Sensory-Based Occupational Therapy Interventions for Young Children with Cerebral Palsy: A Systematic Review

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Abstract

Importance: Sensory-based occupational therapy interventions reveal positive impact on children with cerebral palsy, however current research is limited. This systematic review examined the effectiveness of sensory-based occupational therapy interventions in promoting motor skill development and participation in young children with cerebral palsy.

Objective: To identify, evaluate, and synthesize the current literature concerning sensory-based occupational therapy interventions for young children with cerebral palsy to determine the efficacy of promoting participation and motor development.

Data Sources: A literature search occurred between May 14, 2026 and May 21, 2026. Follow up searches were conducted on May 21, 2026. Databases included EBSCOhost, CINAHL, Academic Search Complete, and PsycINFO using Hawai'i Pacific University's online library databases. Search terms included cerebral palsy AND (children, early childhood, pediatric) AND (occupational therapy, sensory intervention, sensory integration) AND (motor skills or participation) as well as combinations of these terms.

Study Selection and Data Collection: This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Published studies examining sensory-based occupational therapy interventions targeting participation and/or motor skill development in young children diagnosed with cerebral palsy were included in the systematic review. Study protocols and data from systematic reviews, scoping reviews, dissertations, and conference proceedings were excluded.

Findings: Six studies met the inclusion criteria according to the American Occupational Therapy Association's Levels of Evidence including four level two studies and two level four studies. The outcomes of these studies indicate sensory-based occupational therapy interventions specifically sensory integration (SI), constraint-induced movement therapy (CIMT), and hippotherapy are effective in enhancing participation and motor development among children with cerebral palsy.

Conclusion and Relevance: Sensory-based occupational therapy interventions are effective and improve participation and motor skill development for young children with cerebral palsy.

Key words: Cerebral palsy, motor control, functional participation, sensory integration therapy, constraint-induced movement therapy, hippotherapy

Sensory-Based Occupational Therapy Interventions for Young Children with Cerebral Palsy: A Systematic Review

Cerebral palsy (CP) represents the leading cause of physical disability among children with approximately 2-3 cases per 1000 live births (Chorna et al., 2015). CP affects a child's mobility, posture, and ability to participate independently in everyday activities. CP is typically diagnosed early in life, therefore early intervention is especially important, as treatments aimed at supporting development tend to be most effective during childhood. The most common type of CP is spastic cerebral palsy, which accounts for approximately 70–80% of cases (Warutkar et al., 2023). Children with spastic CP often experience motor impairments that may present as hemiplegia, diplegia, quadriplegia, or other movement-related difficulties (Hussein et al., 2025).

Children with cerebral palsy (CP) present impairments in gross motor performance, postural control, and progressive musculoskeletal limitations; these deficits lead to restrictions in activities of daily living (ADLs). Occupational therapy plays an important role in helping children with cerebral palsy improve their functional independence and participate in meaningful daily activities. One intervention approach used in occupational therapy is sensory integration, which aims to address sensory processing challenges that may affect a child's motor performance and participation (Aktas et al., 2025). While sensory integration is commonly used in practice, there is still limited research examining its effectiveness for children with cerebral palsy, particularly in relation to motor function outcomes.

Given the increasing prevalence of cerebral palsy and the limited research studies available, this systematic review was conducted to further explore the evidence supporting sensory integration interventions for children with CP. The purpose of this review was to

examine the current evidence on sensory-based interventions and their effects on motor skill development and participation in young children with cerebral palsy.

