Effects of Nonpharmacological Interventions for Dizziness in Older People: Systematic Review

Julie C. Kendall, Jan Hartvigsen, Michael F. Azari, Simon D. French

**Background.** Nonpharmacological interventions have been shown to have some effectiveness in adults with dizziness; however, the effectiveness of these interventions in older people is unknown.

**Purpose.** The aim of this study was to determine the effects of conservative nonpharmacological interventions for dizziness in older people.

**Data Sources.** The Cochrane Central Register of Controlled Trials, PubMed, EMBASE, SCOPUS, CINAHL, AMED, Index to Chiropractic Literature, PsycINFO, and MANTIS were searched from inception to May 2014.

**Study Selection.** Two investigators independently screened controlled trials with participants who were more than 60 years old and experienced dizziness. Studies of participants with dizziness from a specific diagnosis, such as Ménière disease and benign paroxysmal positional vertigo, were excluded. Outcome measures from the selected studies included self-reported dizziness and postural balance.

**Data Extraction.** Two investigators independently extracted data on participants, interventions, comparison group, outcome measures, and results. The risk of bias of the included studies was assessed with Cochrane guidelines.

**Data Synthesis.** Seven articles consisting of 7 controlled trials were included. All studies involved some form of exercise, including vestibular rehabilitation exercises, postural balance exercises, and tai chi exercise, as the main intervention. The studies had a high risk of bias because of the lack of adequate randomization and allocation concealment, the lack of reporting on cointerventions, the lack of reporting on reasons for dropouts, and the lack of reporting on participant adherence.

**Limitations.** Heterogeneity among the included studies in interventions and outcome measures prohibited a meta-analysis. Only 2 studies reported a significant difference between the intervention group and the comparison group for self-reported dizziness.

**Conclusions.** There is insufficient evidence to determine the effectiveness of nonpharmacological treatments for dizziness in older people. Current evidence is hampered by a high risk of bias, and well-designed trials with adequate masking, randomization, and adherence are needed.
Dizziness is frequently experienced by older people, with an estimated 32% to 50% of women and 22% to 30% of men more than 65 years old reporting dizziness.1-3 Importantly, this prevalence increases with age.1,2 The consequences of dizziness include not only personal distress but also an economic burden on the health care system; for instance, the cost of emergency department visits for dizziness in older people is estimated to be $3.9 million.4 One of the most concerning consequences of dizziness in older people is the association with an increased risk of falls.5 Falls are associated with decreased independence, disability, morbidity, and mortality.6,7 Falls in older people contribute to significant personal and economic burden, and with the aging population, the direct cost of falls in Australia is expected to increase to $1.375 billion per annum by 2051.8

Dizziness in older people may be empirically classified in 6 categories: frailty; psychological disorders; cardiovascular disorders; presyncope; nonspecific disorders; and ear, nose, and throat disorders.9 Older people with dizziness are underreferral for specialist consultations and lack access to appropriate interventions.10 Furthermore, dizziness in older people is often multifactorial11-13 and has been shown to be associated with anxiety,12 spinal pain,12 and increased use of medications.5,11-12 The inappropriate prescription of some medications for dizziness has been questioned,13 and polypharmacy is common, with 33% of older people with dizziness using 5 or more medications and 37% using 3 or more medications that increase the risk of falls.11 The effectiveness of nonpharmacological therapies, alone or in combination, for dizziness—particularly in older people, who may be at risk of polypharmacy—needs to be determined. Nonpharmacological interventions that have reportedly been used for dizziness in older people include exercises (including vestibular rehabilitation therapy),14-18 cognitive-behavioral therapy,17,19,20 and manual therapy.21,22

The effectiveness or optimal combinations of therapies, particularly nonpharmacological therapies, in older people have not been determined, and—to our knowledge—a systematic review of literature on nonpharmacological therapies for dizziness in older people has not been done. In this review, our aim was to address this need by providing an overview of controlled trials carried out to date to determine the effects of conservative, nonpharmacological interventions for dizziness in older people.

