EFFECTS OF REGULAR AEROBIC ACTIVITY ON NEURAL FUNCTION IN PERSONS WITH ALZHEIMER’S DISEASE

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Problem Statement

- *Currently no AD cure*

- *Pharmaceutical – limited symptom affect*

- *Limited research in human subjects*
Rationale

- Alzheimer’s Disease - Most common form of dementia – 35+ million worldwide
  U.S.A 5.3 million – 2010 7.7 million – 2030
  Cost to society: 2005 – $91 billion, Medicare
  2007 – $146+ billion, additional – caregivers / productivity
  (Alzheimer’s Association, 2008)

- Multifactorial biological influences / complexity posit need to consider
  alternatives – from pharmaceutical intervention to alternative methods of prevention / attenuation

- Alternative – Exercise: Documented research relied on self-report and / or integrated modalities (aerobic and resistance exercise).
Exercise hypothesis

- “Exercise enhances neural function, attenuates AD symptoms & delays AD onset”

1. Rats exercised daily - 18 days (treadmill) – increased learning & motor coordination (Carro et al., 2001).

2. AD transgenic mice exercised daily - 5 mths – AD symptom attenuation (Adlard et al., 2005).

3. Mice exercised (voluntary wheel running) – BDNF up regulated – evident after 3 to 7 nights (Cotman et al., 2002).

4. Community-dwelling older adults exercised regularly – reduced cognitive impairment & dementia incidents (Lytle et al., 2004).
Methodology

Participants (N = 19)

- Caucasian adult volunteers
- Residents: Holy Redeemer Hospital / St Josephs Manor (Meadowbrook, PA, USA)
- Mixed gender: females n = 14 males n = 6
- Age: 78 to 99 years (mean age = 85.5 SD 5.2 yrs)
- Probable AD: mild n = 12 moderate n = 7
- Walking aids: walker n = 13 cane n = 1
Treatment: Aerobic activity – Walking

**30-min a day 3 times per week for 12 consecutive weeks**
(Monday, Wednesday and Friday; 10 am)

Assessment instruments:

- **Cognitive function**
  - MMSE – Mini mental state exam.

- **Executive function**
  - BBS – Berg balance scale.
  - TUG – Timed up and go.
  - ADL – Activities of daily living.
Cognition \[ t(18) = 5.74, p < .001 \]  

* Represents a significant difference \( p < .001 \)  

between Pre- and Post-test scores  

Change in score = 3.11 (15.59% increase)
Figure 2. Cognitive function sub-categories mean scores

*Represents a significant difference ($p < .05$) from Pre-test score

Significant change in score in 5 of 6 sub-categories
**Balance**  

[\( t(18) = 7.43, \ p < .001 \)]

*Represents a significant difference (\( p < .001 \)) between Pre- and Post-test scores

**Figure 3. Balance mean scores**

Change in score = 5.16 (14.63% increase)
Figure 4. Mobility mean scores

*Represents a significant difference ($p < .001$) from between pre-test and post-test scores.

Change in score = 4.97 (19.97% decrease)
Activities of daily living  \[ t(18) = 1.48, \ p < .156 \]

Change in score = 3.26 (3.9% increase)
* Significant difference $p < .05$ from pre-test score. Pre-test value is total falls during the 12-week period prior to treatment and Post-test value is total falls during 12-week treatment period.

Figure 6. Incidence of Falls mean scores

Change in score = 11.00 (57.89% decrease)
Caregiver review

- **Pre-treatment:**
  - non cooperative
  - repeated dialogue
  - lack of interest / disassociation

- **Post-Treatment:**
  - cooperative
  - reduced repeated dialogue
  - increased interest in activities
Discussion

- **Outcomes support exercise hypothesis…**
  
  *Posits: Exercise induces BDNF – initiates numerous metabolic pathways...*

  **Enhances…**

  …**Neural function** (e.g., neurotransmitter modulation, protein synthesis, and energy metabolism).

  **Reduces…**

  …**β-Amyloid aggregation** associated with neural plaque formation and neural degradation.
Implications

- Elderly benefit neurologically from regular aerobic activity (cognitive & executive function)...

- Neural function enhancement through exercise impacts quality of life in elderly (sensing environment, mobility, & independence)...

- Non-pharmaceutical AD intervention (exercise attenuates AD symptoms)…
Future AD research

1. Determine effectiveness of different exercise modalities (e.g., specificity, duration, and intensity).

2. Biomarkers: Examine changes in biomarkers due to regular physical activity.

3. Identify mechanisms by which BDNF is exercised-induced – BDNF / IGF-1 relationship,
Cultural change

- Education paradigm = mindset change
  - physical activity vs. exercise
  - enable active lifestyle across lifespan

Use it or lose it - applies to neural function !!
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