Method

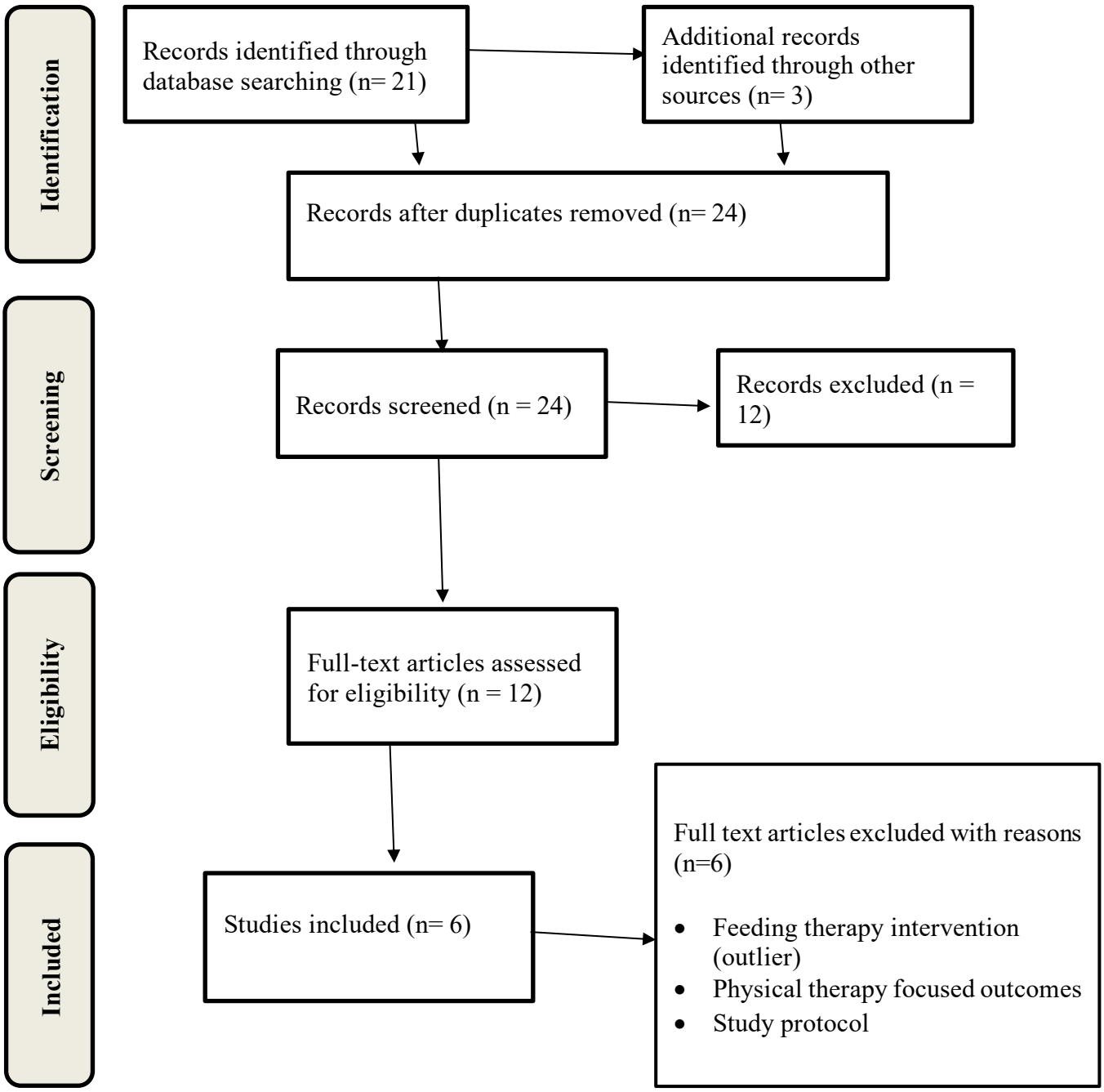
The systematic review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) and incorporated recommended processes for conducting a systematic review. The guiding research question for this systematic review was: Which sensory-based OT interventions are most effective to promote participation and motor skill development in young children with CP?

A broad search of the literature occurred between May 14, 2026 and May 21, 2026. An additional search was conducted on May 21, 2026 to ensure all relevant research was included. The inclusion criteria for studies in this systematic review were as follows: peer-reviewed, published in English, full-text, academic journal, and within five years of publication (dated between 2021-2026). Exclusion criteria, in addition to those studies that did not meet the inclusion criteria, included articles that were study protocols, systematic reviews, scoping reviews, dissertations, and conference proceedings. A search for relevant literature was completed using electronic databases: EBSCOhost, CINAHL, Academic Search Complete, PsycINFO through Hawai'i Pacific University's online library database. Search terms included "cerebral palsy" AND "children OR early childhood OR pediatrics" AND "occupational therapy OR sensory intervention OR sensory integration" AND "motor skills OR participation" as well as combinations of these terms. Appendix A provides an extensive list of the search terms used for this systematic review. The initial search included nine articles related to the research topic

(Figure 1). Four independent reviewers completed the screening and selection of the studies, assessed their quality, and extracted the data.

