

MESTRADO EM PSICOLOGIA

**Activities of Daily Living Inventory
(ADLI): Preliminary psychometric
properties in a sample of Traumatic
Brain Injury patients**

NUNO FILIPE GONÇALVES GOMES

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Universidade do Porto
Faculdade de Psicologia e de Ciências da Educação

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Traumatic Brain Injury patients**

Nuno Filipe Gonçalves Gomes

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Professor Doutor **Fernando Barbosa** (FPCEUP) e pela Professora Doutora **Joana Pinto**.

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Resumo

O traumatismo crânio-encefálico (TCE) é uma das principais causas de incapacidade a longo prazo, frequentemente associado a défices neuro cognitivos, emocionais e funcionais que comprometem a autonomia e a realização das atividades da vida diária (AVD). A avaliação da funcionalidade nas AVD é, por isso, essencial para compreender o impacto da lesão e orientar a reabilitação. O Inventário de Atividades da Vida Diária (ADLI) é um instrumento que permite uma avaliação multidimensional da funcionalidade das AVD, contudo ainda não foi estudado em populações com TCE.

Dessa forma o presente estudo teve como principal objetivo examinar as propriedades psicométricas do ADLI numa amostra portuguesa de indivíduos com TCE. O ADLI inclui uma versão de autorrelato e uma de informante e avalia as atividades em três domínios: básicas (ABVD), instrumentais (AIVD) e avançadas (AAVD). Setenta e sete participantes (41 indivíduos saudáveis e 36 com TCE) completaram um protocolo de avaliação neuropsicológica que incluiu o ADLI e outros instrumentos de avaliação de funcionalidade, desempenho cognitivo e sintomatologia ansiosa e depressiva. Os resultados preliminares do ADLI evidenciaram consistência interna satisfatória e evidência de validade convergente e divergente, apoiando a fiabilidade e demonstrando ser uma medida sensível para avaliar a funcionalidade em atividades básicas, instrumentais e avançadas, oferecendo uma compreensão preliminar do funcionamento diário em indivíduos com TCE.

Palavras-chave: Inventário de Atividades da Vida Diária; traumatismo crânio-encefálico; funcionalidade; validação psicométrica;

Abstract

Traumatic brain injury (TBI) is one of the leading causes of long-term disability, frequently associated with neurocognitive, emotional, and functional deficits that compromise autonomy and the performance of activities of daily living (ADL). Assessing functionality in ADL is therefore essential to understand the impact of the injury and to guide rehabilitation. The Activities of Daily Living Inventory (ADLI) is an instrument that allows a multidimensional assessment of functionality in ADL; however, it has not yet been studied in populations with TBI.

Accordingly, the present study aimed to examine the psychometric properties of the ADLI in a Portuguese sample of individuals with TBI. The ADLI includes both self- and informant-report versions and assesses activities across three domains: basic (BADL), instrumental (IADL), and advanced (AADL). Seventy-seven participants (41 healthy individuals and 36 with TBI) completed a neuropsychological assessment protocol that included the ADLI and other instruments evaluating functionality, cognitive performance, and anxiety and depressive symptoms. Preliminary results of the ADLI revealed satisfactory internal consistency and evidence of convergent and divergent validity, supporting its reliability and demonstrating that it is a sensitive measure for assessing functionality in basic, instrumental, and advanced activities, providing a preliminary understanding of daily functioning in individuals with TBI.

Keywords: Activities of Daily Living Inventory; traumatic brain injury; functionality; psychometric validation;

Índice

Introduction	8
Method	12
Participants	12
Instruments	13
Procedures	17
Results	18
Discussion	29
Conclusion.....	32
References	33

Introduction

Traumatic Brain Injury (TBI) can result from an acute, external force to the head, with associated alteration of consciousness (Donders et al., 2012). Despite being a major public health problem that remains insufficiently recognized (Maas et al., 2017), TBI is the most common form of brain injury. It has a high worldwide incidence with more than 50 million cases per year and 235 hospitalized cases per 100,000 population in Europe (Maas et al., 2017; Tagliaferri et al., 2006; Podell et al., 2010). TBI is considered the leading cause of mortality in young adults and a major cause of death and disability across all ages. Survivors often experience lasting social and interpersonal deficits and may also experience cognitive impairments, especially in attention, memory, and executive functioning (Anderson et al., 2010). Additionally, these impairments are often associated with a wide range of symptoms, including headaches, dizziness, visual problems, exhaustion, emotional outbursts, anxiety, and depression (Fure et al., 2023), and may have a significant impact on their everyday level of functioning, community participation, and return to work (Maas et al., 2017).

In Portugal, the TBI affects individuals of all age groups, showing a bimodal distribution in teenagers and the elderly (Santos et al., 2004), with a greater incidence in the male population, a pattern that mirrors national longevity trends (Dias et al., 2014; Santos et al., 2004). In addition, there has been a shift regarding the main causes of TBI, with a decrease in traffic-related injuries and a progressive predominance of falls (Santos & Agrela, 2019). This pattern is reported to be closely associated with the improvements made regarding road safety and emergency response systems (Santos & Agrela, 2019). Although the Portuguese literature provides valuable insights into demographic variability and incidence trends for TBI (Dias et al., 2014; Santos & Agrela, 2019; Santos et al., 2004), it remains limited by methodological differences and the lack of recent nationwide data, which makes it difficult to obtain an accurate and updated picture of its incidence in Portugal.

Under-ascertainment is frequent because many individuals with mild TBI (mTBI) never seek medical attention, mild injuries may be overlooked in the context of multiple traumas, deaths from polytrauma can be recorded without attributing TBI as an underlying cause, and differences in the application of diagnostic criteria complicate case classification (Santos et al., 2004). To address these diagnostic and reporting limitations, a holistic assessment should combine clinical observation with structured instruments such as the Glasgow Coma Scale (GCS) or the Glasgow Outcome Scale Extended (GOSE), which allow for a more standardized classification by allocating patients to internationally recognized severity strata (Sternbach,

2000). Although the severity of brain injury depends on multiple factors, it varies from mild to moderate and severe, and using the GCS injuries are commonly categorized as mild (GCS of 13-15 range), moderate (9-12 range), or severe (8 or less), with mTBI representing the largest share of cases (Sternbach, 2000). The GOSE, on the other hand, provides a broader measure of functional outcome by classifying the TBI into eight categories ranging from death to upper good recovery, thus allowing a more detailed characterization of disability and recovery trajectories after TBI (Wilson et al., 1998).

The mTBI is defined as a minor head injury that causes a momentary loss of consciousness (less than 30 minutes) followed by reduced cognitive function, or post-traumatic amnesia (lasting under 24 hours) (McInnes et al., 2017). The typical early symptoms can be physical and psychological, including impaired judgment, attention problems, confusion, decreased processing speed, amnesia, short-term memory problems, irritability, depression, anxiety, sensitivity to light or noise, tinnitus, and insomnia. These symptoms generally resolve within a few weeks or months, yet can often persist for long periods of time and even result in permanent disability (Buck et al., 2012).