Method

Data Sources and Searches
The following electronic databases were searched, with assistance from a research librarian, from inception to May 2014: Cochrane Central Register of Controlled Trials, PubMed, EMBASE, Scopus, CINAHL, AMED, Index to Chiropractic Literature, PsycINFO, and MANTIS. Reference lists of included articles and relevant systematic reviews retrieved in the search were screened for additional relevant articles. Search terms related to clinical trials, older age, dizziness, and various nonpharmacological therapies were linked with Boolean operators. Nonpharmacological therapy search terms included (but were not limited to) “vestibular rehabilitation,” “acupuncture,” “chiropractic,” “physiotherapy,” “osteopath,” “cognitive behavior therapy,” and “massage” (eAppendix 1, available at ptjournal.apta.org). Search terms were modified for each database, and appropriate subject headings were used for each database searched.

Study Selection
Two authors (J.C.K. and either M.F.A. or S.D.F.) independently screened all titles and abstracts retrieved via the electronic database search and discarded studies that did not meet the inclusion criteria. The full texts of the remaining articles were obtained, and 2 authors (J.C.K. and either J.H. or M.F.A.) independently applied the inclusion criteria to determine which studies to include. Discrepancies between these review authors were resolved by consultation and consensus between authors.

Outcome measures. The primary outcome measure was any self-reported measure of dizziness (eg, Dizziness Handicap Inventory, visual analog scale, numerical rating scale, subjective improvement, daily activities, and global perceived effect). Also included were objective measures, such as balance (eg, Retrospective study designs, cohort studies, case reports, case series, commentaries, letters to the editor, and expert opinions were excluded. Non-English language articles that could not be assessed were excluded.

Participants. Studies with participants who were more than 60 years old and experienced dizziness were included; thus, participants with presbyacusis, nonspecific dizziness, cervicogenic dizziness with associated osteoarthritis, and dizziness of unspecified origin were included. Excluded studies were those involving participants with dizziness from specific diagnosed causes, including conditions of the ear, nose, throat, central nervous system, or cardiovascular system; migraine-associated vertigo; benign paroxysmal positional vertigo; Ménière disease; peripheral neuropathy; and infection.

Types of interventions. Selected studies were those involving any nonpharmacological interventions, including (but not restricted to) exercises, manual therapy (massage, soft-tissue therapy, manipulation, or traction), cognitive-behavioral therapy, and acupuncture. Studies involving herbal formulations and homeopathic remedies were excluded because they were considered to be pharmacological in nature. Studies with comparison groups consisting of placebo, sham therapy, no treatment (wait list control), and any other type of active intervention were included.
Berg Balance Scale, Activities-specific Balance Confidence Scale, and forceplate center-of-pressure analysis), number of falls, quality of life (eg, Medical Outcomes Study 36-Item Short-Form Health Survey [SF-36] questionnaire), and other outcomes reported in the selected studies.

**Data Extraction**

Two authors (J.C.K. and either J.H., S.D.F., or M.F.A.) independently extracted data from the included articles. The data extracted included characteristics (population, number of participants, age, and sex), interventions (intervention group and control group), and outcomes (primary and secondary outcomes related to dizziness, balance, falls, and quality of life). Discrepancies between authors in data extraction were resolved by consultation and consensus between authors.

**Quality Assessment**

Two review authors (J.C.K. and either J.H., S.D.F., or M.F.A.) independently assessed each article for risk of bias according to the 12-item criteria described in the *Cochrane Handbook for Systematic Reviews of Interventions*. Any discrepancies between authors in the assessment of risk of bias was discussed and resolved through consensus.