Figure 1

Flow Diagram



Results

Six studies met the inclusion criteria for the systematic review. The articles were assessed according to their level of evidence, risk of bias, and methodological quality. This systematic review included six studies that contained relevant information regarding sensory interventions targeting motor control and participation for children with cerebral palsy (CP). See Appendix B. The information from these articles was divided into three themes: (1) Sensory integration and neurodevelopmental approaches, (2) constraint-induced movement therapy and upper extremity interventions, and (3) hippotherapy and multisensory/whole-body rehabilitation approaches. The Cochrane risk-of-bias guidelines were used to assess each article and are provided in Appendix C.

Sensory Integration and Neurodevelopmental Approaches

Two of the six studies discussed the efficacy of sensory integration (SI) therapy (Aktaş et al., 2025; Warutkar et al., 2023). Both studies were Level II studies. They provided evidence that sensory integration and neurodevelopmental interventions are effective and potentially beneficial for improving motor, sensory, and functional outcomes in children with cerebral palsy.

Aktaş et al. (2025) conducted a single-blind randomized controlled trial evaluating SI therapy combined with conventional physiotherapy on upper extremity function in children with cerebral palsy. While a physiotherapist provided the therapy, the interventions and outcomes generalize to occupational therapy. Results demonstrated significant improvements in upper extremity function (QUEST grasp and dissociated movements) and trunk control (TCMS dynamic reaching) within the intervention group ($p < .05$). However, no significant between-group differences were observed in balance outcomes. These findings suggest that although

sensory integration may not improve every aspect of motor performance, it can enhance selective motor control and upper extremity function, which are essential for performing daily occupations.

Warutkar et al. (2023) conducted a randomized controlled trial comparing sensory integration therapy combined with conventional physiotherapy versus conventional therapy alone in children with spastic diplegic cerebral palsy. The intervention group demonstrated statistically significant improvements across motor function, sensory processing (SSP), cognitive function (MMSE), and spasticity (MAS) ($p \leq .001$). This study concluded that SI therapy is an effective adjunct intervention for improving multiple functional domains in pediatric cerebral palsy.

Limitations of the studies on sensory integration included small sample sizes (Aktaş et al., 2025), moderate risk of bias due to unclear allocation concealment and limited blinding (Aktaş et al., 2025 and Warutkar et al., 2023), and heterogeneity (two or more participant characteristics) including wide age ranges and varying severity levels (Aktaş et al., 2025; Warutkar et al., 2023). Additionally, the Warutkar et al. (2023) study only considered children with spastic cerebral palsy, didn't follow-up with participants post-intervention, and provided SI therapy for 40 minutes twice a week for 8-weeks. Despite these limitations, both studies provide evidence that sensory integration may improve motor function and participation.

Neuromotor Intervention Approaches

Two of the six studies examined the efficacy of neuromotor interventions on neurodevelopmental outcomes and sensory motor function. The study by Ali et. al. (2025) was a Level IV cohort study and the study by Hussein et al. (2025) was a Level II single-blind

randomized control trial (see Appendix B). Both studies provided evidence that neurodevelopmental treatment and whole-body vibration are associated with significant improvements in gross motor function, muscle tone, and sensorimotor function among children with cerebral palsy.

Ali et al. (2025) conducted a Level IV cohort study evaluating neurodevelopmental treatment (NDT) delivered in a Snoezelen multisensory environment. Significant improvements were observed in the Hammersmith Infant Neurological Examination (HINE) and the Gross Motor Function Measure (GMFM-88) scores following 12 weeks of intervention ($p \leq .005$). However, therapy frequency within 12 weeks and improvements in HINE and GMFM-88 scores were not statistically significant ($p>.05$), suggesting uncertain dose-response effects.