The moderate TBI differs from the mTBI in aspects such as a loss of consciousness lasting thirty minutes to twenty-four hours, or post-traumatic amnesia of one to seven days (Sheriff & Hinson, 2015). Early manifestations can be physical, cognitive, and emotional. Besides loss of consciousness, physical signs include persistent headache, repeated vomiting, seizures, weakness or numbness in the limbs, and loss of coordination. Cognitive or emotional signs include prolonged confusion, agitation, slurred speech, irritability, and other mood changes (McCrea et al., 2021). Most patients recover much of their function within weeks or months, but longitudinal evidence shows that one quarter still have unfavourable outcomes at twelve months, highlighting the need for careful in-hospital monitoring and structured rehabilitation (McCrea et al., 2021).

Although severe TBI shares many of the manifestations observed in moderate cases, it is distinguished by the intensity and duration of symptoms, such as a loss of consciousness exceeding 24 hours and post-traumatic amnesia lasting longer than seven days (Maas et al., 2017). Severe TBI is also strongly associated with increased mortality, higher rates of long-term disability, and cognitive and behavioural sequelae, with recovery trajectories often requiring prolonged and multidisciplinary rehabilitation approaches (Maas et al., 2017; Sheriff & Hinson, 2015).

Beyond the acute clinical manifestations, TBI frequently results in long-lasting functional consequences that compromise independence and social reintegration, and survivors often struggle with ADL. These may range from basic self-care tasks, such as bathing, dressing, or mobility, to more complex instrumental activities, including financial management, shopping, transportation, and medication use (Dijkers, 2004). Other activities, such as financial management, use of transportation, and household responsibilities, are also commonly affected, particularly in individuals with moderate to severe brain injury (Dijkers, 2004; Forslund et al., 2019; Polinder et al., 2018). These limitations are strongly linked to cognitive impairments in memory, attention, and executive functions, as well as to emotional and behavioural changes, including depression, anxiety, and irritability (Forslund et al., 2019). The loss of autonomy following TBI has been consistently associated with reduced quality of life, lower community participation, and difficulties in returning to premorbid roles and occupations, highlighting the need for accurate and ecologically valid measures of functional outcomes in both research and clinical practice (Dijkers, 2004; Forslund et al., 2019; Polinder et al., 2018).

Participation in daily life activities and work is identified as one of the most important outcomes of TBI rehabilitation by not only patients themselves but also their families and healthcare professionals (Andelic et al., 2019). Studies on return-to-work rates after TBI have reported highly variable outcomes. Van Velzen et al. (2009) observed that only about 30% of patients returned to work one year after injury, regardless of age or cause of injury. However, when broader samples are considered, including patients with mild injuries who may not have required intensive care or inpatient rehabilitation, return-to-work rates can reach as high as 65% (Tibaek et al., 2019). Despite these figures, it is important to emphasize that a substantial proportion of individuals never recover full functional independence or occupational reintegration, even after extensive rehabilitation, highlighting the persistent impact of TBI on long-term functionality.

A successful transition back to work also depends heavily on emotional and psychosocial factors. Symptoms of anxiety and depression are highly prevalent after TBI and are strongly associated with poorer functional outcomes, lower quality of life, and reduced likelihood of returning to work (Juengst et al., 2017). At the same time, differences in cognitive reserve (CR), shaped by factors such as educational attainment, occupational complexity, and lifelong engagement in cognitive-stimulating activities, help explain why patients with similar injuries often present very different recovery trajectories. Cognitive reserve refers to the brain's ability to recruit alternative neural pathways or strategies to maintain performance despite

injury (Stern, 2009). Evidence from TBI research indicates that individuals with higher levels of CR demonstrate better preservation of cognitive and functional abilities, with education and premorbid intelligence emerging as consistent protective factors (Steward et al., 2018; Sumowski et al., 2013). More recently, systematic reviews have confirmed that CR contributes significantly to variability in recovery outcomes after TBI, highlighting its role as a key moderator of post-injury prognosis (Gutiérrez et al., 2024).

Given this complexity, it becomes essential to rely on comprehensive neuropsychological assessment protocols capable of identifying the cognitive, emotional, and behavioural domains most affected by TBI (Sander et al., 2019; Kristensen et al., 2020). Such evaluations are important to develop rehabilitation programs specifically tailored to this population, thereby increasing the chances of partial or complete functional recovery (Mateer & Sira, 2006). However, traditional instruments, such as the Barthel Index or the Lawton and Brody Scale, provide valuable but limited information, as they are often insensitive to subtle deficits and do not fully capture the complexity of functional performance in daily life (Kristensen et al., 2020). A Systematic review highlighted that no consensus exists regarding performance-based measures to evaluate activity and participation after TBI, and that available instruments show important psychometric and ecological limitations (Kristensen et al., 2020). Similarly, a study on community reintegration emphasizes that frequently used assessment tools often fail to reflect cultural variability and the multidimensional nature of real-world recovery (Gray et al., 2014). These limitations reinforce the need for more comprehensive, multidimensional, and context-sensitive assessment instruments with strong psychometric properties, particularly in populations with TBI.

The Activities of Daily Living Inventory (ADLI) was developed to address the mentioned limitations, providing a more comprehensive and ecologically valid assessment of functionality (Pinto et al., 2024). Designed primarily for adults and older adults, it aims to support neuropsychological assessment and rehabilitation by enabling a detailed characterization of everyday functioning. The ADLI includes both self-report and informant-report versions and is organized into four sections that assess basic (BADL), instrumental (IADL), and advanced activities of daily living (AADL), as well as factors that may influence performance, such as routine versus novelty, familiar versus new contexts, sensory acuity deficits, and gendered expectations (Pinto et al., 2024). Furthermore, the instrument distinguishes items according to the presence or absence of difficulties and uses a 0–10 response scale, which allows for greater sensitivity to variations in functional capacity and to changes over time. It also considers two

levels of difficulty in IADL and combines information from both self- and informant-based evaluations, providing a more reliable and multidimensional understanding of daily functioning (Pinto et al., 2024). Although the ADLI shows potential applicability, its psychometric properties have not yet been investigated in individuals with TBI.

Considering that, the present study aims to examine the psychometric properties of the Portuguese version of the ADLI in a sample of individuals with TBI. Specifically, it seeks to evaluate the internal consistency and construct validity of the instrument and to explore its convergent and divergent validity through comparisons with other established measures of functionality and emotional symptomatology. Overall, this study intends to provide evidence supporting the reliability and validity of the ADLI as a measure of functional performance in individuals with TBI.

Method

Participants

A total of 77 participants (42 women) were recruited by convenience sampling, both in the community (healthy group – HG) and in clinical services (traumatic brain injury group– TBIG), including rehabilitation institutions and patients associations, through institutional emails after formal authorization, followed by a snowball method.

Sociodemographic and clinical characteristics of the sample are presented in Table 1. Assessments were carried out either in a private space at the University or in clinical facilities, depending on availability and health status. The inclusion criteria were: (a) Portuguese nationality; (b) Portuguese as the native language; (c) age above 18; and (d) ability to read and understand the items. For the clinical group, a documented history of mild, moderate, or severe traumatic brain injury (TBI) was defined as additional inclusion criterion. The exclusion criteria were: (a) significant motor or sensory deficits that could prevent the completion of the assessment protocol; (b) current clinical diagnosis of major depression; (c) uncorrected vision and/or hearing impairments; and (d) current drug or alcohol addiction. No participants were excluded after applying the inclusion and exclusion criteria, resulting in a final sample of 77 individuals.