The clinical relevance of each publication was also assessed with a 5-item clinical relevance assessment from the Cochrane Back Review Group. Each item was judged as “yes” if it fulfilled the requirement, “no” if it did not fulfill the requirement, or “do not know.” These criteria were applied independently by J.C.K. and one other reviewer (J.H., S.D.F., or M.F.A.). The clinical relevance items included the following:

- Are participants described in detail so that you can decide whether they are comparable to patients whom you see in your practice?
- Are the interventions and treatment settings described well enough that you can provide the same for your patients?
- Were all clinically relevant outcomes measured and reported?

**Data Synthesis and Analysis**

Although a meta-analysis was planned, the included studies were too heterogeneous in their interventions and outcome measures for a meta-analysis; therefore, we present a descriptive, narrative synthesis of the results and quality of the included studies.

**Role of the Funding Source**

Ms Kendall, Dr Hartvigsen, and Dr Azari are supported by a grant from the Foundation for Chiropractic Research and Postgraduate Education of Denmark. Dr French is funded by a professorship provided by the Canadian Chiropractic Research Foundation. No funding program was involved in the design, execution, analysis, or interpretation of this research study.

**Results**

A total of 7 studies met the inclusion criteria and were included (Fig. 1). A total of 1,966 electronic publication records were identified through database searching. After 531 duplicate references were removed, the remaining 1,435 records were screened, and 40 full-text articles were assessed for eligibility; 7 studies were included in qualitative synthesis (meta-analysis). The remaining 33 articles did not meet the inclusion criteria.

**Figure 1.** Identification of included studies.
Table 1.
Characteristics of Included Studies

<table>
<thead>
<tr>
<th>Study (Year)</th>
<th>Participants</th>
<th>Interventions</th>
<th>Comparisons</th>
<th>Outcome Measures</th>
<th>Results</th>
<th>Comments</th>
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<tr>
<td>Moreira Bittar et al (2007)</td>
<td>Participants 65–95 y old and with dizziness not of vestibular origin. Participants were screened for systemic diseases and treated with diet, medication, or both. Participants were not included in the active group until adequate treatment of these conditions. Participants were recruited from a geriatric outpatient unit at a university hospital.</td>
<td>Vestibular rehabilitation therapy (n=52). Individual adaptation of the Cawthorne-Cooksey basic protocols, vestibular-ocular reflex, and Norre exercises.</td>
<td>Older people in the general ward of the hospital (not necessarily treated for systemic diseases) (n=44). Exercises were the same as those for the intervention group.</td>
<td>Total number of participants who obtained complete improvement (remission), 50%-90% improvement (improvement), or &lt;50% improvement (no improvement).</td>
<td>Significantly more participants in the active group than in the control group had “remission” (P&lt;.05). There was no significant difference between the number of participants with remission and the number of participants with improvement.</td>
<td>The study design compared groups of participants who had concomitant systematic conditions that may have contributed to dizziness. Inclusion and exclusion criteria were not defined. The only outcome measure reported was subjective percentage of improvement.</td>
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<tr>
<td>Hall et al (2010)</td>
<td>People at least 60 y old, with documented balance or mobility problems, and with normal vestibular function. Dizziness was defined as symptoms of unsteadiness, spinning, and a sense of movement or lightheadedness. Participants were recruited from an outpatient physical therapy center.</td>
<td>Gaze stability exercises (n=20). Exercises required a participant to fixate on a visual target during either horizontal or vertical head movements and to perform eye-head movements between targets with the goal of seeing clearly during those tasks. Frequency: 3 times per day, total time not to exceed 30 min. Home exercise program consisting of balance and walking exercises.</td>
<td>Randomly assigned to placebo eye exercises with the head stationary (n=19). Saccadic eye movements with and without targets against a white wall. Frequency: 3 times per day until discharge from the outpatient center, total time not to exceed 30 min. Home exercise program consisting of balance and walking exercises.</td>
<td>Self-reported difference in severity of dizziness before and after 1 min of head turns (visual analog scale [VAS]). Self-reported disequilibrium between sitting and walking (VAS). Self-reported disability rating scale, from 0 to 5 (0=no disability, 5=long-term disability). Activities-specific Balance Confidence Scale. Visual acuity during head movement (dynamic visual acuity). Preferred gait speed for 9 m. Dynamic Gait Index (DGI). Computerized Posturography Sensory Organization Test (SOT).</td>
<td>There was a significant difference between groups on the DGI (P=.026). All other outcome measures were not significant between groups.</td>
<td>The randomization procedure was not defined.</td>
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Table 1. Continued

