

Aerobic Exercise and Executive Dysfunction in Early-Stage Alzheimer's Disease: Emerging Evidence from a Systematic Review

Ebru Akbuğa Koç¹, Nilgün Çınar²

¹Department of Physiotherapy and Rehabilitation, Yeditepe University, Istanbul, Türkiye

²Faculty of Medicine, Maltepe University, Istanbul, Türkiye



Background

- Alzheimer's disease (AD) is the leading cause of dementia worldwide.
- Executive dysfunction emerges early and strongly affects independence and daily functioning.
- Aerobic exercise is a promising non-pharmacological strategy for cognitive health.
- Evidence specific to executive function in early AD remains fragmented.

Objective

To systematically evaluate the effects of aerobic exercise on executive dysfunction in individuals with early Alzheimer's disease and identify exercise characteristics associated with favorable cognitive outcomes.

Methods

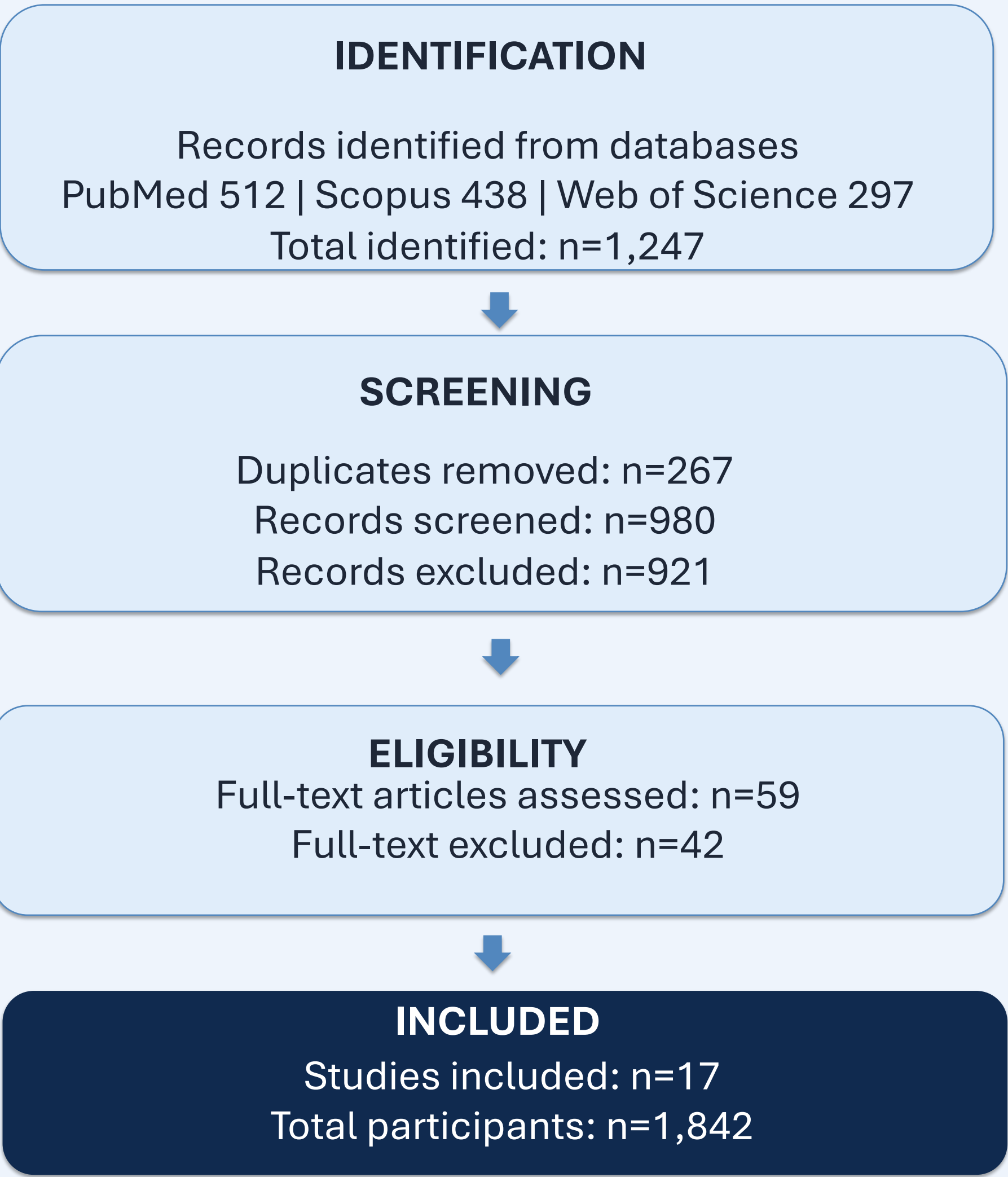
- Design: Systematic review according to PRISMA 2020.
- Databases: PubMed, Scopus, and Web of Science.
- Search period: database inception to December 2024.
- Eligible designs: RCTs, controlled clinical trials, and longitudinal intervention studies.
- Population: early-stage AD with executive function outcomes.
- Quality assessment: RoB 2, ROBINS-I, and GRADE.

Eligibility Criteria

- Early-stage Alzheimer's disease.
- Structured aerobic exercise intervention.
- Concurrent control condition.
- Objective executive function measure.
- Quantitative outcome data available for synthesis.

Results

Study Selection (PRISMA Flow Diagram)



17

Included studies

1,842

Participants

14

RCTs

Executive Function Outcomes

- Cognitive flexibility improved or was preserved in 11 of 13 studies.
- Inhibitory control improved in 9 of 12 studies.
- Working memory improved or remained stable in 8 of 11 studies.
- Exercise groups generally maintained executive function, whereas control groups showed decline.

Optimal Exercise Characteristics

Parameter	Most consistent range
Intensity	Moderate (50-70% HRmax)
Duration	12-26 weeks
Frequency	3-5 sessions/week
Session length	30-60 min/session

Certainty of Evidence (GRADE)

Outcome	GRADE
Cognitive flexibility	Moderate
Inhibitory control	Moderate
Working memory	Low-Moderate

Conclusions

- Moderate-intensity aerobic exercise appears promising for preserving executive function in early AD.
- Benefits were most consistent for cognitive flexibility and inhibitory control.
- Exercise may complement standard medical management as a safe non-pharmacological intervention.
- Larger high-quality RCTs are needed to determine optimal dose and long-term effectiveness.

Clinical Implications

- May help preserve independence and daily functioning. Feasible within multidisciplinary rehabilitation programs. Programs should be individualized and supervised when appropriate.
- Moderate intensity appears to provide the most consistent cognitive benefit.

Limitations

- Heterogeneity in exercise protocols and outcome measures.
- Limited number of high-quality randomized trials.
- Short follow-up periods and modest sample sizes in several studies.

Future Directions

- Large multicenter randomized controlled trials.
- Standardized executive function batteries.
- Long-term follow-up beyond intervention periods.
- Mechanistic studies using biomarkers and neuroimaging.