Based on clinical history and the presence or absence of TBI, participants were divided into two groups: the TBI group ($n = 36$, 15 women) and the healthy control group

($n = 41$, 27 women). Participants did not receive any financial or material compensation for their participation in the study.

Table 1.

Descriptive statistics regarding the sociodemographic and clinical characteristics of the sample

	Full sample ($n = 77$)	Healthy group ($n = 41$)	TBI group ($n = 36$)
Age in years ($M \pm SD$)	33.90 ± 13.49	31.85 ± 15.75	36.22 ± 10.06
Years of formal education ($M \pm SD$)	13.09 ± 3.64	13.90 ± 3.60	12.17 ± 3.51
Daily life autonomy (0-10)	8.65 ± 1.52	9.54 ± 0.74	7.64 ± 1.55
Type of TBI (mild-moderate-severe)	-	-	-
Mild TBI	-	-	39
Moderate TBI	-	-	2
Severe TBI	-	-	0
GOES	-	-	-
Upper good recovery	0	0	36
Lower good recovery	0	0	3
Upper moderate disability	0	0	2

Note. GOES - Glasgow Outcome Scale.

Instruments

Sociodemographic and clinical data were collected through a semi-structured interview specifically designed for this study including variables such as age, sex, education, marital and occupational status, living arrangements, type, location, cause and severity of TBI (Glasgow Coma Scale), loss of consciousness, post-traumatic amnesia, hospitalization and neurosurgical interventions, neuropsychological syndromes (e.g., aphasia, agnosia, apraxia, anosognosia), comorbidities before and after TBI, history of previous head injuries, rehabilitation history, and functional outcomes. Following this initial characterization, participants completed a structured protocol consisting of validated instruments that evaluated injury outcome, functionality, cognitive functioning, psychological symptoms, and reserve proxies, namely the Glasgow Outcome Scale – Extended (GOSE), Barthel Index, the Lawton and Brody IADL Scale (Portuguese version), the Activities of Daily Living Inventory (ADLI), the Addenbrooke's Cognitive Examination–III (Portuguese version), the Cognitive Reserve Inventory (SECrI) and the Hospital Anxiety and Depression Scale (HADS).

Glasgow Outcome Scale – Extended (GOSE; Guerreiro, 2017)

The Portuguese adaptation of the GOSE (Guerreiro, 2012), based on the original guidelines by Wilson and colleagues (1998), was employed as a structured interview for

assessing global functional outcome after TBI. The GOSE classifies outcomes into eight categories: (1) death; (2) vegetative state; (3) lower severe disability; (4) upper severe disability; (5) lower moderate disability; (6) upper moderate disability; (7) lower good recovery; and (8) upper good recovery.

The Barthel Index (BI; Wade & Collin., 1988)

The BI (Mahoney & Barthel, 1965) is a widely used instrument for assessing independence in BADL. It consists of 10 items covering essential self-care and mobility functions: feeding, bathing, grooming, dressing, bowel and bladder control, toilet use, transfers (bed to chair and back), mobility on level surfaces, and stair climbing. Each activity is scored on a scale reflecting whether the individual can perform the activity independently, with assistance, or is fully dependent. The original version of the BI ranges from 0 to 100 points, with higher scores indicating greater independence in daily functioning. The 20-point version, proposed by Wade and Collin (1988), has been one of the most frequently adopted formats in clinical and rehabilitation settings and was the basis for the Portuguese validation by Araújo, Pais-Ribeiro, Oliveira, and Pinto (2007), who reported excellent internal consistency (Cronbach's $\alpha = .96$) in a community sample of older adults.

Lawton and Brody Instrumental Activities of Daily Living Scale (IADL; Araújo et al., 2008)

The IADL (Portuguese version by Araújo et al., 2008) provides a functional measure of autonomy in instrumental activities of daily living. It includes eight domains: using the telephone, shopping, food preparation, housekeeping, laundry, transportation, responsibility for medication, and financial management. In the Portuguese adaptation, each domain is rated on an ordinal scale instead of the original dichotomous version, allowing the capture of partial dependence. The scoring system yields a total score ranging from 0 to 23 points, with higher scores reflecting greater functional independence. The Portuguese validation study demonstrated excellent internal consistency (Cronbach's $\alpha \approx .94$) and strong convergent validity with the Barthel Index, supporting the reliability and clinical applicability of this version in assessing functional independence in older adults and neurological populations in Portugal (Araújo et al., 2008).

Activities of Daily Living Inventory (ADLI; Pinto et al., 2024)

The ADLI is a recently developed instrument with self- and informant-report versions designed to provide a comprehensive assessment of functional performance in adults. It was created to overcome several limitations of existing ADL instruments, which were mostly

developed for geriatric or dementia populations and primarily focus on basic and instrumental activities (Pinto et al., 2024). These measures often have a restricted scope, emphasize physical components, and use small response scales that may compromise their sensitivity and reliability. Moreover, they generally fail to consider cognitive, sensory, or contextual factors that can influence everyday performance (Pinto et al., 2024).

The inventory begins with a sociodemographic section, which collects information on living arrangements, context, and perceived need for assistance in daily activities. Following this introductory section, the ADLI is divided into four main parts. The first section assesses BADL activities such as urinating, evacuating, performing personal hygiene, feeding, transferring between chair and bed, walking, climbing, descending stairs, and dressing (Pinto et al., 2024). The second section focuses on IADL, and includes activities such as shopping, meal preparation, financial management, medication and health management, home management, communication, transportation, and care of others, children, or pets (Pinto et al., 2024). The third section focuses on AADL, based on the Advanced-Activities of Daily Living tool (De Vriendt et al., 2013), but only those regarding complex productive activities beyond what is required to maintain independent living (Pinto et al., 2024). Finally, the ADLI includes a section on contextual and individual factors that may influence functionality, such as routine versus novelty, familiar versus new contexts, sensory acuity deficits, and gendered expectations (Pinto et al., 2024).

Each section includes items organized into two levels of difficulty, and responses are scored on a 0–10 scale (0 = incapable, 10 = fully capable), except two of the items (urinating and evacuating) that have different labels on the response scale (0 = incontinent; 10 = continent) (Pinto et al., 2024). The ADLI provides subscale scores for BADL, IADL, and AADL, as well as a total score, with higher values reflecting better functional performance. Importantly, ADLI includes materials that specify the particular functions targeted by each item (e.g., attention, language, executive functioning) (Pinto et al., 2024).

Preliminary analyses of the Portuguese version of the Activities of Daily Living Inventory (ADLI) demonstrated evidence of both convergent and predictive validity. Specifically, both self- and informant-report versions showed significant correlations between ADLI total, IADL, and AADL scores and visuospatial performance on the ACE-III, as well as positive associations with other established ADL measures (Pinto et al., 2024).