Hussein et al. (2025) conducted a Level II single-blind randomized controlled trial evaluating the effectiveness of whole-body vibration (WBV) in conjunction with standard physical therapy targeting upper extremities. While the interventions were provided by a physical therapist, the treatment approach and outcomes generalize to occupational therapy. Statistically significant improvements were observed between-groups ($p<0.05$) from the Function, Star, Weight and Trace assessment in function, muscle strength, and sensory motor integration. However, there was no significant difference in WBV and muscle tone ($p=0.10$). Within-group comparisons reveal statistically significant differences in all outcome measures in WBVY ($p<0.05$).

Limitations of the neuromotor interventions include the potential variability in intervention adherence outside structured sessions, limited reporting on long-term follow-up outcomes, and heterogeneity in developmental age ranges may influence responsiveness to

intervention, limiting generalizability of findings across all pediatric cerebral palsy populations (Ali et al., 2025; Hussein et al., 2025). Hussein et al. (2025) did not include a follow-up period with their participants and failed to blind participants which reveals the possibility of bias. The sample size of Ali et al. (2025) was small (n=20) which reduced statistical power and reliability of the findings. Additionally, this study lacked a control group, which restricts the ability to attribute findings solely to the intervention. Despite these limitations, both studies provide evidence that neuromotor interventions can improve motor and sensorimotor outcomes.

Hippotherapy and Multisensory/Whole-Body Rehabilitation Approaches

Two of the six studies examined the efficacy of hippotherapy and multisensory or whole-body rehabilitation interventions (Savițchi et al., 2025; Silkwood-Sherer & McGibbon, 2022). One study was a Level II randomized controlled trial, and one was a Level IV quasi-experimental study (see Appendix B). The studies provided evidence that hippotherapy-based interventions are effective and potentially beneficial for improving balance, mobility, gait, and participation outcomes in children with cerebral palsy.

Silkwood-Sherer and McGibbon (2022) conducted a pragmatic multi-center randomized controlled trial evaluating hippotherapy as an adjunct to conventional therapy. The intervention group demonstrated significant improvements in balance (PBS), mobility (ASKp), gait speed (1MWT), and quality of life compared to controls ($p < .05$). Improvements were also sustained at follow-up 12 weeks after hippotherapy, suggesting both immediate and longer-term benefits for postural control and functional participation.

Savițchi et al. (2025) conducted a quasi-experimental study evaluating a combined rehabilitation program including physiotherapy, occupational therapy, and hippotherapy in

children with postural and balance impairments. Participants demonstrated improvements in balance (Berg Balance Scale; BBS) and mobility (Timed Up and Go test), indicating enhanced postural stability and functional mobility following intervention. Results from the BBS reveal a 4.4 improvement from initial and final assessment in motor control, balance, and postural stability. Results from the Up and Go Test reveal an average improvement of 5.5 seconds demonstrating increases in mobility and reaction times.

Limitations include small sample sizes (Savițchi et al., 2025), weak comparative design structure (Savițchi et al., 2025; Silkwood-Sherer & McGibbon, 2022), and moderate risk of bias due to limited blinding and allocation concealment (Silkwood-Sherer & McGibbon, 2022). Additional limitations include variability in intervention dosage and inconsistent treatment protocols across settings. In Savițchi et al. (2025), the small sample size (n=4) represents a constraint in validity and generalizability of results to be able to perform meaningful statistical analysis. Additionally, there is a lack of a comparison group of children receiving standard therapy, so a causal relationship is unable to be observed. The main limitations of the Silkwood-Sherer & McGibbon (2022) study is the small sample size (n=13) and the disparity in size and impairment level between the groups. Researchers experienced difficulties recruiting children that had never received prior hippotherapy intervention and participant attrition occurred due to a prolonged onboarding process.

Discussion

The findings of this systematic review suggest that sensory-based occupational therapy interventions may be effective in improving motor skill development and participation in young children with cerebral palsy. Across the six studies included in this systematic review,

interventions including sensory integration therapy, constraint-induced movement therapy, neurodevelopmental multisensory approaches, and hippotherapy demonstrated positive effects on motor skills, balance, mobility, upper extremity function, and participation in daily activities.

