further restrictions were placed on the searches.

2.3. Study selection and quality assessment

Regarding the study selection, all duplicate studies were excluded. After reading the title and abstract, all the studies that did not meet the selection criteria were also excluded. Each eligible study was analysed independently by two reviewers, and a third reviewer was consulted whenever there was no agreement between them (Cruz-Ferreira et al., 2011). This process with three reviewers served to mitigate the risk of bias.

The methodological quality of the studies was also gauged to reduce the risk of bias. It was assessed using the Physiotherapy Evidence Database (PEDro) scale, which is considered an important, adequate, and reliable tool for evaluating the methodological quality of experimental and quasi-experimental studies in this area (Maher et al., 2003; Olivo et al., 2008). The PEDro scale divides its criteria into three groups, namely external evaluation, internal evaluation, and statistical analysis (Olivo et al., 2008; Verhagen et al., 2001). It contains 11 items, the first of which is not rated on this scale, so they are rated from 0 to 10. Since this scale does not have a cut-off value, a study was considered to be low quality when it had a score below 5 and high quality when it had a score equal to or greater than 5 (Cruz-Ferreira et al., 2011; Boyles et al., 2011; Neuls et al., 2011; Paci et al., 2009).

2.4. Data extraction and synthesis of results

The included studies were analysed by two reviewers independently, and the following information was extracted: author(s), publication date, sample, study design, intervention characteristics, outcomes, instruments, and results. A third reviewer was consulted whenever there was no agreement between the first two. The effects of interventions were studied by assessing the differences in the intervention group over time and comparing the pre- and post-intervention outcomes. The effects of BOIs were also investigated by evaluating the interaction of time and group, comparing the differences in pre- and post-intervention outcomes between the intervention and the control group. Previous research had been carried out to determine which domains to

investigate for this systematic review as well as which variables and sub-variables to include. The cognitive domain included the following variables and sub-variables: cognitive function (total value); complex attention (sustained attention, selective attention, divided attention, and processing speed); executive functions (total value, planning, decision making, working memory, response to feedback/error correction, and mental flexibility); learning and memory (immediate memory, recent memory, long-term memory, and implicit learning); language (total value, expressive language, and receptive language); perceptual motor skills (visual perception, visuoconstructive skill, perceptomotor skill, praxis, and gnosis); and social cognition (recognition of emotions and theory of mind). Body awareness, including body consciousness and body image, constituted the psychomotor domain. Finally, the QoL domain included the indicators total value, general health, cognition, memory, personal care, physical domain, physical function, mobility, limitation in functions related to physical problems, higher motor function, work, vision, language, communication, thinking, personality, mood states, limitations in functions related to emotional problems, emotion, mental health, energy, vitality, family and social function, family function, social function, pain, swallowing, and post-stroke recovery.

The best evidence synthesis (BES) (Slavin 1995) method was used to measure the strength of scientific evidence and reduce the risk of bias. According to Tulder et al. (2003), this method involves classification into strong evidence, when there are two or more high-quality studies; moderate evidence, when there is at least one study of high quality and at least one other study of lower quality; limited evidence, when there is more than one study of high quality or one or more studies of low methodological quality; conflicting evidence, when studies have presented different and contradictory results; or no evidence, when outcomes have not been discussed in any study (Tulder et al., 2003). This classification is based on the number of studies used and on the consistency of the evidence of the studies' scientific and methodological quality (Trinh 2009).

3. Results

The search obtained a total of 2067 studies (Fig. 1). As they did not meet the selection criteria, 1855 studies were excluded. All those that were duplicated (n = 132) were also excluded, resulting in a total of 80

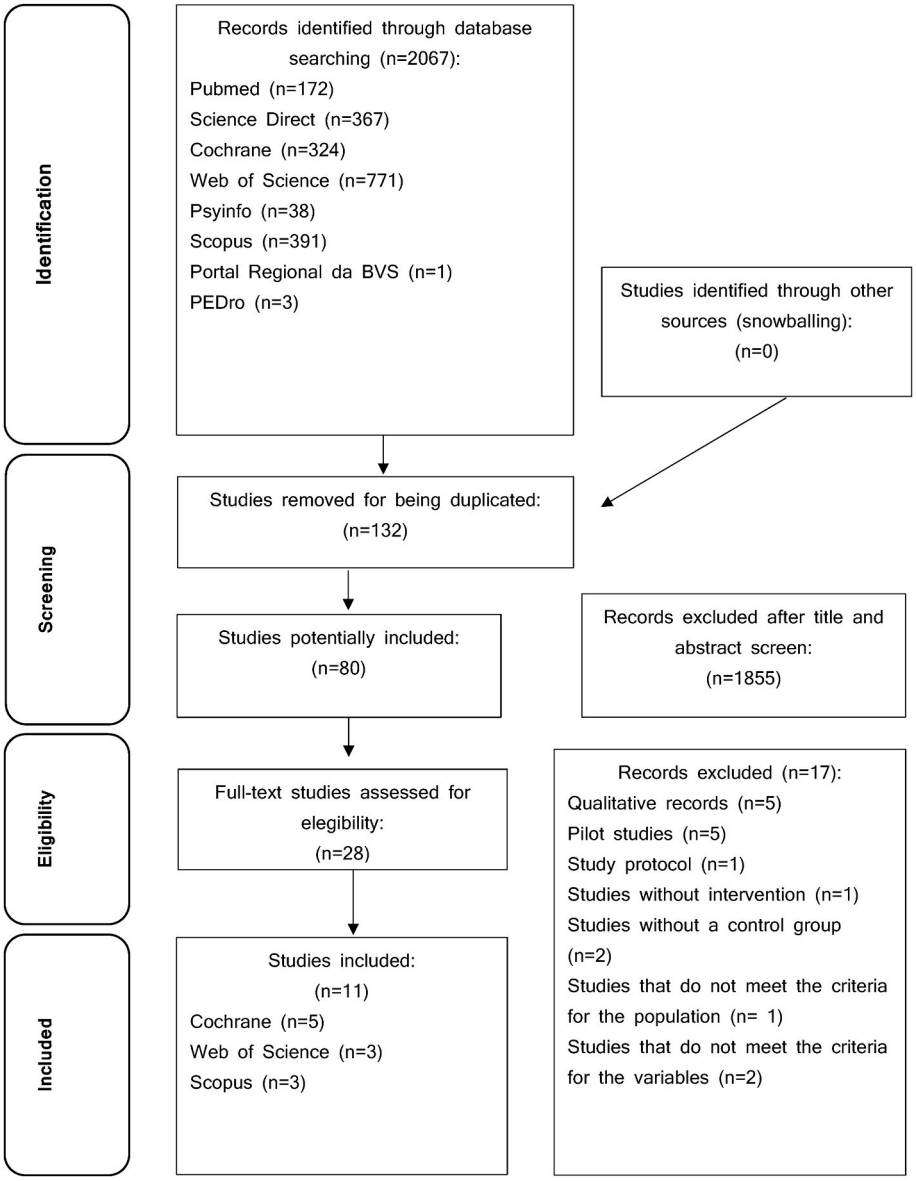

Fig. 1. Flow diagram summarizing the search strategy.

studies. Of these studies, 28 had potential, but only 11 met the inclusion criteria.

3.1. Quantitative study characteristics

The year of publication of the studies ranged between 2005 and 2021. The included studies belonged to countries such as China (n = 2), Finland (n = 1), Japan (n = 1), Australia (n = 1), Sweden (n = 1), Thailand (n = 1), Sweden and Australia (n = 1), Spain (n = 1), Canada (n = 1), and South Korea (n = 1). All the studies were randomized controlled trials, and only the information related to pre- and post-intervention assessments was analysed. Regarding the participants, in all the studies, their ages ranged from 18 to 79 years. The study with the smallest sample had 22 participants, and the study with the largest sample involved 123 participants.