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<tr>
<th>Study (Year)</th>
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<tr>
<td>Hansson et al25 (2008)</td>
<td>Multisensory dizziness in people older than 65 y. Participants were recruited from people referred to a physical therapy center in a major city.</td>
<td>Group vestibular rehabilitation program at a physical therapy center (n=31). The program included the following: standing on foam and turning the head from side to side; walking on a slope and turning the head from side to side; standing on a trampoline, slightly flexing the knees, and turning the head from side to side; standing on a sports mat, walking on the spot, and turning the head from side to side; and sitting on a Bobath ball, with feet on foam, and bouncing slightly while turning the head from side to side. Frequency: 50 min, 2 times per week for 9 wk.</td>
<td>People who were matched for age, experiencing dizziness, and recruited from medical centers in the community. No treatment (n=27).</td>
<td>Dizziness Handicap Inventory (DHI). Balance was assessed as the time able to stand (up to 30 s) under the following conditions: in tandem stance with eyes open and closed, on one leg with eyes open, and on one leg with eyes closed. Ability to walk heel to toe for 5 m or in a figure eight.</td>
<td>There was no significant difference between groups on the DHI. There were significant group differences in standing on one leg with eyes open and closed (P=.038) and walking heel to toe (P=.044). All other balance measures were not significant.</td>
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<td>Kammerlind et al26 (2001)</td>
<td>People older than 65 y and with nonperipheral vertigo, unsteadiness, or both. Participants were recruited from an ear, nose, and throat department at a university hospital.</td>
<td>Group balance training (n=12). Training consisted of the following: 15 min of warm-up (standing and walking while making head, trunk, arm, and leg movement); 25 min of balance training (trampoline, standing on foam, standing on balance disks, ball games, walking exercises, and strengthening exercises for legs); and 10 min of floor balance and strength exercises followed by relaxation and stretching. Frequency: 1 h, 2 times per week for 8 wk.</td>
<td>Randomized to no treatment (&quot;were supposed to live as usual&quot;) (n=12).</td>
<td>Self-reported vertigo/unsteadiness (VAS). Various balance tasks, including Romberg test, standing on one leg, walking forward and backward on a line, and time taken to walk 30 m. SOT.</td>
<td>Dizziness as measured with the VAS significantly improved in the exercise group compared with the control group (P=.046). The intervention group was able to stand on one leg with eyes open significantly longer than the control group (P=.036), but all other balance outcome measures were not significant. There were significant between-group differences on 3/6 SOT components.</td>
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## Table 1. Nonpharmacological Interventions for Dizziness