Sensory integration and neurodevelopmental interventions in studies by Aktaş et al. (2025) and Warutkar et al. (2023) revealed consistent positive outcomes across the studies. Children who participated in these interventions demonstrated improvements in upper extremity function, trunk control, gross motor skills, sensory processing, and overall functional performance. These findings support the idea that sensory-based interventions can help children with cerebral palsy develop the skills needed to participate more successfully in everyday activities. While improvements were reported across multiple studies, differences in treatment frequency and intervention approaches make it difficult to determine which specific methods are most effective.

According to Savițchi et al. (2025) and Silkwood-Sherer and McGibbon (2022), the results support hippotherapy as an effective intervention to improve motor skills in children with cerebral palsy. Hippotherapy as an alternative rehabilitation method or an adjunct therapy positively correlated to improvements in balance, mobility, gait, postural control, and quality of life. These findings suggest that hippotherapy may provide children with opportunities to improve motor skills while participating in a meaningful and engaging activity. The persistence of improvements during follow-up appointments also indicate that some benefits may continue after the intervention has ended.

Although the overall findings were positive, several limitations should be considered. Many of the studies included small sample sizes, differences in intervention dosage, and a lack

of follow-up periods. Variability in participant characteristics and outcome measures also makes comparison across studies difficult. Additional research with larger sample sizes and more consistent intervention protocols is needed to strengthen the evidence supporting sensory-based occupational therapy interventions for children with cerebral palsy.

Strengths and Limitations

The systematic review followed PRISMA guidelines to ensure a structured and transparent study selection process. A clearly defined search strategy and eligibility criteria were used to identify and screen studies for inclusion. The use of a PRISMA flow diagram enhanced transparency in reporting the study selection process. Additionally, studies were evaluated using standardized risk-of-bias tools supporting consistency in methodological appraisal. Finally, the three themes of the studies supported structured synthesis of heterogeneous intervention approaches in pediatric cerebral palsy rehabilitation.

Several limitations were identified in the review process. The number of studies included (n=6) limits the overall strength and generalizability of findings. It is also possible that some relevant studies were not identified as a result by database limitations or search constraints, which pertains to selection bias. Only published peer-reviewed studies were included in the systematic review which could contribute to publication bias. Additional limitations include variability in intervention dosage and inconsistent treatment protocols included in studies. Reporting of study methods in some studies that limited the ability to fully assess the risk of bias.

Implications for Occupational Therapy Practice

The findings from the literature suggest several implications for occupational therapy practice for incorporating interventions catered and structured to each specific client. The findings consistently showed improvements in motor performance and functional participation when sensory-based interventions were included in rehabilitation. This evidence supports the use of individualized, occupation-centered sensory interventions as a complementary approach within occupational therapy practice. Several key implications for OT practice include:

- Tailored rehabilitation treatments to support the needs of each child
    - Personalized and complementary therapies maximize the development of motor skills and functional integration into daily activities.
- Whole-body vibration (WBV) as an adjunct therapy to the traditional CP treatment
    - WBV training improves walking ability, mobility, and muscle power while reducing muscle tone without causing adverse side effects.
- Sensory integration (SI) therapy improves upper extremity, trunk control, and grasp patterns in children with cerebral palsy.
    - OT interventions can be guided by SI therapy to target sensory processing skills required for effective motor performance.
- Equine postural movement during hippotherapy translates to off-horse activities.
    - Multidirectional movements of the horse allow children to maintain an external focus (e.g., staying astride the moving horse) rather than an internal focus (ex. sitting up straight).
    - In OT treatments, the repetitive practice in horse therapy allows children to process postural control at a procedural level.

Conclusion

The studies in this systematic review show evidence supporting the effectiveness of sensory-based occupational therapy interventions for children with cerebral palsy. Sensory integration therapy, constraint-induced movement therapy, neurodevelopmental multisensory interventions, and hippotherapy all demonstrated positive effects on motor development, functional mobility, balance, upper extremity function, and participation.

Additional research is needed to determine the long-term effects of these interventions and identify the most effective treatment approaches. Future studies should explore additional intervention approaches that may be more effective or inclusive for children with varying presentations of cerebral palsy. Finally, research should examine family outcomes associated with these interventions, including their impact on caregiver stress, burden, and overall family well-being.

