Language Performance and Exercise in Older Adults: A Scoping Review

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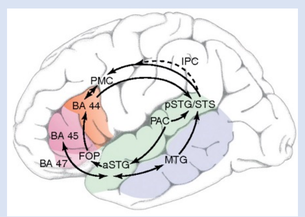
Introduction

Chronological and pathological aging can challenge cognitive and executive functions.

- Information processing, attention, inhibition, and language performance can be affected in older adults with[1] or without[2] neurological conditions.

Exercise has been shown to improve information-processing, reaction time, attention[3], and memory[4] in older adults.

- Some of these cognitive functions are mediated by frontal and prefrontal brain regions[5], which are also involved in different language functions[6].



Friederici & Gierhan (2013)[8]

The benefits of exercise on various cognitive functions have already been reviewed.[5,7] However, little is known about the effect of exercise on language performance.

Aims

A scoping review was conducted to identify:

1) The existing evidence on exercise-induced changes on language performance in adults aged 45-74 years with and without acquired neurological/neurodegenerative conditions.

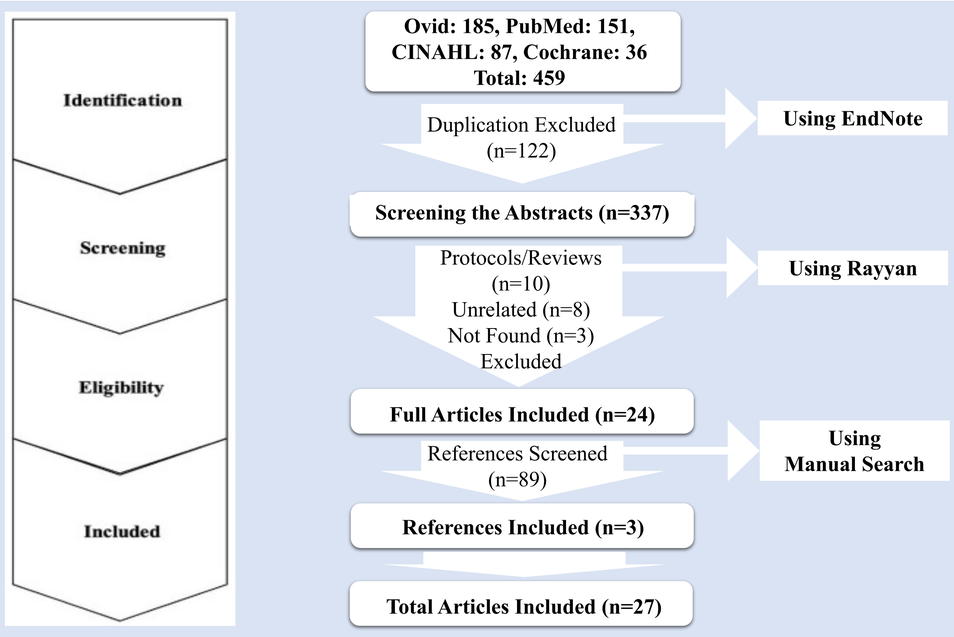
2) The language assessments used and the aspects of language performance influenced by exercise interventions.

Methods

Framework: Arksey and O'Malley (2005)[9] and Levac et al., (2010)[10]

Identifying Relevant Studies	**18 key terms were selected for 2 main domains, i.e.,** exercise and language e.g., cardiovascular exercise OR resistance exercise AND language comprehension OR verbal fluency **4 Databases:** Ovid, PubMed, CINAHL, and Cochrane
Study Selection	**Included: All designs between 1990 – 2021 (April)** **Population:** Adults aged 45-74 years with and without acquired or degenerative neurological conditions affecting language and communication **Intervention: Ex**ercise interventions with well-defined Frequency, Intensity, Time/Duration, Type **Outcome:** Language performance
Charting the Data	**Data extraction information sheet :** Title, year & place of publication, setting, abstract, purpose of the study & research question, study design, participant information and their inclusion and exclusion criteria, intervention & control conditions, baseline & outcome measures, assessment times, and strengths & limitations.
Collocating, Summarizing, and Reporting	Descriptive and thematic analyses using the International Classification of Functioning, Disability, and Health (ICF)[11]