The included studies used BOIs based on creative arts and mind–-body, comparing these types of interventions with other therapies. The duration of the interventions varied between 3 weeks and 24 weeks. However, the most common durations were 4 weeks and 12 weeks.

Creative arts interventions had an average of 27.7 participants, a weekly average frequency of 3.08 times a week, and an average duration of 63.3 min per session. In turn, mind–body interventions had an average of 16.4 participants, an average frequency of three sessions per week, and an average duration of 76 min per session. BOIs were compared not only with conventional therapy but also with other therapies, such as walking, symptom management, neurodevelopmental treatment, motor imagery, and hippotherapy. Outcomes for cognitive functions, body awareness, and QoL were measured at the baseline and post-intervention.

3.2. Quantitative study findings

3.2.1. Cognitive function

Regarding the effects of BOIs as shown in Table 1, on the total value of cognitive function, two studies showed improvements and one study reported no significant differences. For the complex attention variable, two studies revealed improvements in sustained attention; concerning selective attention, one study demonstrated improvements and another study did not show significant differences. Regarding the processing speed sub-variable, one study observed contradictory results in its groups, while another study found no significant differences. However, also for this sub-variable, one study reported contradictory results using two different assessments.

For the effect of BOIs on executive function variables, two studies identified improvements in their total value. Regarding the working memory sub-variable, two studies considered there to have been improvements, and another two studies showed no significant differences. Concerning the mental flexibility sub-variable, one study identified contradictory results in its groups, while another study found no significant differences.

Regarding the effects of BOIs on the learning and memory variable, there were improvements in immediate memory, long-term memory, and implicit learning in one study each. For the sub-variable recent memory, two studies showed improvements and one study did not find significant differences.

In relation to the total value of language, improvements were shown in one study. Conversely, for the perceptual–motor variable, visual perception indicated no significant differences, unlike visuoconstructive skill, in which improvements were observed in one study.

Regarding the effects of BOIs compared with other therapies in the total value of the cognitive function, there were more effects in two studies. However, there were no differences between therapies in three other studies.

Concerning complex attention, two studies did not register significant differences between therapies in sustained care. In contrast, for selective attention, one study considered that there were more effects in one intervention, while another reported that there were no differences between therapies. Regarding the effect of BOIs on processing speed compared with other therapies, there were no differences between therapies. Still, for this sub-variable, one study reported contradictory results across two different assessments.

In relation to executive functions, specifically their total value, one study indicated that there were no significant differences between therapies, while another reported that more effects were obtained with BOIs. For the mental flexibility sub-variable, no differences were recorded between therapies in two different studies. Meanwhile, for the working memory sub-variable, one study observed more effects from BOIs, while three other studies found no differences between therapies.

Regarding the variable of learning and memory, one study reported more effects from BOIs on immediate memory and long-term memory. For the recent memory sub-variable, there were contradictory results in two different studies, and implicit learning showed no differences between therapies in one study.

For the language variable and its total value, there were no differences between the therapies in one study. As for the perceptual–motor variable, there were no differences between the therapies in terms of visual perception and visuoconstructive skill.

3.2.2. Body awareness

The analysed studies showed that BOIs did not register significant differences in the body image outcome as well as when comparing BOIs with other therapies, as shown in Table 1. The body consciousness outcome it was not explored by any of the included studies.

3.2.3. Quality of life

The positive effects of BOIs on QoL were observed in its total value indicator, in the memory indicator, in the physical domain indicator, in the physical function indicator, and in the swallowing indicator. On the contrary, there were no significant differences in QoL in the general health indicator, in the cognition indicator, in the mobility indicator, in the indicator of limitation in functions related to physical problems, and in the indicator of superior motor function. There were also no significant differences in the visual indicator, the communication indicator, and the mood states indicator. There were still no significant differences in the indicators of limitations in the functions related to emotional, emotional, mental health, and energy problems as well as in the indicators of vitality, family and social function, family function, pain, or post-stroke recovery. Still concerning the QoL, the results for the work indicator and the personal care indicator are contradictory. Two studies showed improvements and one reported no significant differences. There were also indicators in which improvements were verified in one study. However, two studies revealed no significant differences. This situation can be observed in the indicators of work, language, thinking, and personality. In the social function indicator, one study registered contradictory results through two different assessments. However, there were no differences in two studies (see Table 1).

Regarding the effects of BOIs compared with other therapies in the QoL domain, more specifically the total value, one study did not observe differences between therapies, while another study detected more effects when using a BOI intervention. There were no differences in the effects between therapies in the general health indicator, unlike the total value of the independence indicator, which showed more effects between therapies. For the personal care indicator, two studies did not find differences between the therapies, while one study showed more effects on the benefits of BOIs. For the physical function indicator and the mobility indicator, no differences were found between the therapies. Furthermore, in the domain of QoL, no differences were obtained in the indicators of limitations in the functions related to physical problems, superior motor function, work, personality, and vision. One study found more effects with BOIs for the language and thinking indicators but no differences in two other studies for the same indicators. Regarding the mood state indicator, two studies did not observe differences between

Table 1
Description and characteristics of the scientific studies.

Authors/year	Type/Study design	Participants	Intervention	Domain/Variable: *Sub-variable* (Instrument)	Results of the effects of BOI	Results for comparing the effects of BOI with other therapies
Tang et al. (2005)	RCT Pre; Post.	Stroke patients; n = 47 Ages: 29–78. **Study groups:** **EG:** n = 25; Average age: 56.84 ± 11.03 years **CG:** n = 22; Average age: 54.86 ± 13.40 years	**GE:** Problem-oriented group willed movement - POWM **GC:** Neurodevelopmental treatment - NDT **Duration:** 8 weeks **Frequency:** 5/6x per week, 50′	**Cognition/Cognitive function:** (Mini Mental State Examination, MMSE)	– (a) –	**Cognition:** No significant differences between **EG** and **CG** on cognitive function effects.
Särkämö et al. (2008)	RCT Pre (1-week post-stroke); Intermediate (3 months post stroke); Post (6 months post stroke)	Stroke patients; n = 60 Ages: 18–75. **Study groups:** **EG1:** n = 19 Average ages: 56.1 ± 9.6 years **EG2:** n = 19 Average ages: 59.3 ± 8.3 years **CG:** n = 17 Average ages: 61.5 ± 8.0 years	**EG1:** Conventional Therapy Group + Music Therapy **EG2:** Conventional Therapy Group + Language **CG:** Conventional Therapy Group **Duration:** 1 month **Frequency:** (1x60′ min)	**Cognition/Complex attention:** ***Sustained attention:*** (Simple reaction time subtests) ***Selective attention:*** (Stroop subtests) **Executive functions:** (Frontal Assessment Battery, FAB) **Working memory:** (Digit span subtest from the Wechsler Memory Scale — Revised, WMS-R) **Learning and memory:** ***Recent memory:*** (Verbal memory: (Rivermead Behavioural Memory Test, RBMT) **Language:** (Boston Diagnostic Aphasia Examination, BDAE); (the verbal fluency and naming subtests from the CERAD battery; shortened version of the Token Test) **Perceptomotor skill:** *Visuospatial skill:* (Clock task); (Benton Visual Retention Test, BVRT); (subtest B from the Balloons Test) **QoL*/Self-care indicator:*** ***Mobility indicator:*** ***Top motor function indicator:*** ***Work indicator:*** ***Vision indicator:*** ***Language indicator:*** ***Thought indicator:*** ***Personality indicator:*** ***Mood status indicator:*** ***Strength indicator:*** ***Indicator of family and social function:*** (Stroke and Aphasia Quality Of Life Scale-39, SAQOL-39)	**EG1, EG2 and CG:** **Cognition:** - Improved sustained attention, selective attention, executive functions, language, recent memory, working memory, visuospatial skill. **QoL:** - There were no significant improvements in personal care, mobility, superior motor function, work, vision, language, thinking, personality, mood states, energy, family and social function.	**Cognition:** **EG1** has more effects on selective attention and recent memory compared to **EG2 and CG.** There are no significant differences **between the effects of EG1, EG2 and CG** on sustained care, executive functions, language, recent memory, working memory, visuospatial skill. **QoL:** There are no significant differences between the effects of EG1, EG2 and CG on personal care, mobility, superior motor function, work, vision, language, thinking, personality, mood states, energy, family and social function.
Wang, et al. (2010)	RCT Pre; Post.	Stroke patients; n = 34 Ages: ≥50 years. **Study groups:** **EG:** n = 17 **CG:** n = 17	**EG:** Tai-Chi Group **CG:** Control Group (rehabilitation) **Duration:** Tai-Chi: 12 weeks Rehabilitation: 12 weeks **Frequency:** Tai-Chi: 1x/week, 50′ Rehabilitation: 1x/week, 80′	**QoL*/Indicator of somatic symptoms:*** ***Indicator of anxiety and insomnia:*** ***Indicator of social dysfunction:*** ***Severe depression indicator:*** (General Health Questionnaire, GHQ)	– (a) –	**QoL:** **EG** has more effects on anxiety and insomnia and severe depression compared to **CG**. There are no significant differences between the effects of **EG** and **CG** on somatic symptoms and social dysfunction.