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Appendix A

Systematic Review Search Terms

Cerebral palsy
AND
Children, early childhood, pediatric
AND
Occupational therapy, sensory integration, sensory intervention
AND
Motor skills, participation

Appendix B

Table 1. *Evidence Table for Sensory-Based OT Interventions for Young Children with CP*

Author/Year	Level of Evidence Study Design Risk of Bias	Participants Inclusion Criteria Study Setting	Intervention and Control Groups	Outcome Measures	Results
Aktaş et al. (2025)	*Level of Evidence:* Level 2 *Study Design:* Single-blind, RCT *Risk of Bias:* Low	*Participants:* *N* = 22 *Inclusion Criteria:* 1. Between the ages of 2 to 18 2. Diagnosis of CP 3. Parental consent to participate *Study Setting:* Special Education and Rehabilitation Centre	*Intervention Group* (*n* = 11): Received supervised conventional physiotherapy 1 day a week and sensory integration therapy 1 day a week for 8 weeks (16 sessions). *Control Group* (*n* = 11): Received supervised conventional physiotherapy 2 times a week for 8 weeks (16 sessions).	Gross motor function classification system (GMFCS) Quality of upper extremity skills test (QUEST) Trunk control measurement scale (TCMS)	No statistically significant difference between the groups in QUEST, TCMS, and PBS scores before treatment ($p > .05$) No statistically significant difference in amount of change in PBS scores between groups ($p > .05$) Scores from grasps and dissociated movements of the sub-scale of QUEST in the IG between pre and post treatment scores was

					statistically significant ($p < .05$) Scores of the dynamic reaching sub-scale of the TCMS in the IG) were statistically significant ($p < .05$)
Ali et al. (2025)	*Level of Evidence:* Level 4 *Study Design:* Cohort study *Risk of Bias:* Low	*Participants:* *N* = 20 *Inclusion Criteria:* 1. Between the ages of 3 to 24 months (premature infants had corrected age: chronological age minus the number of weeks before 40 weeks' gestation) 2. Followed up at Paediatric Clinic, Hospital Pakar	*Intervention:* Received neurodevelopmental treatment (NDT) in Snoezelen multisensory room. Each approach was unique and catered to each child's specific problems. Frequency of treatment varied per child and each session lasted 1 hour and each child was assessed after 12 weeks.	Normality of continuous variables • Shapiro-Wilk test • Visual inspection histograms • Q-Q plots	HINE scores increased from pre- (mean = 60.70, SD = 16.19) to post- (mean = 66.75, SD = 18.18, t = -3.211, P = 0.005) therapy GMFM-88 increased from pre- (mean 49, SD = 34.34) to post-therapy (mean = 101.95, SD = 55.70, t = -6.116, $p<0.001$) Therapy frequency in 12 weeks and improvement in HINE and GMFM-88 scores were not statistically significant ($p>.05$)

		Universiti Sains Malaysia (HPUSM) 3. Diagnosis of CP or increased risk of CP by either: Gross motor delay; Or presence of antenatal, perinatal, or postnatal risk factors *Study Setting:* Hospital Pakar Universiti Sains Malaysia, Kelantan			
Hussein et al. (2025)	*Level of Evidence:* Level 2 *Study Design:* Single-blind, RCT *Risk of Bias:* Moderate	*Participants:* *N* = 54 *Inclusion Criteria* 1. Children from ages 8 to 14 2. Diagnosed Spastic diplegic CP 3. Grade 1-3	*Intervention Group:* (*n* = 28): Received routine rehabilitation exercises and upper limb exercises performed while using whole-body vibration (WBV) machine 3 times a	*Muscle Tone:* • Modified Ashworth scale (MAS) *Function:* • ABILHAN D-Kids *Muscle Strength:* • Force assessment	No significant differences at baseline between two groups ($p>0.05$) *Between-Groups:* The measured outcomes of function, muscle

		on Ashworth Scale (MAS) 4. Parent signed informed consent before participating *Study Setting* Local rehabilitation centers in Ha'il region, Saudi Arabia	week for 4 weeks (12 sessions) *Control Group* (*n* = 26): Received routine rehabilitation exercises 3 times a week for 4 weeks (12 sessions)	• Weight assessment *Sensory Motor Integration:* • Trace assessment • Star assessment	strength, and sensory motor integration from the Function, Star, Weight, and Trace assessment revealed statistically significant differences ($p>0.05$) except muscle tone ($p = 0.10$) *Within-group analysis:* Statistically Significant differences in all outcome measures in WBVY ($p<0.05$) Control group - statistically significant differences in all outcomes except spasticity, function, and trace assessment on left side ($p = 0.33, 0.06, 0.54$)

