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Review article

Walking on four limbs: A systematic review of Nordic Walking in Parkinson disease

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ABSTRACT

Nordic Walking is a relatively high intensity activity that is becoming increasingly popular. It involves marching using poles adapted from cross-country skiing poles in order to activate upper body muscles that would not be used during normal walking. Several studies have been performed using this technique in Parkinson disease patients with contradictory results. Thus, we reviewed here all studies using this technique in Parkinson disease patients and further performed a meta-analysis of RCTs where Nordic Walking was evaluated against standard medical care or other types of physical exercise. Nine studies including four RCTs were reviewed for a total of 127 patients who were assigned to the Nordic Walking program. The majority of studies reported beneficial effects of Nordic Walking on either motor or non-motor variables, but many limitations were observed that hamper drawing definitive conclusions and it is largely unclear whether the benefits persist over time. It would appear that little baseline disability is the strongest predictor of response. The meta-analysis of the 4 RCTs yielded a statistically significant reduction of the UPDRS-3 score, but its value of less than 1 point does not appear to be clinically meaningful. Well-designed, large RCTs should be performed both against standard medical care and other types of physical exercise to definitively address whether Nordic Walking can be beneficial in PD.

1. Introduction

Nordic Walking (NW) is a relatively high intensity activity that involves marching using poles adapted from cross-country skiing poles in order to activate upper body muscles that would not be used during normal walking [1,2]. NW is becoming increasingly popular [3–7]. This probably owes to different reasons including participation in group exercise programmes, which has been shown to be a motivating factor [8], and the low level of perceived exertion. Moreover, NW has the practical advantage that can be done year round in any climate and does not require dedicated facilities or expensive equipments.

NW programmes performed in healthy subjects have been demonstrated to increase physical activity levels, muscular endurance, functional exercise capacity, flexibility, postural stability, stride length and gait pattern [1,9–12]. All these latter become progressively compromised in Parkinson disease (PD) and are only partly ameliorated by pharmacological and/or surgical approaches [13]. As such, NW has been construed to be potentially efficacious in PD [14] and it is increasingly gaining momentum in this condition. However, evidence in this regard is scarce and different studies have produced somewhat contradictory results [14–16].

A recent (2014) Cochrane review aimed to compare different rehabilitation techniques to assess whether any could be recommended over the others in PD [17]. Whereas definitive recommendations could not be provided [17], this review did not include studies using NW programmes so that the efficacy and/or possible superiority of NW over other techniques remains to be determined.

Hence, we performed a systematic review of the literature in order to clarify whether NW programmes are: (1) indeed useful in PD; and (2) superior or equivalent to other physical exercise based approaches.

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1.1. Search strategy and methods

We searched the Medline database (via PubMed: http://www.ncbi.nlm.nih.gov), the EMBASE database and the Physiotherapy Evidence Database – PEDro - (available at http://www.pedro.org.au) for publications until December 2016, using the search terms "Nordic walking", "Pole walking", "Pole striding," AND "Parkinson*". Only original full articles written in English were selected and the reference lists of the retrieved articles were checked for relevant reports not indexed in the electronic databases. Data were extracted by two authors (FB, RE) using a standardized proforma gathering information about study design (e.g, controlled, blinded, etc.), number and type (in terms of disability) of patients enrolled, characteristics of the intervention (duration, number of sessions, etc), analysed outcomes and results. Descriptive analyses were performed on all studies, whereas data from randomized controlled trials (RCT) were pooled into a random-effects model with regard of the Unified Parkinson's Disease Rating Scale (UPDRS), motor subscale (UPDRS-3), e.g., a specific disability score almost invariably used as primary outcome in RCTs in PD, in line with the Cochrane Handbook for Systematic Reviews of Interventions (version 5.0.0). If the RCT had more than 2 interventional groups, the NW arm was compared to the least active treatment (e.g., unassisted domestic exercise or flexibility/relaxation program). We additionally undertook consideration of all the included studies in the pooled analysis to estimate clinical heterogeneity. This was done employing, primarily, the I^2 statistic, which provides an estimate of the percentage of inconsistency thought to be due to chance, alongside the Chi-2 p value that provides the strength of evidence for heterogeneity. The latter analyses were performed with RevMan, version 5.3, Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014. These results are indicated as standardized mean difference (SMD) with 95% confidence intervals (CIs).

2. Results

Nine papers were included in the current review [14–16,18–23]. Two studies included the same population of patients [15,20]. However, the outcomes were different and, hence, both have been considered here. Table 1 provides a detailed overview of the included studies.