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<th>Study (Year)</th>
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<tr>
<td>Kao et al27 (2014)</td>
<td>Older people with chief complaint of dizziness for more than 1 y. Participants were recruited from a physical medicine and rehabilitation department at a veterans hospital.</td>
<td>Vestibular rehabilitation exercises and strength and balance training (n=15). The exercises and training consisted of the following: reading targets from 2 m while performing horizontal head movements during sitting and standing on soft and hard surfaces; leg strengthening in a chair; and standing on one leg. Frequency: 30–40 min, 3 times per week for 6 wk.</td>
<td>People who were matched for age and had no history of dizziness. No treatment (n=15).</td>
<td>Self-reported dizziness (VAS). DHI. Tinetti Fall Risk Performance Scale. Levels in blood of various inflammation and oxidative stress markers (mRNA, PCR, immunoblotting, SIRT1, NAD+/NADH ratio, antioxidant enzyme activity, hydrogen peroxide, and malondialdehyde).</td>
<td>Blood expression and activity levels of SIRT1, an important modulator of inflammation, were different between people who experienced dizziness and people who did not. After exercise training, these values approximated those seen in the control group.</td>
<td>There was no follow-up for the control group. Baseline data from control and intervention groups were compared with postintervention data.</td>
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<tr>
<td>Maciaszek and Osinski15 (2012)</td>
<td>Men 60–80 y old and with self-reported dizziness within the preceding 12 mo. Participants had a relatively sedentary lifestyle, not having done sports or exercise in the preceding 5 y. Participants were recruited by direct mailing and community information.</td>
<td>Tai chi exercises (n=20). Frequency: 45 min, 2 times per week for 18 wk.</td>
<td>Randomized into a no-treatment group (n=20).</td>
<td>Center of pressure (COP) measured on a computerized posturographic system during the “8 Foot Up and Go Test” and limits of stability (leaning forward, backward, left, and right and area of sway).</td>
<td>There were significant differences between groups on 3/6 COP balance parameters (“8 Foot Up and Go Test,” leaning backward, and maximum area of sway).</td>
<td>The randomization procedure was not defined.</td>
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<td>Prasansuk et al28 (2004)</td>
<td>Older people with current symptoms of disequilibrium, unsteadiness, or vertigo. Participants were recruited from communities adjacent to a hospital.</td>
<td>Head-neck balance exercises based on the Cawthorne-Cooksey protocol (n=110). Multivitamin supplementation. Frequency: daily for 20 wk.</td>
<td>Allocated into multivitamin supplementation (n=105). Cawthorne-Cooksey head-neck balance exercises from wk 8–wk 20. Frequency: daily for 20 wk.</td>
<td>Subjective magnitude numerical scale (average severity of symptoms of dizziness) (0=without symptoms, 10=maximum severity of symptoms). Audiometry. Acoustic impedance. Doppler intracranial sonography. Tetra interbalance posturography. Brain stem electrical response audiometric test.</td>
<td>Remission of symptoms was not significantly different between the 2 groups. At wk 8, significantly fewer participants in the exercise group than in the control group had abnormal posturography results (P=0.03). All other outcomes were not significant between the groups.</td>
<td>Every second participant was allocated to the intervention group.</td>
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a mRNA=messenger ribonucleic acid, PCR=polymerase chain reaction, NAD+ = oxidized form of nicotinamide adenine dinucleotide, NADH= reduced form of nicotinamide adenine dinucleotide.

b Interventions for active and comparison groups were identical after 8 weeks. The results presented are from the 8-week time point. All results at the 20-week time point were not significant.
criteria and were excluded (a list of the excluded studies is shown in eAppendix 2, available at ptjournal.apta.org). Screening of reference lists did not identify additional relevant articles. Because of the small number of included studies and their general high risk of bias, the focus of our analysis was describing the available evidence for various therapeutic modalities rather than assessing the effectiveness or comparing the effectiveness of modalities.

Of the included studies, all contained some form of exercise as the main intervention: vestibular rehabilitation exercises, balance exercises, and tai chi exercise. The characteristics of the included studies are shown in Table 1. The included studies were designed as randomized controlled trials, age-matched control trials with or without dizziness, and a nonrandomized controlled trial.

The most common outcome measures were self-reported dizziness and balance, with dizziness being measured in 6 of 7 studies and balance being measured in 6 of 7 studies. Other outcome measures included gait speed or gait performance, inflammation markers in blood, and vestibular and cerebral tests (audiometry, acoustic impedance, and Doppler intracranial sonography).