Savițchi et al. (2025)	*Level of Evidence*: Level 4 *Study Design:* Descriptive case series with pre- and post- intervention assessment (quasi-experimental study) *Risk of Bias*: Moderate	*Participants*: *N* = 4 children - 1 girl and three boys Ages: 4-6 years old *Inclusion Criteria:* 1. Grade III (n=1, 25%) had hemiparesis; Grade II (n= 3, 75%) mild hemiparesis 2. Recruited from medical rehabilitation center in Republic of Moldova *Study setting:* Republican School of Equestrianism &Modern Pentathlon Kinetica Medical Rehabilitation Center, Republic of	*Intervention:* 10 physiotherapy sessions; 15 occupational therapy sessions; 15 hippotherapy sessions	BBS (Berg Balance Scale) Timed Up and Go Test (6m)	*BBS*: 4.4 point improvement from initial and final assessment (45 → 49.4) in motor control, balance, postural stability *Up and Go Test (6m)*: average improvement of 5.5 seconds (26.8 sec → 21.2 sec) → increases in mobility and reaction times

		Moldova			
Silkwood-Sherer & McGibbon (2022)	*Level of Evidence:* Level 2 *Study Design:* Pragmatic, multi-center randomized control trial with pre- and post-intervention; 12-week follow up assessment *Risk of Bias:* Low	*Participants:* *N* =13 *Inclusion criteria* 1. Diagnosis of spastic cerebral palsy made by a pediatric neurologist 2. 36 months to 78 months 3. Ability to stand 4 seconds without an assistive device 4. Ability to walk with or without an assistive device for 40 ft 5. A PBS score of ≤51 (91%)	*Intervention Group* (*n* = 9: Received 12 weekly hippotherapy sessions (30 minutes) added to child's scheduled therapy sessions *Control group* (*n* = 4): Received usual therapy with no hippotherapy added	Pediatric Balance Scale (PBS): balance Activities Scale for Kids (1 Minute Walk Test): gait speed Activities Scale for Kids (ASKp): mobility, self-care, daily tasks PreSchool version of the Children's Assessment of Participation and Enjoyment (APCP): skill development, physical recreation, play/social activities Pediatric Quality of Life: health-related quality of life	*Between-groups:* treatment group significantly outperformed control on PBS post-intervention (+33.98% vs. −6.67%, p=.011). *Within treatment group:* significant improvements in PBS (P0–P1 p=.02; P0–P2 p=.02), ASKp (P0–P1 p=.025; P0–P2 p=.016), delayed improvement in 1MWT (P1–P2 p=.02), and PedsQL-CP (P0–P2 p=.03 *improvements in treatment group

		Study setting: 4 outpatient therapeutic riding/hippotherapy centers across the U.S. (California, Florida, Texas, Arizona)			continued to develop for 12 weeks after hippotherapy *Control group*: no significant changes
Warutkar et al. (2023)	*Level of Evidence:* Level 2 *Study Design*: Randomized Control Trial (RCT) *Risk of Bias:* Low	*Participants:* *N* = 40 *Inclusion Criteria*: 1. Between the ages of 6 and 10 2. Diagnosis of spastic diplegic CP with Gross Motor Function Classification System (GMFCS) level I to III 3. Children can follow demands *Study Setting* Physiotherapy	*Intervention Group* (*n* = 20): Received sensory integration therapy (SIT) for 25 minutes and conventional physiotherapy for 20 minutes. Included vision perception activity, body awareness, and tactile perception. *Control Group* (*n* = 20): Received conventional physiotherapy for 45 minutes.	Short sensory profile (SSP) Gross Motor Function Classification System (GMFCS) Pediatric mini-mental state examination (MMSE) Modified Ashworth Scale (MAS)	Combined SIT and conventional physiotherapy reveal statistically significant differences in motor function improvements in children for all outcome measures GMFCS: group A (7.28, p=0.0001) and group B (4.48, p=0.0001) SSP: group A (27.91, p=0.0001), group B (11.31, p=0.0001) MMSE: group A (6.89, p=0.0001),

		Outpatient Department (OPD)	Included strengthening, stretching, and range of motion exercises for upper limbs, lower limbs, and trunk.		group B (6.32, p=0.0001) MAS: group A (24, p = 0.0001), group B (15.96, p=0.0012)

Note.