Overall, 4 RCTs [15,19,20,22,23] and 4 observational studies [14,16,18,21] were identified, for a total of 127 patients studied. For all studies but one [19], patients had mild to moderate motor disability [e.g., Hoehn and Yahr (H&Y) stage 1–3]. One study included also advanced patients (e.g., H&Y = 4) [19].

In all studies, NW programmes were similar and usually featured 2 sessions of 60 min per week (Table 1). Duration of the intervention ranged from 6 to 24 weeks (mean ± standard deviation = 11.4 ± 5.6). For all studies but one [14], follow-up evaluation was performed only at the end of the intervention period. One study performed an additional evaluation 5 months after the end of the intervention period [14]. The majority of studies (n = 5) considered both functional and clinical outcomes, 2 only functional outcomes and 2 only clinical outcomes (Table 1). Six studies succeeded in showing an improvement of the considered outcomes (Table 1), whereas 3 (for a total of 49 patients, 38.5% of the entire population of 127 patients considered here) did not [15,16,21]. Considering the studies where positive results were found, both functional and clinical outcomes (reflecting motor disability and quality of life) improved in most cases (Table 1). Importantly, two studies additionally showed an amelioration following NW in terms of a number of non-motor symptoms (NMS) including pain, apathy, attention and concentration [19,22]. The only study evaluating patients 5 months after the end of the intervention program showed that benefits on both functional [6 min walking test, 10 m walking test and timed up and go test (TUG)] and clinical (PDQ-39) outcomes persisted [14].

Only 3 studies [15,19,20,23] compared NW to either free walking, flexibility/relaxation training or LSVT®BIG (a technique derived from the Lee Silverman Voice Treatment featuring high-intensity training of movement amplitude). Thus, one study found NW to be superior to free walking and flexibility/relaxation training in ameliorating stride length, gait variability and rest hearth rate [19]. In another one NW was superior to free-walking in improving self-speeded TUG and self-selected speed [23]. In the remaining one (e.g., the Berlin LSVT®BIG Study, for which two papers on different outcomes are available) NW did not show any improvements on functional/clinical outcomes, but improved reaction time (using the Testbattery for attentional performance) compared to domestic exercise but not to LSVT®BIG [20].

In the majority of studies compliance was reported to be high (at least 87%) either in terms of patients who completed the intervention or number of sessions attended [14,19–22]. Data regarding adverse events (AE) due to intervention was very scarce. Two studies reported no AE [14,23], whereas such data were not available for 6 studies. The remaining one [19] detailed AE occurring during the intervention and it was thus reported that 9 patient out of 30 (30%) had some sort of AE (Table 1). Of these, 3 (10% of the entire cohort) had to miss up to 3 consecutive sessions (3.8% of the scheduled sessions) but completed the intervention thereafter [19].

UPDRS-3 scores for the four RCTs were obtained from the original papers or upon direct requesting to the authors. Fig. 1 represents the forest plot indicating the SMD in UPDRS-3 score across the 4 included RCTs including 73 patients in the active group and 74 in the control group. This analysis had an overall pooled outcome value of −0.64 (95% CI -0.98 to −0.30; $p < 0.001$). The I^2 value was of 3% ($p = 0.38$), indicative of a little degree of heterogeneity.

3. Discussion

The results of this systematic review would suggest that NW might be useful in PD, but the low quality and/or observational nature of many studies as well as the small samples included hamper drawing definitive conclusions. Although the pooled analysis on the 4 RCTs (for a total of 73 patients in the NW arm) yielded a significant result favouring the NW program, the low value of the SMD (e.g., −0.64) raises the question of whether this is clinically meaningful.

NW has been shown in healthy subjects to determine higher cardiorespiratory fitness as compared to free walking because of the higher amount of muscle mass used through additional motor activity of the upper body [3,10]. In turn, this leads to higher energy expenditure with obvious beneficial effects on several parameters such as resting heart rate, blood pressure, exercise capacity and maximal oxygen consumption [2,3,9]. This makes NW suitable for primary and secondary prevention of cardiovascular/metabolic conditions. Moreover, NW has been shown to exert additional benefits in a wide range of different conditions, including low back pain, fibromyalgia, and cancer (for a review see Ref. [3]). Beyond these results, NW has been shown to ameliorate specific locomotion parameters including stride length, stride length variability, double stance and postural stability [3,9,12]. Based on these premises, it was seemingly obvious to test the efficacy of NW in PD, the second most common neurodegenerative disease that typically manifests with walking disturbances.

While the majority of studies showed an improvement of either functional or clinical outcomes (Table 1), 3 studies did not