(*continued on next page*)

Table 1 (*continued*)

Authors/year	Type/Study design	Participants	Intervention	Domain/Variable: *Sub-variable* (Instrument)	Results of the effects of BOI	Results for comparing the effects of BOI with other therapies
Immink et al. (2014)	RCT Pre; Post;	Stroke patients; n = 22 Ages: ≥18 years. **Study groups:** **EG:** n = 11 Average ages: 56.1 ± 13.6 years **CG:** n = 11 Average ages: 63.2 ± 17.4 years	**EG:** Yoga **CG:** Control Group **Duration:** Ten weeks. **Frequency:** Group classes: 1x/week, 90' + home solo training 6x/week, 40´	**QoL/*Physical domain indicator:*** ***Communication indicator:*** ***Emotion indicator:*** ***Memory indicator:*** ***Social function indicator:*** ***Post-stroke recovery indicator:*** (The Stroke Scale, SIS)	**EG:** **QoL:** - Improved physical domain, memory domain and post-stroke recovery. - There were no significant differences in communication, emotion and social participation. **CG:** **QoL:** - There are no significant differences in the domain of memory, communication, emotion and participation and recovery after stroke	– (b) –
Johansson et al. (2015)	RCT Pre; Post.	Stroke patients; n = 34 Ages: 18-65 **Study groups:** **EG1:** n = 12 Average ages: 48.0 ± 9.4 years **EG2:** n = 13 Average ages: 46.3 ± 11.5 years **CG:** n = 9 Average ages: 51.2 ± 10.6 years	**EG1:** Face-to-face MBSR Group **EG2:** MBSR Internet Group **CG:** Control Group (Walk) **Duration:** 8 weeks **Frequency:** 8x/week, 150′ **GE1:** 1x150´min/7h **GE2:** 1x150´min/7h **GC:** 1x90´min	**Cognition/Attention:** ***Sustained attention:*** (Attentional Blink Task) ***Processing speed:*** (Digit Symbol-Coding subtest from Wechsler Adult Intelligence Scale III, WAIS-III) **Body awareness:** ***Body Image:*** (Self-Compassion Scale, SCS)	**EG1:** **Cognition:** - Improved sustained attention. - There were no significant differences in the processing speed. **Body awareness:** - There were no significant differences in body image. **EG2:** **Cognition:** - Improved sustained attention and processing speed. **Body awareness:** - There were no significant differences in body image. **CG:** **Cognition:** - Improved the processing speed. - There were no significant differences in sustained attention. **Body awareness:** - There were no significant differences in body image.	**Cognition:** There are no significant differences between the effects **of EG1** and **EG2** and **CG** on sustained attention and processing speed. **Body awareness:** There are no significant differences between the effects of **EG1** and **EG2** and **CG** on body image.
Kongkasuwan et al. (2016)	RCT Pre; Post.	Stroke patients; n = 118 Ages: ≥50 years. **Study groups:** **EG:** n = 59 Average age: 67.1 ± 9.2 years **CG:** n = 59; Average age: 65.5 ± 9.9 years	**EG:** Conventional physical therapy + creative art therapy **CG:** Conventional physical therapy. **Duration:** Four weeks. **Frequency:** 2x/week, 90′-120′ **EG:** + 2x/week, 4 weeks, 8 creative art sessions.	**Cognition/Cognitive function:** (The Abbreviated Mental Test) **QoL/*Indicator of the total QoL value:*** (Thai QoL questionnaire) ***Indicator of the total value of independence:*** (Barthel Index)	– (a) –	**Cognition:** There are no significant differences between the effects of **EG** and **CG** on cognitive function. **QoL:** **EG** has more effects on the total value of QoL and the total value of independence compared to the **CG**.
Bunketorp-Käll et al. (2017)	RCT Pre; Post; Follow-up (3 and 6 months).	Stroke patients; N = 123 Ages: 50-75 **Study groups:** **EG1:** n = 40 Average ages: 62.7 ± 6.7 years. **EG2:** n = 41 Average ages: 62.6 ± 6.5	**EG1:** Rhythm group and music **EG2:** Hippotherapy Group **CG:** Control group with rhythm and music (after 1 year) **Duration**: 12 weeks **Frequency:** **EG1:** 2x week, 90′ **EG2:** 2x week, 240′	**Cognition/Cognitive function:** (Barrow Neurological Institute Screen for Higher Cerebral Functions, BNIS) **Executive functions:** ***Working memory:*** (Letter-Number Sequencing, LNS)	**EG1:** **Cognition:** - Improved working memory. - There were no significant differences in cognitive function. **EG2 and CG:** **Cognition:** - There were no significant differences in cognitive	**Cognition:** **EG1** has more effects on working memory compared to **EG2** and **CG**. There are no significant differences between the effects of **EG1** and **EG2** and **CG** on cognitive function.

(*continued on next page*)

Table 1 (*continued*)

