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Moderate Exercise Effects on Gait Speed in Elderly Europeans: A Meta-Analysis

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Abstract: **Gait is a fundamental, but complicated activity of everyday life that requires the functional integration of skeletal, muscular, nervous, circulatory, and respiratory systems. The multiple characteristics of age-related variation in age-related performance in elderly adults and this decline are linked with a wide range of health outcomes, making gait health a key target for therapeutic interventions. There are some inconsequent findings in clinical trials about the effects of exercise on the gait of speed. The aim of the current meta-analysis is aimed towards understanding the influence of moderate exercise effects on gait speed in elderly Europeans. Three studies have been selected and included in the present work. A total number of 472 participants were examined. All three articles described the mean difference (MD) for overall effect of exercise interventions on participation. Random-effect mode was used, and increased heterogeneity was estimated between the studies (pq= 0.022, I2= 74%). We found that there was no overall effect of the exercise interventions on participation (MD= -0.12, 95%CI: -1.25 to 1.00, Z= -0.48, p= 0.89). In summary, this review did not show an overall positive effect of exercise on participation in meaningful life roles in older adults. There is a need for development of novel interventions aimed at enhancing this critical aspect of health for older adults.**

Keywords: **Elderly, Gait speed, Exercise, Europe, Meta-analysis.**

1. INTRODUCTION

Gait is a fundamental, but complicated activity of everyday life that requires the functional integration of skeletal, muscular, nervous, circulatory, and respiratory systems. The multiple characteristics of age-related variation in age-related performance in elderly adults and this decline are linked with a wide range of health outcomes, making gait health a key target for therapeutic interventions [Rosso AL, et al., 2013; Sorond FA, et al., 2015].

Gait can be characterized in many ways, such as speed, variability, and dynamics, each capturing distinct aspects of gait. Gait speed has received the most attention: reduced average walking speed has been associated with lower quality of life. It is also associated with increased risk of falls and mortality from all causes, and accelerated progression of chronic diseases such as diabetes, chronic heart failure, and dementia [Studenski S, et al., 2011; Salzman B. Gait et al., 2010; Verghese J, et al., 2014].

Increased time variability has also been shown to predict independent future falls in healthy ambulatory adults [Herman T, et al., 2010; Mirelman A, et al., 2012] and to distinguish individuals with precursor and early Parkinson's disease from healthy controls [Mirelman A, et al., 2011]. Conversely, measurements that characterize long-distance walking dynamics have received less attention, although they also show promise of unique information on gait physiology, quantification of age-related and pathological changes in mobility control systems, and to increase the objective measurement of functional mobility [Hausdorff JM, 2007; Ihlen EA, et al., 2016; Hausdorff JM. 2009; Terrier P, De´riaz O, 2012; Rhea CK, et al., 2014].

There are some inconsequent findings in clinical trials about the effects of exercise on the gait of speed. Strength training or a combination of dynamics - with aerobic training seems promising, and there are many more ways to explore such as equilibrium, functionality and flexibility. However, we have limited time for effective exercise with this target population. Consequently, it is important to know if we need to focus exclusively on resistance training or to invest time in another type of exercise that contributes to the results.

The aim of the current meta-analysis is aimed towards understanding the influence of moderate exercise effects on gait speed in elderly Europeans.

2. METHODS

Inclusion criteria:

- Types of studies: randomized controlled trials
- Types of participants: European adults, aged >60 years, resided in the community
- Types of interventions: any moderate exercise or physical activity compared with usual care
- Types of outcomes: post-intervention gait speed

Exclusion criteria:

Studies with limited clinical information or inaccurate number of cases, single-arm studies, literature reviews, case reports, not published in English, which only conference abstracts were available were excluded.

Interventions:

Exercise interventions on preferred gait speed in older adults

Measurement index:

Mean difference in gait speed, between pre- and post-intervention

Retrieval method:

A literature search was conducted with the following keywords, mesh terms, and free text words such as “aged”, “elderly”, “randomized controlled trial”, “exercise”, and “gait speed”, from Cochrane Register of Controlled Trials (CENTRAL), MEDLINE and EMBASE database up to April 2018. Searching language is limited to English.