Addenbrooke's Cognitive Examination-III (ACE-III; Hsieh et al., 2013)

The ACE-III (Portuguese version by Machado et al., 2015) was used to assess global cognitive functioning. The instrument is scored out of 100 points and evaluates five cognitive domains: attention (max = 18 points; assessed through orientation, immediate verbal recall, and serial subtraction); memory (max = 26 points; including delayed verbal recall, verbal learning, recognition, and semantic memory); verbal fluency (max = 14 points; phonemic and semantic fluency); language (max = 26 points; comprehension, repetition, naming, reading, and writing); and visuospatial abilities (max = 16 points; including constructive tasks such as cube copy and clock drawing, as well as perceptual tasks such as dot counting and incomplete letter identification). Higher scores indicate better cognitive performance. The Portuguese version demonstrated very good internal consistency ($\alpha = .91$).

Inventory of Sensory, Emotional, and Cognitive Reserve (SECri; Pinto et al., 2023)

The SECri was recently developed to operationalize the Sensory, Emotional, and Cognitive Reserve (SEC) model, which extends the traditional concept of cognitive reserve by including sensory and emotional components (Pinto et al., 2024). The SECri assesses three domains of reserve using self- and informant-report versions: sensory reserve (SR), emotional reserve (ER), and cognitive reserve (CR). The SR domain evaluates sensory acuity and perception across different sensory modalities. The ER domain assesses individual differences in resilience, emotion regulation, and exposure to life events. The CR domain encompasses proxies of lifelong cognitive enrichment, such as education, occupation, leisure and cultural engagement, and bilingualism.

Participants rate each item on a scale ranging from 0 (strongly disagree) to 10 (strongly agree), with higher scores indicating greater capacity in the respective domain. Studies have shown excellent internal consistency in the SR domain (self-report: $\alpha = .93$; informant-report: $\alpha = .98$), acceptable internal consistency in the ER domain (self-report: $\alpha = .70$; informant-report: $\alpha = .77$), and acceptable to excellent internal consistency in the CR domain (self-report: $\alpha = .76$; informant-report: $\alpha = .98$). Moreover, evidence of convergent and predictive validity was also found, with significant associations between SECri scores and measures of emotional regulation, multisensory integration, and cognitive performance (Pinto et al., 2024).

Hospital Anxiety and Depression Scale (HADS; Pais-Ribeiro & Silva, 2004)

The Portuguese version of the HADS (Pais-Ribeiro et al., 2007) was used to assess anxiety and depression levels. It consists of 14 items divided into two subscales: Anxiety (7

items) and Depression (7 items). Each item is rated on a 4-point Likert-type scale ranging from 0 (low) to 3 (high). Subscale scores range from 0 to 21, obtained by summing the respective item scores. The authors suggest a cut-off score of 8 as the clinical threshold, with lower values indicating the absence of clinically significant anxiety or depression. More specifically, according to Zigmond and Snaith (1983), scores may be categorized as follows: “normal” (0–7); mild (8–10); moderate (11–15); and severe (16–21). Furthermore, this version demonstrated an acceptable internal consistency for both subscales, with Cronbach’s alpha values of .76 for Anxiety and .81 for Depression (Pais-Ribeiro et al., 2007).

Procedures

The study was approved by the Ethics Committee, and all participants signed the informed consent prior to data collection. The data were collected in a single session, administered by the same person, with the order of instruments balanced across participants to control for order effects. The informant-report version of ADLI was completed by a family member in all cases.

Statistical analyses were conducted using IBM SPSS Statistics, version 30. Descriptive statistics (means, standard deviations, frequencies, and percentages) were used to characterize the sample in terms of sociodemographic and clinical variables. Psychometric analyses of the Activities of Daily Living Inventory (ADLI) included item-level examination of response distributions, missing values, and floor and ceiling effects, with criteria set at > 10% for missing data and > 15% for floor and ceiling effects (Carlsson et al., 2020; Dong & Peng., 2013). Internal consistency of ADLI subscales (BADL, IADL, AADL) was estimated by Cronbach’s alpha coefficients and was considered adequate for Cronbach’s alphas higher than .70.

The assumption of normality was verified using the Shapiro–Wilk test. Significant deviations from normality were observed across subscales, although they were expected given the functional nature of the variables (presence of ceiling effects) and were not considered severe enough to compromise the validity of the parametric analyses.

Additionally, descriptive statistics were calculated for the SECri and its domains in order to characterize the cognitive reserve profile of the sample. These data were used exclusively for descriptive purposes and not included in the main psychometric analyses.

Convergent validity was analysed through Pearson correlations between ADLI scores and established measures of functionality, namely from the Barthel Index and the Lawton and

Brody IADL Scale. Divergent validity was examined by exploring correlations between ADLI scores and the anxiety and depression subscale scores of the HADS, under the assumption that functionality and emotional distress represent related but distinct constructs. Additional correlations with cognitive performance, as measured by the ACE-III, were also performed to further examine the construct validity of the ADLI. The strength of correlations was interpreted according to Cohen's (1988) and Field's (2024) guidelines, with values of r around .10 considered small, between .30 and .50 moderate, and above .50 large.

For all correlational analyses, the significance level was set at $\alpha = .05$.

Results

Descriptive statistics of functional performance, as assessed by the ADL questionnaires, are presented in Table 2. Mean scores and standard deviations are shown for the full sample, the healthy control group, and the TBI group.

Table 2.

Descriptive Statistics (M $\pm$ SD) on the ADL Performance

ADL Questionnaires	Full sample ($n = 77$)	Healthy group ($n = 41$)	TBI group ($n = 36$)
Barthel Index Total	19.47 $\pm$ 1.12	20 $\pm$ 0.00	18.86 $\pm$ 1.42
Lawton IADL Scale Total	20.27 $\pm$ 3.62	22.12 $\pm$ 1.552	18.17 $\pm$ 4.13
ADLI Self-report Total			
ADLI – BADL	206.64 $\pm$ 4.79	208.02 $\pm$ 2.78	205.06 $\pm$ 6.02
ADLI – IADL	471.05 $\pm$ 54.45	480 $\pm$ 44.24	460.86 $\pm$ 63.25
ADLI – AADL	475.36 $\pm$ 60.24	497.51 $\pm$ 45.27	450.14 $\pm$ 65.64
ADLI Informant-report Total	-	-	
ADLI – BADL	-	-	203.25 $\pm$ 7.481
ADLI – IADL	-	-	445.36 $\pm$ 59.99
ADLI – AADL	-	-	409.53 $\pm$ 64.34

Note. IADL = Instrumental Activities of Daily Living; ADLI = Activities of Daily Living Inventory; BADL = Basic Activities of Daily Living; AADL = Advanced Activities of Daily Living.

Descriptive statistics of the Sensory, Emotional, and Cognitive Reserve Inventory (SECri) are presented in Table 3. Mean scores and standard deviations are reported for the full sample, the healthy control group, and the TBI group, across both self-report and informant-report versions. The results provide an overview of cognitive, emotional, and sensory reserve indicators in the study sample.