Authors/year	Type/Study design	Participants	Intervention	Domain/Variable: *Sub-variable* (Instrument)	Results of the effects of BOI	Results for comparing the effects of BOI with other therapies
		years. **CG:** n = 41 Average ages: 63.7 ± 6.7 years.			function and working memory.	
Grau-Sánchez et al. (2018)	RCT Pre; Post; Follow-up (3 months).	Stroke patients; n = 40 Ages: ≥18 years. **Study groups:** **EG:** n = 19 Average ages: 60.1 years **CG:** n = 20 Average ages: 62.5 years	**EG:** Musical Therapy Group **CG:** Conventional Therapy Group **Duration:** 4 weeks **Frequency:** 5x/week, 20 sessions, 30′	**Cognition/Attention:** ***Selective attention:*** (Stroop task) **Executive functions:** ***Working Memory:*** (Digit span subtest from Wechsler Adult Intelligence Scale III, WAIS-III) ***Mental Flexibility:*** (Trail Making Test, TMT-A) **Learning and memory:** ***Recent memory:*** *(Verbal memory:* Rivermead behavioral memory test Rey auditory verbal learning test, RAVLT) ***Implicit learning:*** (Rey auditory verbal learning test, RAVLT) **QoL*/Total value indicator:*** ***Strength indicator:*** ***Family function indicator:*** ***Language indicator:*** ***Mobility indicator:*** ***Mood status indicator:*** ***Personality indicator:*** ***Self-care indicator:*** ***Social function indicator:*** ***Thought indicator:*** ***Top motor function indicator:*** ***Vision indicator:*** ***Indicator of work and productivity:*** (Stroke-Specific Quality of Life questionnaire, SS-QOL) ***Physical function indicator:*** ***Indicator of limitation in functions related to physical problems:*** ***Pain indicator:*** ***General health indicator:*** ***Vitality indicator:*** ***Indicator of social functions:*** ***Indicator of limitations in functions related to emotional problems:*** ***Mental health indicator:*** (Health survey questionnaire, SF-36)	**EG:** **Cognition:** - It's improved learning. - There were no significant differences in selective attention, working memory, mental flexibility, and recent memory. **QoL:** - Improved the total score of QoL, language, self-care and productivity and work, physical function and social functions evaluated by (SF-36). - There were no significant differences in energy, family functions, mobility, mood states, personality, social function (SS-QOL), thinking, superior motor function, vision, functions related to physical problems, pain, general health, vitality, limitations related to emotional problems and mental health. **Gc:** **Cognition:** - There were no significant differences in working memory and mental flexibility, selective attention, recent memory and learning. **QoL:** - It's improved self-care. - There were no significant differences in total score, energy, family functions, language, mobility, mood, personality, social functions (SS-QOL), thinking, superior motor function, vision, work and productivity, physical function, functions related to physical problems, pain, general health, vitality, social functions (SF-36), limitations relating to emotional problems and mental health.	**Cognition:** There are no significant differences between the effects of **EG** and **CG** on selective attention, processing speed, working memory, mental flexibility, immediate and recent memory and learning. **QoL:** **EG** has more effects on language compared to **CG.** There are no differences significant effects of **EG** and **CG** on the total value of QoL, energy, family function, language, mobility, mood states, personality, self-care, social function (SS-QOL), thinking, superior motor function, vision, work and productivity, physical function, functions related to physical problems, in pain, general health, vitality, social functions (SF-36), limitations related to emotional problems and mental health.
Zheng et al. (2020)	RCT Pre; Intermediate (8 and 16 weeks); Post (24 weeks); Follow-up (28 weeks)	Stroke patients; n = 48 Ages: 45–75 years. **Study groups:** **EG:** n = 24 Average age: 61.63 ± 9.21 years **CG:** n = 24; Average age:	**EG:** Baduanjin **CG:** Conventional therapy **Duration:** 24 weeks **Frequency:** 3x/week, 40′	**Cognition/Cognitive function:** (Montreal Cognitive Assessment, MoCA); **Attention:** ***Processing speed:*** (Digit Symbol Coding, DSC, subtest from the Wechsler Memory Scale — Revised (WMS-R); (Test of Attention Performance, TAP, V.2.3) **Executive functions:** Trail Making Test, TMT - B)	**EG:** **Cognition:** - Improved cognitive function, processing speed (TAP), executive functions, immediate memory, recent memory and long-term memory. - There were no significant differences in reaction time velocity (CSD) and visuospatial skill.	**Cognition:** **Ge** has more effects on cognitive function, processing speed (TAP), executive functions, immediate memory, recent memory and long-term memory than **CG**. There are no significant differences between the effects of **EG** and **CG** on processing speed (CSD).

(*continued on next page*)

Table 1 (*continued*)

Authors/year	Type/Study design	Participants	Intervention	Domain/Variable: *Sub-variable* (Instrument)	Results of the effects of BOI	Results for comparing the effects of BOI with other therapies
		62.75 ± 6.41 years		***Mental flexibility:*** Trail Making Test, TMT-A) **Learning and memory:** ***Immediate memory, recent memory, long-term memory:*** (Auditory Verbal Learning Test, AVLT) **Percetivomotora:** ***Visual perception:*** ***Visuospatial skills:*** (Clock Drawing Task, CDT)	**CG:** - Improved cognitive function, executive functions.	
Haire et al. (2021)	RCT Pre 1; Pre 2; Post.	Stroke patients; n = 30 Ages: 30-79 **Study groups:** **EG1:** n = 10 Average ages: 54.7 ± 10.76 years **EG2:** n = 10 Average ages: 55.5 ± 15.01 years **EG3:** n = 10 Average ages: 57.6 ± 11.14 years	**EG1:** TIMP Group **EG2:** TIMP Group + cMI **EG3:** TIMP + MI Group **Duration:** 3 weeks **Frequency:** 3x/week, 45′ **EG:** 3x 45′ **EG2:** 3x 30′+15 ′ **EG3:** 3x 30'+15′	**Cognition/Executive functions:** ***Mental flexibility:*** (Trail Making Test, TMT-B) ***Working memory:*** (Digit Span Test, subtest from Wechsler Adult Intelligence Scale III, WAIS-III)	**EG1 and EG2:** **Cognition** - There were no significant differences in mental flexibility, working memory. **EG3:** **Cognition** - It's improved mental flexibility. - There were no significant differences in working memory.	**Cognition:** There are no significant differences in the effects of **EG1**, **EG2** and **EG3** on mental flexibility and working memory.
Song et al. (2021)	RCT Pre; Intermediate (3 months); Post (6 months).	Stroke patients; n = 34 Ages: ≥18 years. **Study groups:** **EG:** n = 18; Average age: 58.72 ± 17.13 years **CG:** n = 16; Average age: 57.18 ± 10.65 years	**EG:** Tai-Chi **CG:** Symptom Management Intervention **Duration:** 6 months **Frequency:** **EG**: 2x/week, 50'; **CG:** 1x/week. .	**Cognition/Cognitive function:** (Korean version of the Montreal Cognitive Assessment, K-MOCA); (Korean version of the Mini Mental State Examination, K-MMSE). **QoL/*Strength indicator:*** ***Family function indicator:*** ***Language indicator:*** ***Mobility indicator:*** ***Mood status indicator:*** ***Indicator of social functions:*** ***Personality indicator:*** ***Thought indicator:*** ***Personal care indicator:*** (Stroke-Specific Quality of Life questionnaire, SS-QOL)	**EG:** **Cognition:** - Improved cognitive function (MOCA and MMSE). **QoL:** - Improved personality, thinking and personal care. - There were no significant differences in energy, family involvement, language, mobility, mood index, social rules. - It improved swallowing. - It did not improve mobility, sensoriality, cognition and mood. **CG:** **Cognition:** - There were no significant differences in cognitive function. **QoL:** - Improved personal thinking and care. - There were no significant differences in energy, family involvement, language, mobility, mood, social rules.	**Cognition:** **EG** has more effects on cognitive function (MOCA and MMSE) compared to **CG.** **QoL:** **EG** has more effects on thinking, personal care comparatively to the **GC.** There are no differences significant effects of **EG** and **CG** on energy, family involvement, language, mobility, mood index, social rules and personality.

(a)Does not present inferential statistical results; (b) Control group inactive.
RCT – Randomized Controlled Trial; POWM - Problem-oriented willed movement; NDT - Neurodevelopmental treatment; MBSR - Mindfulness-Based Stress Reduction; Timp - Therapeutic instrumental music performance; IM - Imagery engine; cMI - Engine imagery with cues.

therapies. In addition, in these studies, the indicators of limitations in the functions related to emotional problems and the mental health indicator showed no differences. Continuing in the domain of QoL, there were more effects between therapies benefiting BOIs according to one study on the indicator of anxiety and insomnia and on the indicator of severe depression. The indicators energy, vitality, family and social function, family function, and social function did not register differences between therapies. In addition, the indicators of social dysfunction, somatic symptoms, and pain showed no differences (see Table 1).

