

# Functional Capacity in Activities of Daily Living in the Alzheimer's Disease Continuum

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## Abstract

**Background:** The most common and prevalent dementia worldwide is Alzheimer's disease (AD). AD is a continuum composed of Subjective Cognitive Impairment (SCD), Mild Cognitive Impairment (MCI), and Alzheimer's Disease dementia (ADD) stage. One of the main clinical variables in patients with dementia is performance in functional capacity since its alterations are associated with poor prognosis and disease progression. Functional capacity is measured through activities of daily living (ADL), which are divided into three domains: i) Basic (BADL), ii) Instrumental (IADL), and iii) Advanced (AADL). The study aimed to characterize the performance of the different stages of the AD continuum in the ADL domains and their association with cognitive abilities.

**Method:** A cross-sectional study of subjects at different stages of the AD continuum was conducted: Healthy Controls (CTR) (n = 17), SCD (n = 77), MCI (n = 30), and ADD (n = 23), who were matched for age, sex, and education. ADLs were estimated using The Technology-Activities of Daily Living Questionnaire (T-ADLQ), which assesses the three domains and a total score. T-ADLQ performance was compared across groups and correlated with cognitive ability instruments (ACE-III and IFS).

**Result:** The results showed that patients with ADD performed worse on the BADL, IADL, and total ADLs compared to the other three groups. There were no significant differences between the CTR, SCD, and MCI on the BADL, IADL, and total ADLs. However, the AADL, in addition to differentiating the ADD patients from the other three groups, also showed differences between CTR and MCI subjects and between SCD and MCI subjects (Table 1 and Figure 1). The correlation study showed that AADL correlated significantly with global cognitive and executive function assessment (Figure 2).

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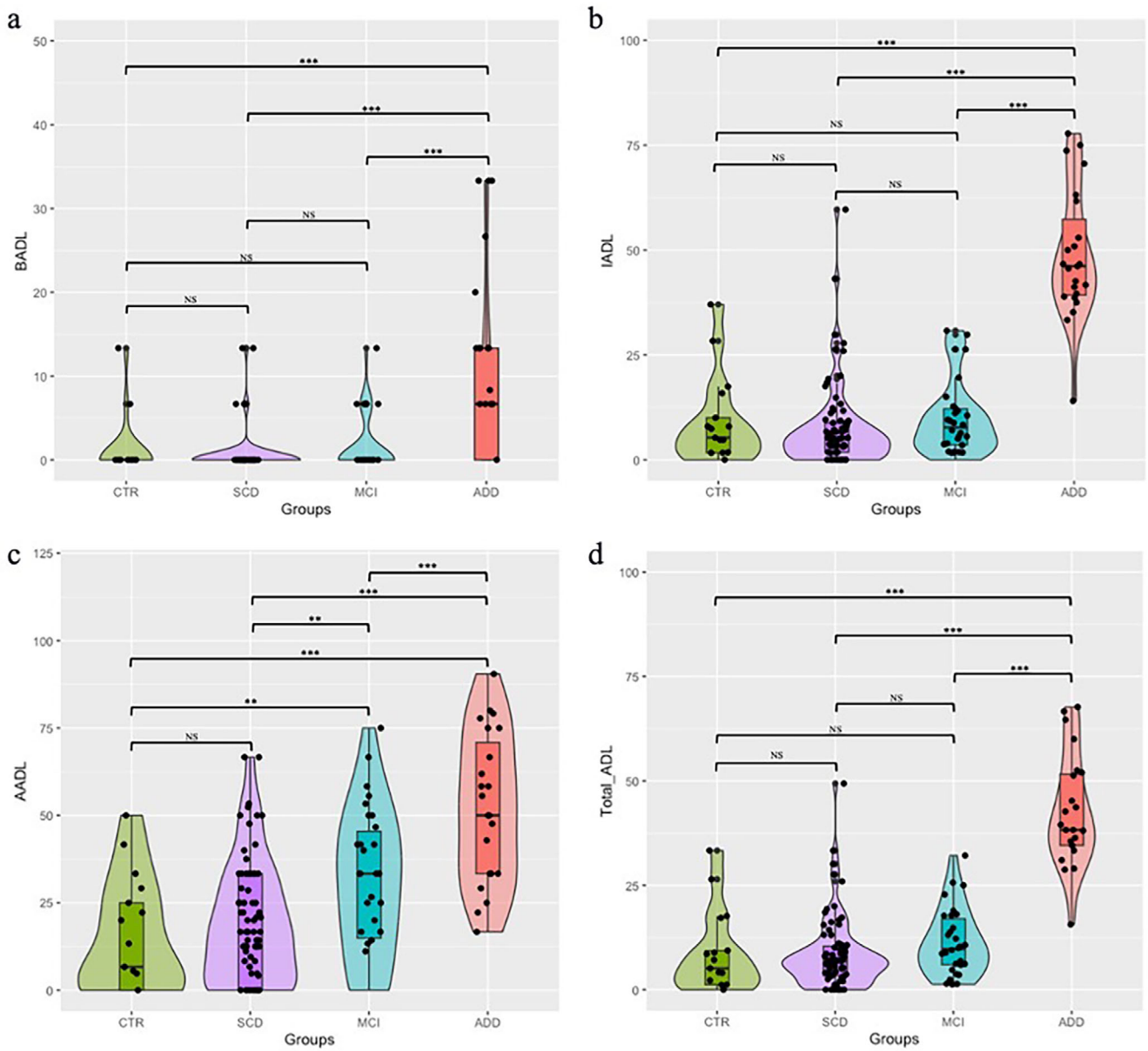
**Conclusion:** AADL shows progressive functional impairment at different stages of the AD continuum, which is further associated with global cognitive and executive function performances. As one progresses to a more advanced stage of the disease continuum, the performance of ADLs, especially AADLs, worsens, which could indicate a marker of disease progression, allowing for better patient follow-up.