Table 3.*Descriptive Statistics: SEcri Performance (M ± SD)*

	Full sample (n = 77)	Healthy group (n = 41)	TBI group (n = 36)
Self-report SEcri – cognitive reserve	34.39 ± 6.93	35.85 ± 4.89	32.72 ± 8.48
Self-report SEcri – emotional reserve	22.35 ± 3.25	22.49 ± 3.36	22.19 ± 3.15
Self-report SEcri – sensory reserve	14.60 ± 1.23	14.51 ± 1.38	14.69 ± 1.04
Self-report SEcri Total	68.22 ± 6.27	69.05 ± 4.95	67.28 ± 7.46
Inf-report SEcri – cognitive reserve	-	-	30.86 ± 8.57
Inf-report SEcri – emotional reserve	-	-	21.44 ± 2.99
Inf-report SEcri – sensory reserve	-	-	13.53 ± 1.16
Inf-report SEcri Total	-	-	63.42 ± 7.74

Note. SEcri: Inventory of sensory, emotional, and cognitive reserve

Table 4 presents the distribution of missing values, ceiling effects, and floor effects for the ADLI self-report items. In line with the established criteria, only missing values above 10% and floor or ceiling effects above 15% are reported.

For the BADL subscale, no missing values or floor effects were observed. However, marked ceiling effects were present in several items, namely urination (97.2%), defecation (97.2%), eating (94.4%), transfers (94.4%), walking (100%), orientation in home and familiar streets (100%), crossing the street (97.2%), dressing (97.2%), choosing clothes by initiative (94.4%), and choosing clothes according to the weather (91.7%).

In the IADL subscale, missing values above the threshold were identified only in the management of personal care devices (16.7%). Regarding ceiling effects, a wide range of activities exceeded the 15% criterion, particularly in shopping (e.g., selecting products in store 66.7%), meal preparation (e.g., preparing a cold meal, 86.1%; cooking a simple hot meal, 72.2%), house care (e.g., using cleaning utensils, 91.7%), financial management (e.g., identifying notes/coins, 97.2%; paying small expenses, 94.4%), medication management (e.g., identifying medications, 97.2%), communication (e.g., sending text messages, 94.4%), and several others. Relevant floor effects were also observed, mostly in transportation, including driving in unfamiliar streets (25.0%), changing route due to traffic (25.0%), handling breakdowns/accidents (22.2%), using a map/GPS (25.0%), and traveling by plane (25.0%).

For the AADL subscale, only one item presented missing values, with “Other advanced activities” reaching 100%. Ceiling effects were observed in three items: keeping appointments

(16.7%), resuming interrupted activities (19.4%), and performing tasks in noisy environments (16.7%). No floor effects were found in this domain.

In summary, the results show the absence of relevant missing values in the BADL domain, while both ceiling and floor effects were frequently observed in the IADL domain, particularly in financial management, medication management, and transportation. In contrast, the AADL domain presented minimal ceiling effects, no floor effects, and only one item with missing responses.

Table 4.

ADLI Item acceptability: missing values, ceiling and floor effects

ADLI Self-report ADLI - BADL Item(s)	Missing values	Ceiling effect (%)	Floor effect (%)
Urination	0.0	97.2	0.0
Defecation	0.0	97.2	0.0
Personal hygiene	0.0	91.7	0.0
Maintaining adequate hygiene	0.0	80.6	0.0
Using appropriate cleaning products	0.0	83.3	0.0
Eating	0.0	94.4	0.0
Recognizing food by taste	0.0	91.7	0.0
Recognizing food by smell	0.0	69.4	0.0
Eating initiative/timing	0.0	88.9	0.0
Meal decision (time of day)	0.0	86.1	0.0
Transfers (chair/bed)	0.0	94.4	0.0
Walking	0.0	100.0	0.0
Orientation – home	0.0	100.0	0.0
Orientation – familiar streets	0.0	100.0	0.0
Orientation – unfamiliar streets	0.0	58.3	0.0
Crossing the street	0.0	97.2	0.0
Walking plus conversation	0.0	72.2	0.0
Stairs	0.0	83.3	0.0
Dressing	0.0	97.2	0.0
Choosing clothes – initiative	0.0	94.4	0.0
Choosing clothes – weather	0.0	91.7	0.0
ADLI - IADL			
Item(s)			
Shopping			
Identify the need to shop	8.3	44.4	0.0
Make a shopping list	8.3	41.7	0.0
Select products in store	8.3	66.7	0.0
Adjust the list during shopping	8.3	11.1	0.0
Identify promotions	8.3	13.9	0.0
Buy clothes/shoes	8.3	59.0	0.0
Choose between products	8.3	63.9	0.0
Buy a gift	8.3	13.9	0.0

Meal preparation			
Identify the need to cook	5.6	61.1	0.0
Use kitchen utensils	5.6	80.6	0.0
Choose ingredients	5.6	58.3	0.0
Prepare a cold meal	5.6	86.1	0.0
Cook a simple hot meal	5.6	72.2	0.0
Plan a complete meal	5.6	36.1	0.0
Manage cooking time	5.6	13.9	0.0
Cook with instructions	5.6	13.9	0.0
Cook from memory	5.6	16.7	0.0
Cook a new recipe	5.6	13.9	0.0
Adjust recipe to guests	5.6	27.8	0.0
Cook while multitasking (physical)	5.6	13.9	0.0
Cook while multitasking (mental)	5.6	11.1	0.0
Solve cooking problems	5.6	13.9	0.0
Weekly meal planning	5.6	13.9	0.0
House care/management			
Identify the need for house care	0.0	41.7	0.0
Identify cleaning utensils	0.0	91.7	0.0
Use cleaning utensils	0.0	91.7	0.0
Do simple household tasks	0.0	66.7	0.0
Keep the house tidy	0.0	27.8	0.0
Keep the house clean	0.0	30.6	0.0
Separate laundry	0.0	13.9	0.0
Use appliances	0.0	44.4	0.0
Plan a cleaning routine	0.0	13.9	0.0
Learn new appliances	0.0	36.1	0.0
Financial management			
Identify notes/coins	0.0	97.2	0.0
Pay small expenses (cash)	0.0	94.4	0.0
Count money for larger expenses	0.0	75.0	0.0
Identify product prices	0.0	66.7	0.0
Calculate change	0.0	58.3	0.0
Pay with a bank card	0.0	88.9	0.0
Recall PIN	0.0	52.8	0.0
Withdraw cash (ATM)	0.0	80.6	0.0
Check balance (ATM)	0.0	80.6	0.0
Make transfers/payments (ATM)	0.0	75.0	0.0
Pay bills on time	0.0	44.0	0.0
Read/analyse receipts	0.0	77.8	0.0
Compare product prices	0.0	44.4	0.0
Check the account online	0.0	33.3	0.0
Make online purchases	0.0	47.2	0.0
Make investments	0.0	5.6	0.0
Health care			
Manage physical health	0.0	30.6	0.0
Manage emotional health	0.0	11.1	0.0
Schedule health check-ups	0.0	13.9	0.0
Medication management			
Identify medications	2.8	97.2	0.0
Follow prescription – timing	2.8	47.2	0.0
Follow prescription – dosage	2.8	72.2	0.0
Know purpose of medications	2.8	58.3	0.0
Monitor medication stock	2.8	52.8	0.0
Act in case of a misdose	2.8	11.1	0.0