3.3. Qualitative study characteristics

The methodological quality scores of the 11 studies included in the present study varied between 5 and 8 points, and four of them had already been classified in the PEDro database, so it was not necessary to calculate their scores again. The remaining seven studies were then classified according to the scale, with a total average value of 6.55 points. One study had a total of 5 points, four studies had a total of 6 points, five studies had a total of 7 points, and, finally, only one study had a total of 8 points. As shown in Table 2, all the studies had a quality

Table 2
Methodological quality of experimental studies according to the PEDro scale.

Criterion	Tang et al. (2005)	Särkämö et al. (2008)	Wang, et al. (2010)	Immink et al. (2014)	Johansson et al. (2015)	Kongkasuwan et al. (2016)	Bunketorp-Käll et al. (2017)	Grau-Sánchez et al. (2018)	Zheng et al. (2020)	Haire et al. (2021)	Song et al. (2021)	Average
Eligibility criteria	1	1	1	1	1	1	1	1	1	1	1	**1**
Random allocation	1	1	1	1	0	1	1	1	1	1	1	**0,91**
Concealed allocation	0	1	0	1	0	1	1	1	1	1	0	**0,64**
Baseline comparability	1	1	1	1	1	1	1	1	1	1	1	**1**
Blind subjects	0	0	0	0	0	0	0	0	0	0	0	**0**
Blind therapists	0	0	0	0	0	0	0	0	0	0	0	**0**
Blind assessors	1	1	1	1	0	0	1	1	1	0	0	**0,64**
Adequate follow-up	1	1	1	1	1	1	1	1	0	1	1	**0,91**
Intention-to-treat analysis	0	0	0	0	1	1	1	0	1	0	1	**0,45**
Between-group comparisons	1	1	1	1	1	1	1	1	1	1	1	**1**
Point estimates and variability	1	1	1	1	1	1	1	1	1	1	1	**1**
Total (0–10)[a]	***6***	***7***	***6***	***7***	***5***	***7***	***8***	***7***	***7***	***6***	***6***	***6,55***

[a] The item relating to the eligibility of participants does not enter into the calculation of the value of the PEDro scale, since it is an external validity criterion.

equal to or higher than 5, so it can be concluded that only high-quality studies were included in this systematic review (Boyles et al., 2011; Neuls et al., 2011; Paci et al., 2009). The studies obtained a maximum classification for the items corresponding to internal validation (item 1) and statistical analysis (items 10 and 11). Regarding internal validation (items between 2 and 8), only one study had the maximum rating (item 4), while two obtained a rating of 0 (items 5 and 6). It is also possible to conclude that two items (items 2 and 8) had an average rating above 0.9, which can be considered as a high rating (Olivo et al., 2008; Verhagen et al., 2001). Furthermore, it was possible to verify the existence of two criteria (items 2 and 8) for which only one study of the eleven included had a null classification. These criteria refer to the random distribution of the participants by the respective groups and the permanence of the participants throughout the study. Furthermore, it was observable that the criteria for blind distribution and blind evaluation (items 3 and 7, respectively) had an average result of 0.64 since four studies had this null classification. Finally, the criterion with the lowest average rating was related to the analysis of intention to treat, so only five studies had a positive rating.

3.4. Qualitative study findings

3.4.1. Body-oriented interventions

There was strong scientific evidence that BOIs improve the sustained attention cognitive function and the total value of executive functions. Strong scientific evidence was found that BOIs have no effect on QoL, specifically on its indicators of mobility, higher motor function, vision, communication, mood states, energy, and family function.

Limited scientific evidence was found that BOIs improve other cognitive functions, specifically immediate memory, long-term memory, learning, the total value of language, and visuoconstructive skill. There was also limited scientific evidence that BOIs improve the domain of QoL, specifically regarding the indicators of the total value of QoL, memory, physical domain, physical function, and swallowing. Limited scientific evidence was found that BOIs have no effect on some cognition sub-variables, such as visual perception, or on the body awareness for body image. The same evidence was found in the domain of QoL, in its indicators of general health, cognition, limitations in functions related to physical problems, and limitations in functions related to emotional problems. We obtained identical results for the QoL indicators of emotion, mental health, vitality, family and social function, pain, and post-stroke recovery.

There was conflicting scientific evidence about BOIs in cognition, namely cognitive function, selective attention, speed of information processing, working memory, mental flexibility, and recent memory. The same is true for the domain of QoL, for the indicators of personal care, work, language, thinking, personality, and social function.

Finally, there was no scientific evidence of the effects of BOIs on the sub-variables divided attention, planning, decision making, responding to feedback/error correction, expressive language, receptive language, perceptual–motor skills, praxis, gnosis, recognition of emotions, theory of mind, and body awareness.

3.4.2. Body-oriented interventions compared to other therapies

There was strong scientific evidence that there are no more benefits of the therapies under study for cognitive functions, namely sustained attention and mental flexibility. There was also strong scientific evidence that BOIs do not have more benefits than another therapy in the domain of QoL in the indicators of mobility, personality, energy, social function, higher motor function, work, vision, mood states, and family function.

There was limited scientific evidence that BOIs provide more benefits for sub-variables, such as immediate memory and long-term memory, than other type of therapies. The same was observed in the domain of QoL concerning the indicators total value of independence, anxiety and insomnia, and severe depression when compared with other therapies.

Limited scientific evidence indicated that there are no more benefits of BOIs concerning implicit learning, the total value of language, visual perception, visuoconstructive skill, and body consciousness. There was also limited scientific evidence that there are no more benefits of BOIs than of other therapies for some QoL indicators, such as general health, physical function, limitations in functions related to physical problems, limitations in functions related to emotional problems, mental health, vitality, pain, social dysfunction, and somatic symptoms, and for the indicator of family and social function.

4. Discussion

This systematic review aimed to identify scientific evidence of BOIs' effects in adult and elderly patients after stroke on cognition, body awareness, and QoL. It was apparent that some studies have proved that there are benefits of BOIs in cognition and QoL. Regarding the effects of BOIs compared with other therapies, it was found that there were also benefits in cognition and QoL when compared with other therapies.

Studies have proved that BOI interventions exert positive effects on cognition, specifically on the variables of sustained attention, the total value of executive functions, immediate memory, long-term memory, implicit learning, language, and visuoconstructive skill. From the results obtained, it was apparent that sustained attention, executive functions, and the variable of learning and memory have a greater expression in terms of the number of studies showing more effects. This is to be expected since this type of therapy allows cognitive stimulation and promotes attention through strategies such as focus (Tarsha et al., 2020).

It was possible to identify contradictory results regarding the effects of BOIs in the cognitive domain, namely the selective attention, working memory, and work indicators. These differences between the results of the studies may have several causes: they may be related to the use of different assessment instruments or differences between the interventions themselves, such as different session durations, different frequencies per week, and even different strategies and procedures. All these factors end up influencing the final result of each BOI intervention for the outcomes under study.

Regarding the effects of BOIs compared with other therapies, more effects of BOIs were evidenced in the cognitive domain, for the variables of immediate memory and long-term memory. These induced improvements may be related to these interventions' ability to promote the memory of patients who have suffered cognitive changes, such as a stroke (Yu et al., 2021). There were contradictory results between the studies when comparing their interventions for the selective attention variable. That was not expected since music therapy is able to stimulate divided attention. However, different strategies between interventions may have led to these contradictory results (Pfeiffer and Sabe 2015).