Study screening and data extraction:

Collected information mainly consisted of first author, dates of accrual, study design, study sample size, participant characteristics, study arms, study intervention, median follow-up time, and outcome (pre- and post-intervention gait speed).

Quality evaluation:

Quality evaluation was done according to the quality evaluation standard recommended by Cochrane handbook 5.0: (1) whether the randomized method is correct or not; (2) whether allocation concealment method is used or not; (3) whether blinding or not is adopted; (4) whether there is bias caused by data deficiency or not; (5) whether there is bias caused by selective report or not; (6) whether there are other types of bias or not. Each quality standard will be divided into “yes”, “no” and “not clear” (Higgins JPT and Green S, 2011).

Statistical treatment:

Meta-analysis was made using Meta-Essentials (Suurmond R et al., 2017). They were calculated mean difference and 95% confidence intervals (CIs) for continues variables (gait speed pre- and post-intervention value). When each document used the same measurement and unit to one index, measurement data counted weighed mean difference. A random effect model was used because when studies are gathered from researchers operating independently, the random-effects model is more easily justified than the fixed-effect model. Heterogeneity across trials was assessed using the Cochrane Q-statistic ($p<0.05$ was considered significant) and I^2-statistic. I^2 describes the percentage of total variation across studies; that is,

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due to heterogeneity rather than chance. A value of 0 % indicates no heterogeneity, and larger values indicate increased heterogeneity. Publication bias was visually estimated by assessing funnel plots and two tests (Begg's test and Egger's test). All statistical evaluations were made assuming a two-sided test with a significance level of 0.05. (Ellis and Paul D, 2010)

3. RESULTS

Search results:

807 articles were identified by title and abstract. Articles that did not meet the necessary requirements (inclusion and exclusion criteria) were excluded. Finally, 3 studies have been selected and included in the present work (Green J, et al., 2002; Harrington R, et al., 2010; Roaldsen KS, et al., 2014).

Quality evaluation and general characteristics of the included studies:

The quality evaluation of 3 articles is shown in Figure 1, and their general characteristics are shown in Table 1. All the three finally selected studies consist of randomized studies. A total number of 472 participants were examined.

Meta-analysis:

All three articles described the mean difference (MD) for overall effect of exercise interventions on participation. Random-effect mode was used, and increased heterogeneity was estimated between the studies (p_q= 0.022, I^2= 74%). We found that there was no overall effect of the exercise interventions on participation (MD= -0.12, 95%CI: -1.25 to 1.00, Z= -0.48, p= 0.89). Does not exist publication bias from the Begg-Mazumdar test (p= 0.301) and Egger test (p= 0.092). The forest plot for the overall effect of exercise interventions on participation, is shown in Figure 2.