Manage emergency medication	2.8	72.2	0.0
Adjust to prescription changes	2.8	25.0	0.0
Personal care devices management			
Identify the need to manage personal devices	16.7	55.6	0.0
Locate glasses/contact lenses/hearing aid	16.7	55.6	0.0
Use personal devices correctly	16.7	80.6	0.0
Maintain personal devices	16.7	13.9	0.0
Security			
Identify emergency contacts	2.8	61.1	0.0
Evaluate dangerous situations	2.8	50.0	0.0
Ensure personal/family safety	2.8	16.7	0.0
Identify scams/fraud	2.8	13.9	0.0
Act in a domestic emergency	2.8	13.9	0.0
Act in a medical emergency	2.8	11.1	0.0
Communicate with other(s)			
Recall own phone/email	0.0	69.4	0.0
Recall relatives contacts	0.0	13.9	5.6
Recall home address	0.0	13.9	0.0
Dial numbers/make calls	0.0	86.1	0.0
Send text messages	0.0	94.4	0.0
Write notes/letters by hand	0.0	61.1	0.0
Use social media	0.0	19.4	0.0
Make video calls	0.0	75.0	0.0
Send/receive emails	0.0	97.2	0.0
Use a computer for communication	0.0	86.1	0.0
Write letters on a computer	0.0	77.8	0.0
Write formal letters on a computer	0.0	83.3	0.0
Childcare			
Basic childcare tasks	52.8	22.2	0.0
Prevent childcare risks	52.8	13.9	0.0
Manage routine with child	52.8	25.0	0.0
Complex childcare tasks	52.8	25.0	0.0
Childcare while multitasking	52.8	11.1	0.0
Care of other(s)			
Basic eldercare tasks	69.4	5.6	0.0
Prevent eldercare risks	69.4	11.1	0.0
Manage routine with eldercare	69.4	8.3	0.0
Full eldercare responsibility	69.4	11.1	0.0
Eldercare while multitasking	69.4	5.6	0.0
Animal care			
Pet physiological care	38.9	52.8	0.0
Ensure pet safety	38.9	11.1	0.0
Manage pet routine	38.9	13.9	0.0
Manage pet health	38.9	8.3	0.0
Transports			
Taxi – give the address	0.0	83.3	0.0
Buy ticket/pass	0.0	83.3	0.0
Use public transport	0.0	94.4	0.0
Drive familiar streets	0.0	69.4	25.0
Drive unfamiliar streets	0.0	44.4	25.0
Choose the best route	0.0	50.0	25.0
Change route (traffic)	0.0	66.7	5.6
Handle breakdown/accident	0.0	41.7	25.0
Use a map/GPS	0.0	36.1	2.8
Car maintenance	0.0	66.7	

Travel by plane	0.0	25.0	22.2
Drive with music	0.0	55.6	25.0
Drive while talking	0.0	58.3	5.6
ADLI - AADL			
Item(s)			
Scheduling weekly tasks	0.0	11.1	0.0
Keeping appointments	0.0	16.7	0.0
Resuming interrupted activities	0.0	19.4	0.0
Performing tasks in noisy environments	0.0	16.7	0.0
Repairing objects or clothing	0.0	5.6	0.0
Dual task: physical and mental	0.0	5.6	0.0
Dual task: mental and mental	0.0	11.1	0.0
Anticipating unexpected events	0.0	11.1	0.0
Handling unexpected events	0.0	11.1	0.0
Other advanced activities	100.0	0.0	0.0

Note. ADLI = Activities of Daily Living Inventory; BADL = Basic Activities of Daily Living; IADL = Instrumental Activities of Daily Living; AADL = Advanced Activities of Daily Living

Regarding internal consistency (see Table 5), overall, the reliability ranged from acceptable to excellent across the different types of daily activities. reliability for the BADL subscale ranged from moderate to good, with Cronbach's alpha coefficients indicating acceptable internal consistency across most items. In contrast, most instrumental activities yielded moderate to high correlations, with alpha values remaining stable across deletions, suggesting robust reliability. AADL showed greater variability, with some items displaying lower contributions, but the subscale still demonstrated good internal consistency, reflecting the broader heterogeneity of these tasks.

Table 5.*ADLI Internal Consistency with the use of Cronbach's Alpha*

ADLI Self-report		Corrected item-total	Cronbach's
ADLI - BADL	Item(s)	correlation	Alpha if item deleted
Urination		.79	.70
Defecation		.78	.68
Personal hygiene		.71	.68
Maintaining adequate hygiene		.44	.69
Using appropriate cleaning products		.08	.71
Eating		.75	.69
Recognizing food by taste		.43	.69
Recognizing food by smell		.42	.69
Eating initiative/timing		.46	.69
Meal decision (time of day)		.50	.68
Transfers (chair/bed)		.04	.71
Walking		.00	.71
Orientation – home		.00	.71
Orientation – familiar streets		.00	.71
Orientation – unfamiliar streets		-.09	.72
Crossing the street		-.07	.71
Walking plus conversation		.26	.70
Stairs		.57	.67
Dressing		.15	.70
Choosing clothes – initiative		.85	.68
Choosing clothes – weather		.67	.67
ADLI - IADL			
Item(s)			
Shopping			
Identify the need to shop		.60	.87
Make a shopping list		.66	.87
Select products in store		.57	.87
Adjust the list during shopping		.57	.87
Identify promotions		.61	.87
Buy clothes/shoes		.55	.87
Choose between products		.62	.87
Buy a gift		.55	.87
Meal preparation			
Identify the need to cook		.58	.87
Use kitchen utensils		.59	.87
Choose ingredients		.60	.87
Prepare a cold meal		.59	.87
Cook a simple hot meal		.61	.87
Plan a complete meal		.74	.87
Manage cooking time		.60	.87
Cook with instructions		.62	.87
Cook from memory		.55	.87
Cook a new recipe		.55	.87
Adjust recipe to guests		.67	.87
Cook while multitasking (physical)		.67	.87
Cook while multitasking (mental)		.71	.87
Solve cooking problems		.59	.87
Weekly meal planning		.56	.87