**Table 1. Clinical and Demographic Data**

|                              | CTR (0)                       | SCD (1)                    | MCI (2)                    | ADD (3)                    | $\chi^2/p$ (global)      | <i>p</i> (post-hoc)   |
|------------------------------|-------------------------------|----------------------------|----------------------------|----------------------------|--------------------------|---|
| <b>Number of cases (147)</b> | 17                            | 77                         | 30                         | 23                         |                          |   |
| Male/Female                  | 5 (29%) / 12 (71%)            | 22 (29%) / 57 (71%)        | 5 (17%) / 25 (83%)         | 10 (44%) / 13 (56%)        | 0.204 <sup>a</sup>       | ---   |
| Age                          | 76.59 ± 4.53<br>(72 - 91)     | 75.22 ± 4.58<br>(69 - 90)  | 76.47 ± 4.90<br>(71 - 89)  | 76.96 ± 7.68<br>(64 - 97)  | 0.414 <sup>b</sup>       | ---   |
| Education                    | 12.00 ± 4.00<br>(4 - 17)      | 10.77 ± 4.39<br>(4 - 24)   | 8.93 ± 2.77<br>(6 - 17)    | 11.09 ± 4.01<br>(4 - 16)   | 0.056 <sup>b</sup>       | ---   |
| ACE-III                      | 88.42 ± 5.85<br>(77 - 99)     | 85.27 ± 7.53<br>(69 - 100) | 72.35 ± 10.10<br>(56 - 95) | 60.74 ± 12.34<br>(37 - 82) | <b>0.000<sup>b</sup></b> | P1= 1.000 (0-1), P2= <b>0.000 (0-2)</b><br>P3= <b>0.000 (0-3)</b> , P4= <b>0.000 (1-2)</b><br>P5= <b>0.000 (1-3)</b> , P6= <b>0.000 (2-3)</b> |
| IFS                          | 19.73 ± 3.34<br>(10.5 - 23.5) | 18.69 ± 4.44<br>(7 - 26)   | 13.17 ± 4.59<br>(3 - 24)   | 11.33 ± 4.82<br>(3 - 20)   | <b>0.000<sup>a</sup></b> | P1= 1.000 (0-1), P2= <b>0.000 (0-2)</b><br>P3= <b>0.000 (0-3)</b> , P4= <b>0.000 (1-2)</b><br>P5= <b>0.000 (1-3)</b> , P6= 0.820 (2-3)        |
| Basic ADL                    | 1.18 ± 3.52<br>(0 - 13)       | 0.61 ± 2.46<br>(0 - 13)    | 1.56 ± 3.36<br>(0 - 13)    | 10.80 ± 11.48<br>(0 - 33)  | <b>0.000<sup>a</sup></b> | P1= 1.000 (0-1), P2= 1.000 (0-2)<br>P3= <b>0.000 (0-3)</b> , P4= 1.000 (1-2)<br>P5= <b>0.000 (1-3)</b> , P6= <b>0.000 (2-3)</b>               |
| Instrumental ADL             | 8.93 ± 10.42<br>(0 - 37)      | 7.76 ± 10.02<br>(0 - 60)   | 9.78 ± 8.71<br>(0 - 31)    | 48.84 ± 15.43<br>(14 - 78) | <b>0.000<sup>a</sup></b> | P1= 1.000 (0-1), P2= 1.000 (0-2)<br>P3= <b>0.000 (0-3)</b> , P4= 1.000 (1-2)<br>P5= <b>0.000 (1-3)</b> , P6= <b>0.000 (2-3)</b>               |
| Advanced ADL                 | 14.81 ± 16.33<br>(0 - 50)     | 18.94 ± 17.34<br>(0 - 67)  | 30.75 ± 21.06<br>(0 - 75)  | 51.96 ± 21.34<br>(17 - 90) | <b>0.000<sup>a</sup></b> | P1= 1.000 (0-1), P2= <b>0.034 (0-2)</b><br>P3= <b>0.000 (0-3)</b> , P4= <b>0.023 (1-2)</b><br>P5= <b>0.000 (1-3)</b> , P6= <b>0.000 (2-3)</b> |
| Total ADL                    | 8.62 ± 9.72<br>(0 - 33)       | 8.52 ± 8.54<br>(0 - 49)    | 11.43 ± 7.94<br>(1 - 32)   | 42.58 ± 13.28<br>(16 - 68) | <b>0.000<sup>a</sup></b> | P1= 1.000 (0-1), P2= 1.000 (0-2)<br>P3= <b>0.000 (0-3)</b> , P4= 0.933 (1-2)<br>P5= <b>0.000 (1-3)</b> , P6= <b>0.000 (2-3)</b>               |