PRISMA Flowchart of Study Screening Process



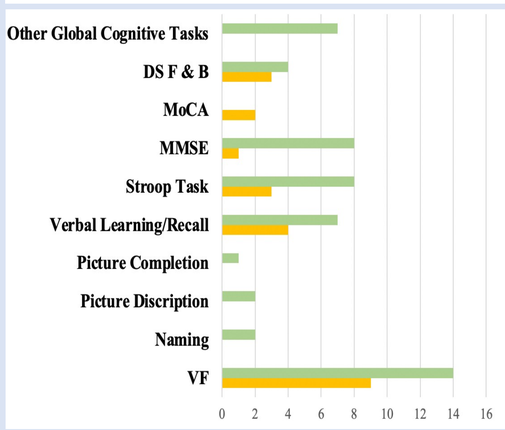
Results

Full texts of the final 45 studies were assessed for eligibility and 27 studies were finally included. 10 studies were on healthy aging[12-21] and 17 were on older adults with acquired neurological/neuro degenerative conditions[22-38].

Included Studies

No Neurological Conditions	7 RCTs 2 Within-Subject 1 Cross-Sectional
Mild Cognitive Impairment	2 RCTs 1 Within-Subject
Alzheimer's Disease	6 RCTs 1 Within-Subject
Parkinson's Disease	2 Within-Subject 1 Case-Study
Major Depressive Disorder	1 RCT
Cognitive Deterioration	1 RCT
Stroke	2 Within-Subject

Language and Cognitive Assessments

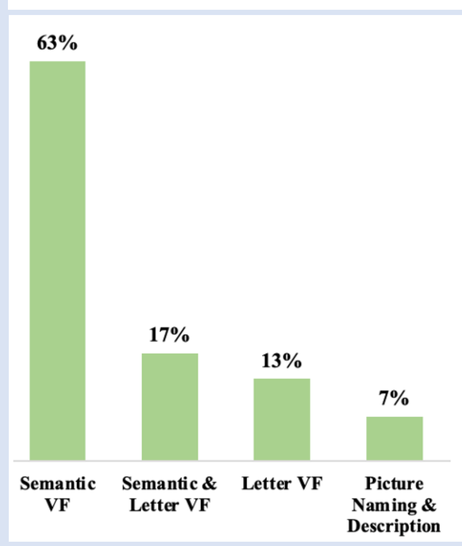


Adults with Neurological Conditions
Adults without Neurological Conditions
Other Global Cog Tasks: Cambridge Cognitive Examination (Brazilian Version); Alzheimer's Disease Assessment Scale Cognitive; Cambridge Brain Sciences Cognitive Battery; Addenbrookes's Cognitive Examination-Revised; The Brief Cognitive Battery.
DS F&B= Digit Span Forward and Backward
MoCA= Montreal Cognitive Assessment
MMSE= Mini-Mental State Examination
VF= Verbal Fluency.

10 studies on older adults without neurological conditions (N= 616, 522 females) reported enhanced semantic and phonological VF[12-21] with 70% significant improvement [12-18] following exercise interventions.

Of the 17 studies on older adults with neurological conditions (N= 1368, 791 females), 10 studies (58.82%) showed a **trend** toward better picture naming/description, semantic VF, and phonological VF [22-31] following exercise protocols. These include participants with **Parkinson's Disease**[25,26,30], **Dementia**[24], **mild Alzheimer's Disease (AD)**[29], **Mild Cognitive Impairment (MCI)**[22,23,27], or **cognitive deterioration**[31]**.** In adults with **Stroke,** naming[28] showed improvement following exercise while VF[32] remained unchanged.
In seven of these 10 studies (41.17%) significant improvement[22-28] was reported following exercise protocols.

Language Aspects



Finally, no change in VF tasks was reported for adults with **AD**[35-38] or **MCI at the risk of AD**[34] or **with Major Depression Disorder**[33]**.**

Discussion

Performance on language tasks that place more demands on linguistic processes and effortful executive functions mediated by frontal and prefrontal brain regions[39,40], e.g., VF and naming, responded better to exercise[3] in adults without neurological conditions and in a subset of the population with neurological conditions.

These findings are consistent with previous reviews assessing the effect of exercise on different aspects of cognitive performance[4,7] with selective benefits mostly for executive-control processes[4].

This scoping review can inform future research on language and exercise interventions in clinical settings.

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