House care/management		
Identify the need for house care	.20	.87
Identify cleaning utensils	-.04	.87
Use cleaning utensils	-.04	.87
Do simple household tasks	.27	.87
Keep the house tidy	.46	.87
Keep the house clean	.52	.87
Separate laundry	.22	.87
Use appliances	.27	.87
Plan a cleaning routine	.17	.87
Learn new appliances	.47	.87
Financial management		
Identify notes/coins	.42	.87
Pay small expenses (cash)	.41	.87
Count money for larger expenses	.54	.87
Identify product prices	.61	.87
Calculate change	.05	.87
Pay with a bank card	.47	.87
Recall PIN	.27	.87
Withdraw cash (ATM)	.59	.87
Check balance (ATM)	.48	.87
Make transfers/payments (ATM)	.61	.87
Pay bills on time	.44	.87
Read/analyse receipts	.37	.87
Compare product prices	.22	.87
Check the account online	.45	.87
Make online purchases	.34	.87
Make investments	.49	.87
Health care		
Manage physical health	.30	.87
Manage emotional health	.26	.87
Schedule health check-ups	.05	.87
Medication management		
Identify medications	.34	.87
Follow prescription – timing	.41	.87
Follow prescription – dosage	.24	.87
Know purpose of medications	.46	.87
Monitor medication stock	.53	.87
Act in case of a misdose	.38	.87
Manage emergency medication	.44	.87
Adjust to prescription changes	.41	.87
Personal care devices management		
Identify the need to manage personal devices	.26	.87
Locate glasses/contact lenses/hearing aid	.24	.87
Use personal devices correctly	.46	.87
Maintain personal devices	.30	.87
Security		
Identify emergency contacts	.18	.87
Evaluate dangerous situations	.36	.87
Ensure personal/family safety	.09	.87
Identify scams/fraud	.18	.87
Act in a domestic emergency	.46	.87
Act in a medical emergency	.47	.87
Communicate with other(s)		
Recall own phone/email	.65	.87
Recall relatives contacts	.26	.87
Recall home address	.44	.87

Dial numbers/make calls	.44	.87
Send text messages	.61	.87
Write notes/letters by hand	.61	.87
Use social media	.57	.87
Make video calls	.67	.87
Send/receive emails	.66	.87
Use a computer for communication	.65	.87
Write letters on a computer	.67	.87
Write formal letters on a computer	.46	.87
Childcare		
Basic childcare tasks	.44	.87
Prevent childcare risks	.47	.87
Manage routine with child	.45	.87
Complex childcare tasks	.47	.87
Childcare while multitasking	.17	.87
Care of other(s)		
Basic eldercare tasks	.16	.87
Prevent eldercare risks	.20	.87
Manage routine with eldercare	.18	.87
Full eldercare responsibility	.26	.87
Eldercare while multitasking	-.25	.87
Animal care		
Pet physiological care	-.14	.87
Ensure pet safety	.82	.87
Manage pet routine	.76	.87
Manage pet health	.82	.87
Transports		
Taxi – give the address	.10	.87
Buy ticket/pass	.77	.87
Use public transport	.61	.87
Drive familiar streets	.70	.87
Drive unfamiliar streets	.81	.87
Choose the best route	.66	.87
Change route (traffic)	.64	.87
Handle breakdown/accident	.77	.87
Use a map/GPS	.61	.87
Car maintenance	.70	.87
Travel by plane	.81	.87
Drive with music	.66	.87
Drive while talking	.64	.87
ADLI - AADL		
Item(s)		
Scheduling weekly tasks	.51	.87
Keeping appointments	.78	.86
Resuming interrupted activities	.61	.87
Performing tasks in noisy environments	.75	.86
Repairing objects or clothing	.20	.91
Dual task: physical and mental	.68	.87
Dual task: mental and mental	.61	.97
Anticipating unexpected events	.82	.85
Handling unexpected events	.82	.85
Other advanced activities	-	-

Note. ADLI = Activities of Daily Living Inventory; BADL = Basic Activities of Daily Living; IADL = Instrumental Activities of Daily Living; AADL = Advanced Activities of Daily Living

In relation to convergent validity (see Table 6), BADL scores from the ADLI showed significant positive correlations with the Barthel Index, both for the self-report version ($r = .55, p < .001$) and for the informant-report version ($r = .57, p = .008$). A similar pattern was observed for the IADL domain, where scores from both self-report ($r = .44, p < .001$) and informant-report ($r = .40, p = .016$) significantly correlated with the Lawton Instrumental Activities of Daily Living Scale. These results provide evidence of consistent convergence between the ADLI and established measures of basic and instrumental daily functioning.

Table 6.

ADLI Convergent Validity

Variables	Bivariate Correlations	
	Barthel Index total	Lawton IADL
Self-report ADLI – BADL	.55**	
Self-report ADLI-IADL		.44**
Informant- report ADLI-BADL	.57**	
Informant- report ADLI-IADL		.40*

Note. $p < .05^*$, $**p < .01$; ADLI = Activities of Daily Living Inventory; BADL = Basic Activities of Daily Living; IADL = Instrumental Activities of Daily Living.

Regarding predictive validity (see Table 7), ADLI self-report scores showed significant positive correlations with ACE-III total scores across several domains. Specifically, temporal orientation correlated with ACE-III attention I ($r = .37, p = .026$), spatial orientation with ACE-III attention II ($r = .63, p < .001$), language with ACE-III language ($r = .68, p < .001$), and executive functions with ACE-III verbal fluency ($r = .67, p < .001$). No significant correlations were found between ADLI memory and the ACE-III memory subscore ($r = .31, p = .063$). In relation to the ADLI informant-report, spatial orientation correlated positively with ACE-III attention II ($r = .62, p < .001$), language correlated with ACE-III language ($r = .63, p < .001$), and executive functions with ACE-III verbal fluency ($r = .65, p < .001$). No significant correlations were found between ADLI memory and the ACE-III memory subscore ($r = .23, p = .173$) and between ADLI temporal orientation and the ACE-III attention I subscore ($r = .22, p = .201$).

Table 7,
Predictive Validity of the ADLI

Variables	Bivariate Correlations				
	ACE-III attention I	ACE-III attention II	ACE-III memory	ACE-III fluency	ACE-III language
Self-report					
Temporal orientation	.37*				
Spatial orientation		.63**			
Language					.68**
Memory			.31		
Executive functions				.67**	
Informant-report					
Temporal orientation	.23				
Spatial orientation		.62**			
Language					.63**
Memory			.22		
Executive functions				.65**	

* $p < .05$; ** $p < .01$

Note. ACE-III = Addenbrooke's Cognitive Examination-III; ADLI = Activities of Daily Living Inventory.

Table 8 presents the results of the divergent validity analysis. Significant negative correlations were found between HADS depression and the self report version of ADLI subscales: BADL ($r = -.55, p < .001$), IADL ($r = -.53, p < .001$), and AADL ($r = -.57, p < .001$). Similarly, significant negative correlations were observed between HADS anxiety and ADLI subscales: BADL ($r = -.50, p = .002$), IADL ($r = -.50, p = .002$), and AADL ($r = -.49, p = .002$).

The same can be reported about the informant version. Significant negative correlations were found between HADS depression and BADL ($r = -.49, p = .002$), IADL ($r = -.52, p = .001$), and AADL ($r = -.48, p = .003$) and between HADS anxiety and BADL ($r = -.48, p = .003$), IADL ($r = -.47, p = .004$), and AADL ($r = -.52, p = .001$).

Table 8.
ADLI Divergent Validity between HADS and functionality

Variables	Bivariate Correlations	
	HADS Depression	HADS Anxiety
Self-report ADLI – BADL	-.55**	-.50**
Self-report ADLI-IADL	-.53**	-.50**
Self-report ADLI-AADL	-.57**	-.49**
Inf-report ADLI-AADL	-.49**	-.48**
Inf-report ADLI-AADL	-.52**	-.47**
Inf-report ADLI-AADL	-.48**	-.52**

** $p < .01$

Note. ADLI = Activities of Daily Living Inventory; BADL = Basic Activities of Daily Living; IADL = Instrumental Activities of Daily Living.