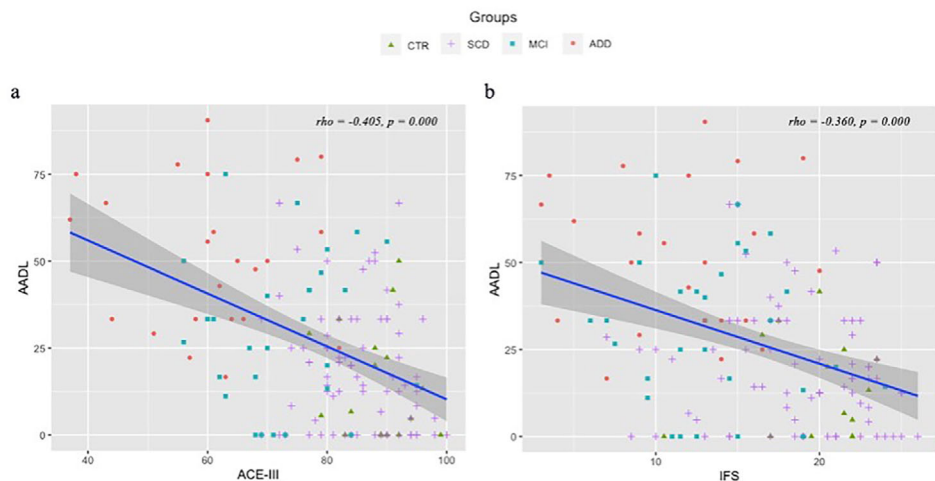
Data are presented in mean ± standard deviation (minimum–maximum); a: Chi-square; b: One-way ANOVA (Post-hoc: Bonferroni test); CTR: Healthy Controls; SCD: Subjective Cognitive Decline; MCI: Mild Cognitive Impairment; ADD: Alzheimer's Disease Dementia; ACE-III: Addenbrooke's Cognitive Examination III; IFS: INECO Frontal Screening; ADL: Activities of Daily Living; P1: values refer to the comparison between CTR group and SCD; P2: values refer to the comparison between CTR group and MCI; P3: values refer to the comparison between CTR group and ADD; P4: values refer to the comparison between SCD group and MCI; P5: values refer to the comparison between SCD group and ADD; P6: values refer to the comparison between MCI group and ADD. *p*-value < 0.05.

**Figure 1. Performance on BADL, IADL, AADL, and Total ADL.**



a: BADL: Basic Activities of Daily Living; b: IADL: Instrumental Activities of Daily Living; c: AADL; Advanced Activities of Daily Living; Total ADL; Activities of Daily Living; CTR: Subjects Controls; SCD: Subjective Cognitive Decline; MCI: Mild Cognitive Impairment; ADD: Alzheimer's Disease Dementia; ADL: Activities of Daily Living; NS: non-significant differences; \*\*\*  $p < 0.001$ ; \*\*  $p < 0.05$ .

Figure 2. Correlation Between AADL and Cognitive Abilities in all sample.



a: Spearman correlation between AADL and Addenbrooke's Cognitive Examination III (ACE-III). b: Spearman correlation between AADL and INECO Frontal Screening (IFS).