Only 2 studies reported a statistically significant difference favoring the intervention for self-reported dizziness. For balance performance, 4 studies found significant differences favoring the intervention between the intervention group and the control group. However, in each study in which balance was measured, multiple balance outcome measures were used. In addition, for all balance parameters, no single study reported statistically significant differences between the intervention group and the control group. Generally, the sample sizes were small, and only one of the included studies reported that a sample size calculation was performed; therefore, the possibility that statistically significant differences were missed because of the small sample sizes cannot be ruled out.

There was a high risk of bias in all of the included studies because of the lack of adequate randomization and allocation concealment, the lack of reporting on cointerventions, the lack of reporting on reasons for dropouts, selective reporting of results, and the lack of reporting on participant adherence (Fig. 2). In addition, the studies lacked adequate reporting to allow informed conclusions about the clinical relevance of the interventions for all of the conditions treated to be drawn (Tab. 2). Finally, the participants were not clearly described, and all but one study failed to provide adequate information about the clinical setting.

Discussion
The body of literature addressing the effectiveness of nonpharmacological therapies for dizziness in older people is hampered by serious methodological shortcomings, a high risk of bias, and inadequate reporting. Therefore, at present, no conclusions about the effectiveness of any of these therapies can be drawn.

The strength of the present study is that, to our knowledge, it is the first systematic review evaluating nonpharmacological therapies for dizziness in older people. However, this review is limited by the general lack of literature—particularly high-quality literature—in this area; consequently, we are unable to make judgments about the effectiveness of any of these therapies that fall under the broad term “nonpharmacological” is difficult to define. It is possible that not all relevant search terms were used and that publications were missed. Additionally, because of a lack of resources, non-
Nonpharmacological Interventions for Dizziness

Table 2.
Assessment of Clinical Relevance

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<td>Are participants described in detail so that you can decide whether they are comparable with patients whom you see in your practice?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Are the interventions and treatment settings described well enough that you can provide the same for your patients?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<tr>
<td>Were all clinically relevant outcomes measured and reported?</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
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<td>Is the size of the effect clinically important?</td>
<td>Do not know</td>
<td>No</td>
<td>No</td>
<td>Do not know</td>
<td>Do not know</td>
<td>Do not know</td>
<td>No</td>
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<tr>
<td>Are the likely treatment benefits worth the potential harms?</td>
<td>Do not know</td>
<td>Do not know</td>
<td>Do not know</td>
<td>Do not know</td>
<td>Do not know</td>
<td>Do not know</td>
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Interesting, no study met our inclusion criteria for cognitive-behavioral therapy or manual therapy. A systematic review of psychotherapy for dizziness\(^29\) concluded that although the number of studies was small, cognitive-behavioral therapy may be effective for patients with dizziness; however, the 3 studies included did not meet our inclusion criteria because of the age of the participants\(^19\,20\) and a specific diagnosis for dizziness.\(^17\) Similarly, 2 systematic reviews of manual therapy for dizziness associated with neck pain in younger adult populations found that although there was a general lack of high-quality publications, there was limited to moderate support for manual therapy.\(^30\,31\)

This review highlights the paucity of high-quality research addressing nonpharmacological therapies for dizziness in older people. Research with high methodological quality is needed across a range of therapies to address dizziness in older people. Furthermore, studies assessing therapies alone or in combination are needed to define optimal treatment strategies. In addition, studies with long-term follow-up for these therapies are needed to assess long-term effectiveness.

All authors were involved in designing the study. Ms Kendall performed the electronic database searching, with assistance from Majbritt Johansen. Ms Kendall performed all screening of title, abstracts, and (where appropriate) full text with the assistance of one of the other authors (Dr Hartvigsen, Dr Azari, or Dr French). Assessment of risk of bias and clinical relevance was performed by Ms Kendall and one of the other authors (Dr Hartvigsen, Dr Azari, or Dr French). All authors contributed to analysis and interpretation of data. The manuscript was drafted by Ms Kendall, and all authors were involved in revision and approval of the final version. The authors thank Majbritt Johansen, Research Librarian at the University of Southern Denmark, for her assistance with the electronic database searching.

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