- ASKp = Activities scale for kids
- APCP = Assessment of participation and enjoyment
- BFMF = Bimanual Fine Motor Function scale
- CIMT = constraint-induced movement therapy
- CP = cerebral palsy
- ERP = Event Related potential
- GMFCS = Gross Motor Function Classification System
- ICP = Infantile cerebral palsy
- MAS = modified Ashworth Scale
- MMSE = mini-mental state examination
- NDT = neurodevelopmental treatment
- RCT = randomized controlled trial
- SIT = sensory integration therapy
- SSP = short sensory profile
- TD = typical development

Appendix C

Risk-of-Bias Table for Sensory-Based OT Interventions for Young Children with CP

Risk-of-Bias Table for Randomized Controlled Trial (RCT) and Non-RCT (Two or More Group Design)										
	Selection Bias (Risk of bias arising from randomization process)			Performance Bias (effect of assignment to intervention)		Detection Bias		Attrition bias	Reporting bias	Overall risk-of-bias (low, moderate, high)
Citation	Random Sequence Generation	Allocation Concealment (until participants enrolled and assigned)	Baseline difference between interventio n groups	Blinding of Participants During the Trial	Blinding of Study Personnel During the Trial	Blinding of Outcome Assessment: Self-reported outcomes	Blinding of Outcome Assessment : Objective Outcomes (assessors aware of intervention received?)	Incomplete Outcome Data (data for all or nearly all participants)	Selective Reporting (results being reported selected on basis of the results?)	
Aktaş et at. (2025)	+	?	+	-	-	?	+	+	+	Low
Hussein et al. (2025)	+	?	+	-	-	-	+	+	+	Low
Silkwood-Sherer & McGibbon (2022)	+	?	-	-	-	+	+	-	+	Moderate
Warutkar et al. (2023)	?	?	?	-	-	-	?	+	+	Low

Note. Categories for risk of bias are as follows: Low risk of bias (+), unclear risk of bias (?), high risk of bias (–). Scoring for overall risk of bias assessment is as follows: 0–3 minuses, low risk of bias (L); 4–6 minuses, moderate risk of bias (M); 7–9 minuses, high risk of bias (H).

Citation. Table format adapted from Higgins, J. P. T., Sterne, J. A. C., Savović, J., Page, M. J., Hróbjartsson, A., Boutron, I., . . . Eldridge, S. (2016). A revised tool for assessing risk of bias in randomized trials. Cochrane Database of Systematic Reviews 2016, Issue 10 (Suppl. 1), 29–31. https://doi.org//10.1002/14651858.CD201601

Risk of Bias for Before-After (Pre-Post) Studies with No Control Group (One Group Design)												
Citation	Study question or objective clear	Eligibility or selection criteria clearly described	Participants representative of real-world patients	All eligible participants enrolled	Sample size appropriate for confidence in findings	Intervention clearly described and delivered consistently	Outcome measures pre-specified, defined, valid/reliable, and assessed consistently	Assessors blinded to participant exposure to intervention	Loss to follow-up after baseline 20% or less	Statistical methods examine changes in outcome measures from before to after intervention	Outcome measures were collected multiple times before and after intervention	Overall risk of bias assessment (low, moderate, high risk)
Ali et al. (2025)	Y	Y	Y	Y	N	Y	Y	N	N	Y	N	Moderate
Savițchi et al. (2025)	Y	Y	Y	NR	N	Y	Y	N	Y	Y	N	Low

Note. Y = yes; N = no; NR = not reported. Scoring for overall risk of bias assessment is as follows: 0–3 N, Low risk of bias (L); 4–8 N, Moderate risk of bias (M); 9–11 N, High risk of bias (H).

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