There was strong scientific evidence that BOIs induce improvements in the cognitive domain, specifically in sustained attention and the total value of executive functions. This effect of BOIs on sustained attention can be explained by a distinguishing factor of these interventions, which is their maintenance of focus not only on the task but also on the patient's body. This focused attention allows the therapist and the patient to understand what is felt and how the body feels (Price et al., 2011). Regarding the positive effects of BOIs on executive functions, it was expected that BOIs could stimulate the cognitive domain and executive functions of stroke patients (Bojnourdi et al., 2019).

We observed strong scientific evidence that there were no more effects of BOIs on sustained attention when compared with a conventional therapy and walking intervention or on mental flexibility compared with conventional therapy and a motor imagery intervention. Interventions such as walking stimulate sustained attention in stroke patients with cognitive impairment, so it was to be expected that the effects of BOIs would not be evident compared with this intervention (Arsic et al., 2015; Fiorini et al., 2017). Another unexpected result was the fact that there were more effects on mental flexibility in a motor imagery intervention than in BOIs because there was no previous evidence of such effects in this population.

The variables that did not show any significant improvements induced by BOIs were visual perception, body image, and some QoL indicators, such as general health, cognition, mobility, limitations in functions related to physical problems, higher motor function, vision, and communication. This situation was also observed for the QoL indicators of mood states, limitations in functions related to emotional problems, emotion, mental health, energy, vitality, family and social function, family function, pain, and recovery after stroke. Considering BOIs' characteristics, the variable body awareness could have been expected to show some improvements, but this was not the case. This result could be related to the fact that the only study focusing on this matter was related to mindfulness. As Jani et al. (2018) reported, this therapy requires a greater maintenance of focus and concentration, which can be difficult to achieve in this population, especially for prolonged periods. Thus, since the variable of body awareness was the least investigated by the studies in this systematic review, it is necessary for future research to focus on this dimension and on how BOI therapies can affect it.

It was possible to observe improvements induced by BOIs in QoL, specifically the indicators of the total value of QoL, memory, physical domain, physical function, and swallowing. Thus, BOIs proved to be beneficial not only for cognitive outcomes but also in the domain of QoL, supporting the idea that they can act as beneficial and effective therapies in the various human dimensions under study. This was expected since BOIs are characterized by a holistic therapeutic approach and have the potential to promote and stimulate different areas affected by a stroke (Röhricht 2009; Röhricht et al., 2014).

Some studies proved the existence of more effects of BOIs than other therapies, in the domain of QoL, for the indicators of the total value of independence, anxiety and insomnia, and severe depression. These results were expected given that several aspects, such as the emotional and physical ones, are stimulated by BOIs. These aspects indirectly interfere with a patient's independence, either through the relationship with a therapist or through activities that require motor control and precision of movements (Eum and Yim 2015). Furthermore, techniques that combine movement with relaxation have the potential to produce effects on patients' mental health, specifically on variables such as anxiety, insomnia, and severe depression (Taylor-Piliae et al., 2014). It was also possible to observe contradictory results concerning the total value of executive functions, recent memory, and QoL, more specifically for the indicator of the total value of QoL. This fact may be related, once again, to differences between the interventions.

We found strong scientific evidence that there were no significant differences regarding BOIs' benefits when compared with other therapies for the QoL indicators of mobility, higher motor function, vision, communication, and mood states. The same applies to the energy and family function indicators. Since BOIs contribute to QoL (Froesch-Baumann 2002), these results were not expected, especially for indicators such as superior motor function as they are therapies that use considerable movement. Still, following this line of thought, the results of emotional indicators such as mood and energy states were also not expected since these therapies explore and promote the patient's emotional dynamics (Röhricht et al., 2014). One more strong piece of scientific evidence found was that there was no benefit of BOIs on the mobility indicator compared with conventional therapy or a symptom management intervention. Moreover, no additional benefits of BOIs on the higher motor function, work, vision, and mood indicators were evident when compared with conventional therapy. More effects of the symptom management intervention were observed for the mobility indicator, which was not expected. As this intervention consisted only of monitoring patients via telephone, it did not require more mobility from patients than BOIs. There was also strong scientific evidence that there were no benefits of BOIs for personality and energy indicators compared with conventional therapy and a symptom management intervention. An improvement in these indicators is to be expected since the symptom management intervention only seeks to make the symptoms known and

to clarify the patients' knowledge about them, requiring constant follow-up. Nevertheless, this monitoring can affect factors such as motivation and fatigue, which may be relevant to indicators such as personality and energy. This is the most common and accepted therapy in rehabilitating patients, mainly using a multidisciplinary team that seeks to stimulate individuals holistically. Thus, the effects of conventional therapy on both cognitive and QoL variables were not surprising.

Eleven studies with a score equal to or greater than five points, indicating that they are high-quality studies (Cruz-Ferreira et al., 2011; Boyles et al., 2011; Neuls et al., 2011; Paci et al., 2009), were included in the sample. This made it impossible to extract information with moderate scientific evidence. Furthermore, it may have shown strong scientific evidence more often; once was enough if two studies indicated the same results. Unfortunately, the experimental studies involving interventions faced difficulties in satisfying some criteria, such as blind participants and therapists, so this high methodological quality could not be verified. Thus, in this systematic review, these were the two items that obtained a null classification. This result may be associated with the impossibility, in this context, of including patients in the therapeutic process without them knowing which therapy it is (de Morton 2009). Regarding internal validity, although this criterion was not included in the final classification of article quality, it was verified that the articles obtained the maximum classification, indicating homogeneity of the groups and allowing a more reliable comparison of the results (Paci et al., 2009). In terms of statistical analysis, it was verifiable that all the studies showed high quality, allowing the interpretation of the results through measures of precision and variability (Olivo et al., 2008; Verhagen et al., 2001). This high quality was expected given that these studies were recent. Older studies have frequently shown lower quality (Moseley et al., 2002). The high quality of the included studies also enhanced the results obtained in this systematic review as the probability of the experimental design obtaining biased results was lower, increasing the probability of clinical replicability (Verhagen et al., 2001). Similarly, it can be an indicator that authors focusing on this area of investigation are developing studies with concern for their quality and methodological criteria, thus contributing to their viability and credibility.

There was strong scientific evidence that BOIs have the same effects as other therapies for most of the variables under study. Such results were not expected since there were not two or more studies that pointed to more effects of BOIs. However, as these were high-quality studies, their limited evidence pointing to the existence of more effects of BOIs can be considered, despite not having a marked strength of evidence.

The results concerning the effects of BOIs on variables such as selective attention, working memory, and work indicator were contradictory. This finding could be explained by the differences between the studies' interventions. Since they were not investigated by the included studies, there was no scientific evidence of the effects of BOIs on the variables divided attention, planning, decision making, response to feedback/error correction, expressive and receptive language, perceptual–motor skills, praxis, gnosis, emotion recognition, theory of mind, and body consciousness. These dimensions are important and have an impact on the daily life of stroke patients, so we consider that it would be interesting to explore them and determine whether BOIs exert any effects on them.

5. Conclusions

This systematic review aimed to identify scientific evidence on the effects of BOIs in adult and elderly patients suffering from a stroke on cognitive functions, body awareness, and quality of life. This systematic review showed that this topic is relevant globally since the studies included belong to geographically dispersed authors across several continents. It was possible to verify that there was no pattern in the ages of the participants. Despite the prevalence of strokes increasing with advancing age, the participants in the studies ranged from 18 to 79 years old. All the studies included scored an average of 6.6 points on the PEDro scale, indicating them to be of high quality.

Some studies provided scientific evidence of the benefits of BOIs for cognition, namely sustained attention, the total value of executive functions, immediate memory, long-term memory, implicit learning, language, and visuoconstructive skill. In addition, it was possible to conclude that BOIs induce improvements in QoL indicators, specifically the total value of QoL, memory, physical domain, physical function, and swallowing.