Discussion

The present study aimed to examine the psychometric properties of the ADLI in a Portuguese sample of individuals with TBI.

Regarding internal consistency, Cronbach's alpha values were mostly acceptable, indicating adequate internal reliability across the three ADLI subscales (BADL, IADL, and AADL). This suggests that the items within each domain coherently measure the intended constructs, providing preliminary evidence of the instrument's reliability in this TBI sample. The lower alpha values were observed in the BADL subscale and were expected, as basic daily activities typically present reduced score variability in individuals with mTBI or relatively preserved functional independence (Sijtsma, 2009; Tavakol & Dennick, 2011). This pattern is well documented in traditional ADL measures, such as the Barthel Index, where ceiling effects and limited heterogeneity are frequently observed among higher-functioning individuals (Mahoney & Barthel, 1965; Wade & Collin, 1988). These findings support the ADLI's internal consistency while reflecting the expected behaviour of basic daily living items in samples with relatively high autonomy levels.

In terms of item acceptability, ceiling effects were frequent, particularly in BADL and several IADL items, whereas floor effects did not exceed the predefined threshold. This pattern indicates that some activities may have limited discriminative ability among individuals with higher levels of independence, a finding commonly reported in functional measures applied to neurological or rehabilitation samples (Terwee et al., 2007; Hobart et al., 2001). This overall distribution is consistent with prior literature showing that ADL instruments with multiple levels of task complexity, from basic to advanced, tend to be more appropriate for heterogeneous clinical populations (Kristensen et al., 2020; Lawton & Brody, 1969). Accordingly, the present findings support the adequacy of the ADLI's item performance while showing the relevance of maintaining activities of different cognitive and physical demands to ensure coverage across different functional profiles.

Convergent validity was supported by significant positive correlations between the ADLI subscale scores, BADL and IADL and the classical measures of functionality, the Barthel Index and Lawton IADL Scale, respectively. Specifically, both self-report and informant-report

versions of the ADLI showed significant strong correlations with the Barthel Index in the BADL domain and significant moderate correlations with the Lawton Scale in the IADL domain, supporting the expected association between higher ADLI scores and greater independence in everyday functioning. Importantly, both the self-report and informant-report versions presented similar magnitudes of association, confirming the cross-validity of both forms and suggesting their complementary value in clinical practice. Overall, these results reinforce the ADLI's ability to capture functional capacity across basic and instrumental activities, reinforcing its potential for future application in clinical settings.

For divergent validity, significant negative correlations were found between ADLI scores and HADS anxiety and depression, suggesting that higher levels of anxiety and/or depression are related to lower perceived functional capacity. This inverse relationship is consistent with previous findings showing that emotional symptoms, particularly depression, are strong predictors of reduced participation and perceived autonomy in individuals with TBI (Juengst et al., 2017; Cantor et al., 2014). Psychological distress can influence both actual performance and self-perception of functioning, as elevated anxiety and depressive symptoms are known to impair motivation, self-efficacy, and cognitive efficiency, ultimately limiting engagement in everyday activities (Benedictus et al., 2010; Ponsford et al., 2014).

Moreover, the consistency of these associations across both self- and informant-report versions of the ADLI reinforces the robustness of this pattern, suggesting that emotional distress exerts a measurable impact on daily living regardless of the reporting source.

In addition to the functional and emotional measures, descriptive data from SECri were also examined to characterize participants' reserve profiles. As expected, the healthy group presented slightly higher total SECri scores compared with the TBI group, particularly in the cognitive reserve dimension. Emotional and sensory reserve scores were similar between groups, suggesting that interpersonal and perceptual aspects of reserve may be relatively preserved after mTBI. These findings are consistent with the literature emphasizing the protective role of cognitive reserve in maintaining functional autonomy and cognitive efficiency following TBI (Bartrés-Faz & Arenaza-Urquijo, 2011; Stern et al., 2020).

Predictive validity analyses further demonstrated significant correlations between ADLI and ACE-III dimensions, especially in attention, language, and fluency. These findings are consistent with previous research highlighting that impairments in these domains are among the most relevant predictors of reduced functional autonomy following TBI (Anderson et al., 2010;

Forslund et al., 2019; Goverover et al., 2017). Attention and executive functions are fundamental for the planning, sequencing, and monitoring of daily activities, and deficits in these abilities often lead to poorer ADL outcomes even in individuals with preserved general cognition (Cahn-Weiner et al., 2002; Royall et al., 2007). In addition, the absence of a significant correlation with the memory domain should not be interpreted as contradictory but rather as reflecting the automatic and overlearned nature of many ADL tasks, which tend to rely more on procedural and attentional mechanisms than on explicit recall (Chaytor & Schmitter-Edgecombe, 2003). Moreover, individuals with TBI often develop compensatory strategies such as external reminders, structured routines, or environmental cues that can mitigate memory-related difficulties during daily functioning (Cicerone et al., 2019).

On the other hand, the correlation with the language subscale reinforces the importance of communicative and comprehension skills for everyday functioning, as language abilities are essential for understanding routines, managing tasks, and interacting effectively in daily life (Norman et al., 2019). These results suggest that the ADLI captures aspects of cognitive functioning most directly implicated in functional autonomy and supports its predictive validity in individuals with TBI.

Although the general results support the ADLI as a comprehensive, valid tool, capable of measuring the functionality of each individual across a broad spectrum of daily activities, ranging from BADL to AADL, some limitations should be noted. The relatively small, convenience-based sample limits the generalization of the findings. Furthermore, the predominance of participants with relatively preserved functional levels, similar education and not significantly different levels of reserve, may have contributed to the observed ceiling effects. Future research should include individuals with different degrees of severity and in various stages of recovery.

In summary, this study provides an initial psychometric analysis of the ADLI in Portugal with a TBI sample, showing acceptable internal consistency, significant and positive correlations with traditional and well-established scales that measure functionality, significant divergent correlations between depression, anxiety, and functionality across all three ADLI domains, and predictive associations with different ACE-III domains. These results highlight the potential of the ADLI to complement neuropsychological assessment protocols of individuals with TBI, addressing gaps left by traditional instruments that are less sensitive to the complexity of everyday functioning (Cahn-Weiner et al., 2002; Goverover et al., 2007; Spooner & Pachana, 2006).

Conclusion

In conclusion, this study provided an initial understanding of the psychometric properties of the ADLI in a Portuguese sample of individuals with TBI. The instrument demonstrated adequate internal consistency and convergent, divergent, and predictive validity with well-established measures, supporting its reliability for assessing daily living activities. However, additional studies are required to deepen the understanding of the ADLI's psychometric properties and to test its utility in different contexts and patient groups.

By enhancing the assessment of functionality through the inclusion of activities with varying levels of complexity, with a sample with different degrees of TBI severity, the ADLI may contribute to a more comprehensive understanding of everyday performance in those individuals. That way this instrument will be able to strengthen both clinical and research practices by enabling a more sensitive detection of subtle functional changes contributing to improving the quality of care and promoting better functional outcomes for individuals living with the consequences of TBI.

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