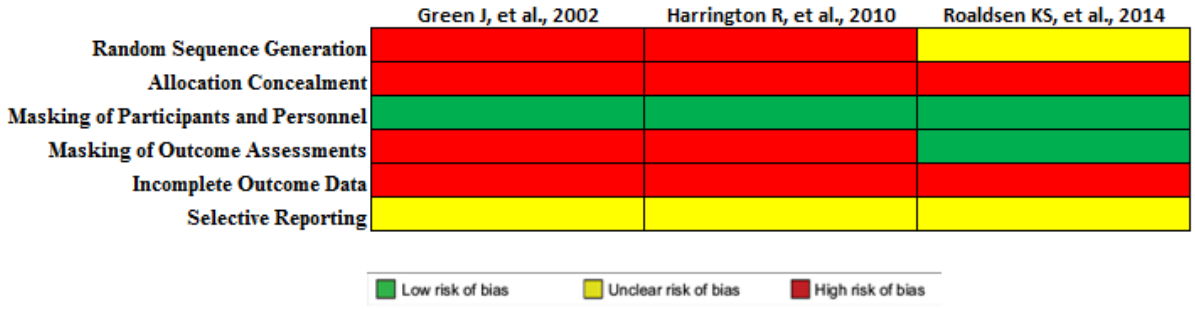

Figure 1: Risk of bias graph

Table 1: General characteristics of studies

Author and year publication	Study design	Country	Study sample size	Intervention	Usual Care
Green J, et al., 2002	RCT	UK	170 patients with chronic stroke and persistent mobility problems mean age = 72–74 y 56% men	Routine community physical therapist service, at home or outpatient; maximum of 13 wk, minimum of 3 contacts/patient	No treatment
Harrington R, et al., 2010	RCT	UK	243 people who survived stroke mean age = 70–71 y 54% men	Leisure and community center activities; 2×/wk for 8 wk; total of 16 sessions; 1 h of exercise and 1 h of education	Information sheet on local groups and contact numbers; visit by stroke coordinator
Roaldsen KS, et al., 2014	RCT	SWEDEN	59 older adults mean age = 77 y 29% men	12 wk of progressive task-specific group balance training, 3x/wk for 45 min; provided by physical therapists	Instructed to maintain usual lifestyle

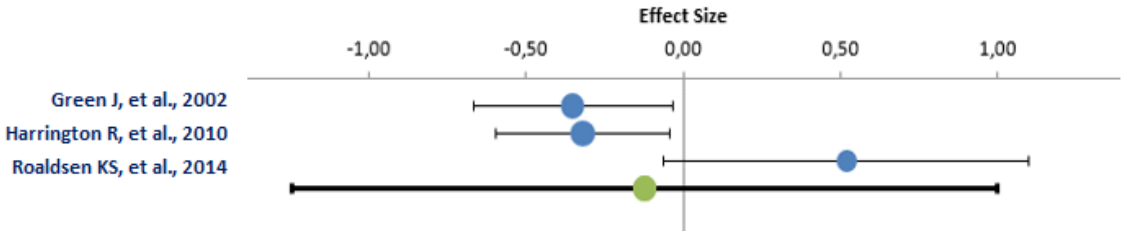

Figure 2: Forest plot for the BMD change of the femoral neck between the WBV and Control group.

4. DISCUSSION

Exercise has a positive effect on improving functional limitations in multiple clinical populations. The results from the 3 randomized studies included in this meta-analysis show that the benefits of exercise do not necessarily extend to the role of adulthood adults with a wide range of chronic conditions and mobility constraints. Therefore, our results do not support the assumption that exercise-based interventions related to improved functioning also lead to improved participation. Given the importance of participation as critical to the health of patients, there is a need to develop complex interventions that go beyond the exercise for the elderly.

After an extensive search of the literature, we could identify only 3 trials that included a clear measure of participation as a result. Therefore, despite its importance and its recognition as a critical aspect of health, participation is not a comparable result in existing literature on restoring exercise to older adults.

Intervention in exercise sometimes does not predict in the view of increasing participation, but with the aim of increasing the ease and safety that the patient is already involved in. However, some participation measures focus only on frequency and do not include an evaluation of the value resulting from the participation or limitation that a person perceives. This may be problematic for measurement purposes, as it is likely that an intervention improves the ease with which patients are involved without affecting their frequency, especially if a patient is already satisfied with his current level of involvement.

A difficult aspect of this review is related to complexity in the definition and measurement of participation. There are many definitions of participation in the bibliography and there is no clear consensus on how best to implement it. Our study has had several limitations due to the wide range of possible terminology used to describe participation whose search may have overlooked the relevant studies. However, our criteria for identifying appropriate participation measures caused a possible exclusion of studies that included measures incorporating certain aspects of participation.

Moreover, the synthesis and duration of exercise interventions were heterogeneous, which limits direct comparisons between studies. Eventually although the quality of the test may have been restrictive, most studies were at risk of causing bias only to cover participants and staff. Such coverage is difficult to succeed in exercise studies and may have little effect on self-reported participation measures.

5. CONCLUSION

In summary, this review did not show an overall positive effect of exercise on participation in meaningful life roles in older adults. There is a need for targeted interventions that go beyond exercise to address participation and its determinants. Participation involves a person's health, the individual's preferences, as well as the physical, social, and cultural environment; it is likely that complex interventions addressing these underlying concepts will have the greatest impact. There is a need for development of novel interventions aimed at enhancing this critical aspect of health for older adults.

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