Regarding the effects of BOIs compared with other therapies, scientific evidence was found of the benefits of BOIs for immediate memory, long-term memory, and QoL, more specifically for the indicators of the total value of independence, anxiety and insomnia, and severe depression, when compared with conventional therapy.

There was strong scientific evidence that BOIs improve cognitive functions, namely sustained attention, and the total value of executive functions. However, contrary to expectations, BOIs provide the same benefits for some variables studied as other therapies. There was also strong evidence that BOIs do not affect the QoL regarding mobility, higher motor function, vision, communication, mood states, energy, and family function or when compared with other therapies in the variables of the cognitive domain, namely sustained attention and mental flexibility, and in the domain of QoL, for the indicators of mobility, superior motor function, work, vision, mood, personality, and energy.

In the future, it is important to study the variables that were not explored by the included studies, such as, regarding the cognitive function, divided attention; planning; decision-making; response to feedback/error correction; expressive and receptive language; perceptual-motor ability; praxis; gnosis; emotion recognition; and theory of mind. Concerning body awareness, there is a lack of studies focusing on body consciousness and body image. Since these dimensions are important and affect stroke patients' daily life and quality of life, it is essential to explore these dimensions, verifying whether there are effects of BOIs. It is also important to investigate the effect of the remaining BOIs that were not explored by the studies included in this review, such as embodiment and body psychotherapy, and their potential contribution to the psychomotor intervention.

Clinical relevance

- BOI evidenced to induce positive effects in several cognitive outcomes and QoL indicators.
- BOI have shown to be valid in stroke recovery with similar or higher benefits compared to other therapies.

Sources of funding

None.

CRediT authorship contribution statement

João Barreto: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Writing – original draft, Writing – review & editing. **Catarina Pereira:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – review & editing. **Gabriela Almeida:** Conceptualization, Investigation, Validation, Writing – review & editing. **Bruna Isabelinha:** Conceptualization, Investigation, Validation, Writing – review & editing. **Ana Cruz-Ferreira:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Validation, Writing – review & editing.

Declaration of competing interest

All authors have nothing to declare

Acknowledgments

None.

References

American Psychiatric Association, 2014. DSM-5: Manual diagnóstico e estatístico de transtornos mentais. Artmed Editora.
Arsic, S., Konstantinovic, L., Eminovic, F., Pavlovic, D., Popovic, B., Arsic, V., 2015. Correlation between the quality of attention and cognitive competence with motor action in stroke patients. BioMed Res. Int. 1–8.
Bays, C.L., 2001. Quality of life of stroke survivors: a research synthesis. J. Neurosci. Nurs. 33 (6), 310–316.
Bojnourdi, S.S., Abad, A., Fadardi, J., 2019. The effectiveness of body psychotherapy on executive functions in patients with post-stroke depression. J. Fundament. Mental Health 21 (6), 399–409.
Boyles, R., Toy, P., Mellon, J., Hayes, M., Hammer, B., 2011. Effectiveness of manual physical therapy in the treatment of cervical radiculopathy: a systematic review. J. Man. Manip. Ther. 19 (3), 135–142.
Bunketorp-Käll, L., Lundgren-Nilsson, Å., Samuelsson, H., Pekny, T., Blomvé, K., Pekna, M., Pekny, M., Blomstrand, C., Nilsson, M., 2017. Long-term improvements after multimodal rehabilitation in late phase after stroke: a randomized controlled trial. Stroke 48 (7), 1916–1924.
Cozzolino, M., Vivo, R., Celia, G., 2022. School-based mind–body interventions: a research review. Human Arenas 5, 262–278.
Cruz-Ferreira, A., Fernandes, J., Laranjo, L., Bernardo, M., Silva, A., 2011. A systematic review of the effects of pilates method of exercise in healthy people. Arch. Phys. Med. Rehabil. 92 (12), 2071–2081.
Cumming, T.B., Marshall, R.S., Lazar, R.M., 2013. Stroke, cognitive deficits, and rehabilitation: still an incomplete picture. Int. J. Stroke 8 (1), 38–45.
de Morton, N.A., 2009. The PEDro scale is a valid measure of the methodological quality of clinical trials: a demographic study. Aust. J. Physiother. 55 (2), 129–133.
Eum, Y., Yim, J., 2015. Literature and art therapy in post-stroke psychological disorders. Tohoku J. Exp. Med. 235 (1), 17–23.
Fiorini, L., Maselli, M., Castro, E., Tocchini, S., Sportiello, T., Laschi, C., Cavallo, F., 2017. Feasibility Study on the Assessment of Auditory Sustained Attention through Walking Motor Parameters in Mild Cognitive Impairments and Healthy Subjects, vol. 39. Annual International Conference of the IEEE Engineering in Medicine and Biology Society, pp. 897–900.
Froesch-Baumann, M., 2002. How Does Integrative Body Psychotherapy Contribute to Quality of Life? *Jack Lee Rosenberg: Celebrating a Master Psychotherapist*, pp. 1–23.
Grau-Sánchez, J., Duarte, E., Ramos-Escobar, N., Sierpowska, J., Rueda, N., Susana, R., Rifà, X., Heras, M., Pedro, J., Särkämö, T., Rodríguez-Fornells, A., 2018. Music-supported therapy in the rehabilitation of subacute stroke patients: a randomized controlled trial. Ann. N. Y. Acad. Sci. 1423 (1), 318–328.
Haire, C.M., Vuong, V., Tremblay, L., Patterson, K., Chen, J.L., Thaut, M.H., 2021. Effects of therapeutic instrumental music performance and motor imagery on chronic post-stroke cognition and affect: a randomized controlled trial. NeuroRehabilitation 48 (2), 195–208.
Immink, M.A., Hillier, S., Petkov, J., 2014. Randomized controlled trial of Yoga for chronic poststroke hemiparesis: motor function, mental health, and quality of life outcomes. Top. Stroke Rehabil. 21 (3), 256–271.
Isabelinha, B., Cruz-Ferreira, A., Maximiano, J., Almeida, G., 2022. Effects of body-oriented therapies on the negative symptoms in people with schizophrenia: a systematic review. J. Bodyw. Mov. Ther. 32.
Jani, B.D., Simpson, R., Lawrence, M., Simpson, S., Mercer, S.W., 2018. Acceptability of Mindfulness from the perspective of stroke survivors and caregivers: a qualitative study. Pilot Feasibility Stud. 4, 4–57.
Johansson, B., Bjuhr, H., Karlsson, M., Karlsson, J.O., Rönnbäck, L., 2015. Mindfulness-based stress reduction (MBSR) delivered live on the internet to individuals suffering from mental fatigue after an acquired brain injury. Mindfulness 6, 1356–1365.
Kongkasuwan, R., Voraakhom, K., Pisolayabutra, P., Maneechai, P., Boonin, J., Kuptniratsaikul, V., 2016. Creative art therapy to enhance rehabilitation for stroke patients: a randomized controlled trial. Clin. Rehabil. 30 (10), 1016–1023.
Lo, L.T., Lee, L.C., Ho, T.H., 2019. Creative arts-based therapies for stroke survivors: a qualitative systematic review. Front. Psychol. 9, 1–12.
Love, M.F., Sharrief, A., Chaoul, A., Savitz, S., Beauchamp, E.S., 2019. Mind-body interventions, psychological stressors, and quality of life in stroke survivors: a systematic review *Stroke*, 50 (2), 434–440.
Maher, C.G., Sherrington, C., Herbert, R.D., Moseley, A.M., Elkins, M., 2003. Reliability of the PEDro scale for rating quality of randomized controlled trials. Phys. Ther. 83 (3), 713–721.
Martins SC 2006 Protocolo de atendimento do AVC isquémico agudo. Sociedade de Cardiologia do Rio Grande do Sul 15 1–6..
Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G., 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 6, 1–6.
Moseley, A.M., Herbert, R.D., Sherrington, C., Maher, C.G., 2002. Evidence for physiotherapy practice: a survey of the Physiotherapy evidence database (PEDro). Aust. J. Physiother. 48 (1), 43–49.
Neuls, P.D., Clark, T.L., Van Heuklon, N.C., Proctor, J.E., Kilker, B.J., Bieber, M.E., Newton, R.A., 2011. Usefulness of the Berg Balance scale to predict falls in the elderly. J. Geriatr. Phys. Ther. 34 (1), 3–10.
Ojaghihaghighi, S., Vahdati, S.S., Mikaeilpour, A., Ramouz, A., 2017. Comparison of neurological clinical manifestation in patients with hemorrhagic and ischemic stroke. World J. Emergency Med. 8 (1), 34–38.
Olivo, S.A., Macedo, L.G., Gadotti, I.C., Fuentes, J., Stanton, T., Magee, D.J., 2008. Scales to assess the quality of randomized controlled trials: a systematic review. Phys. Ther. 88 (2), 156–175.
Paci, M., Matulli, G., Baccini, M., Rinaldi, L.A., Baldassi, S., 2009. Reported quality of randomized controlled trials in neglect rehabilitation. Neurol. Sci. 31, 159–163.
Paula, P.D., Pinto, K.O., Lúcia, S.D., 2008. Relação entre depressão e disfunção cognitiva em pacientes após acidente vascular cerebral: um estudo teórico. Psicologia hospitalar 6 (1), 21–38.
Pfeiffer, C.F., Sabe, L.R., 2015. Music therapy and cognitive rehabilitation: screening of music cognition in adult patients with right hemisphere stroke. Psychomusicology: Music, Mind, and Brain 25 (4), 392–403.
Price, C., Krycka, K., Breitenbucher, T., Brown, N., 2011. Perceived helpfulness and unfolding processes in body-oriented therapy Practice. Indo-Pacific J. Phenomenol. 11 (2), 1–15.
Probst, M., Coppenolle, H.V., Vandereycken, W., 1995. Body experience in anorexia nervosa patients: an overview of therapeutic approaches. Eat. Disord. 3 (2), 145–157.
Probst, M., Knapen, J., Poot, G., Vancampfort, D., 2010. Psychomotor therapy and psychiatry: what's in a name? Open Compl. Med. J. 2 (1), 105–113.
Rodrigues, A., Cruz-Ferreira, A., Marmeleira, J., Veiga, G., 2022. Effects of body-oriented interventions on preschoolers' social-emotional competence: a systematic review. Front. Psychol. 12, 1–22.
Röhricht, F., 2009. Body oriented psychotherapy. The state of the art in empirical research and evidence-based practice: a clinical perspective. Body Mov. Dance Psychother. 4 (2), 135–156.
Röhricht, F., Gallagher, S., Geuter, U., Hutto, D., 2014. Embodied cognition and body psychotherapy: the construction of new therapeutic environments. Sensoria. J. Mind, Brain Culture 10 (1), 11–20.
Särkämö, T., Tervaniemi, M., Laitinen, S., Forsblom, A., Soinila, S., Mikkonen, M., Hietanen, M., 2008. Music listening enhances cognitive recovery and mood after middle cerebral artery stroke. Brain 131 (3), 866–876.
Shiv, B., Loewenstein, G., Bechara, A., Damasio, H., Damasio, A.R., 2005. Investment behavior and the negative side of emotion. Psychol. Sci. 16 (6), 435–439.
Slavin, R.E., 1995. Best evidence synthesis: an intelligent alternative to meta-analysis. J. Clin. Epidemiol. 48 (1), 9–18.
Song, R., Park, M., Jang, T., Oh, J., Sohn, M.K., 2021. Effects of a Tai-Chi-based stroke rehabilitation program on symptom clusters, physical and cognitive functions, and quality of life: a randomized feasibility study. Int. J. Environ. Res. Publ. Health 18 (10), 5453–5465.
Stuckey, H.L., Nobel, J., 2010. The connection between art, healing, and public health: a review of current literature. Am. J. Publ. Health 100 (2), 254–263.
Tang, Q.P., Yang, Q.D., Wu, Y.H., Wang, G.Q., Huang, Z.L., Liu, Z.J., Fan, Z.Y., 2005. Effects of problem-oriented willed-movement therapy on motor abilities for people with poststroke cognitive deficits. Phys. Ther. 85 (10), 1020–1033.
Tarsha, M.S., Park, S., Tortora, S., 2020. Body-centered interventions for psychopathological conditions: a review. Front. Psychol. 10, 2907–2921.
Taylor-Piliae, R.E., Hoke, T.M., Hepworth, J.T., Latt, L.D., Najafi, B., Coull, B.M., 2014. Effect of Tai-Chi on physical function, fall rates and quality of life among older stroke survivors. Arch. Phys. Med. Rehabil. 95 (5), 816–824.
Trinh, K., 2009. Summaries and recommendations of the global impression method. J. Acupuncture Tuina Sci. 7, 296–302.
Tulder, M., Furlan, A., Bombardier, C., Bouter, L., 2003. Updated method guidelines for systematic reviews in the Cochrane collaboration back review group. Spine 28 (12), 1290–1299.
Van Stralen, H.E., Van Zandvoort, J.E., Dijkerman, H.C., 2011. The role of self-touch in somatosensory and body representation disorders after stroke. Philosophic. Transact. Royal Soc. Biol. Sci. 366 (1581), 3142–3152.
Verhagen, A.P., De, Vet HC., De Bie, R.A., Boers, M., Van Den Brandt, P.A., 2001. The art of quality assessment of RCTs included in systematic reviews. J. Clin. Epidemiol. 54 (7), 651–654.
Wang, W., Sawada, M., Noriyama, Y., Arita, K., Ota, T., Sadamatsu, M., Kishimoto, T., 2010. Tai-Chi exercise versus rehabilitation for the elderly with cerebral vascular disorder: a single-blinded randomized controlled trial. Psychogeriatrics 10 (3), 160–166.
Younge, J.O., Gotink, R.A., Baena, C.P., Roos-Hesselink, J.W., Hunink, M.M., 2015. Mind–body practices for patients with cardiac disease: a systematic review and meta-analysis. Eur. J. Prevent. Cardiol. 22 (11), 1385–1398.
Yu, L., Liu, F., Nie, P., Shen, C., Chen, J., Yao, L., 2021. Systematic review and meta-analysis of randomized controlled trials assessing the impact of Baduanjin exercise on cognition and memory in patients with mild cognitive impairment. Clin. Rehabil. 35 (4), 492–505.
Zheng, G., Zheng, Y., Xiong, Z., Ye, B., 2020. Effect of Baduanjin exercise on cognitive function in patients with post-stroke cognitive impairment: a randomized controlled trial. Clin. Rehabil. 34 (8), 1028–1039.
Zou, L., Yeung, A., Zeng, N., Wang, C., Sun, L., Thomas, A., Wang, H., 2018. Effects of mind-body exercises for mood and functional capabilities in patients with stroke: an analytical review of randomized controlled trials. Int. J. Environ. Res. Publ. Health 15 (4), 721–734.
Zou, L., Loprinzi, P.D., Yeung, A.S., Zeng, N., Huang, T., 2019. The beneficial effects of mind-body exercises for people with mild cognitive impairment: a systematic review with meta-analysis. Arch. Phys. Med. Rehabil. 100 (8), 1556–1573.