BMC Geriatrics

RESEARCH

Open Access

The relationship between intrinsic capacity and functional ability in older adults

Somayeh Ahmadi[1], Pouya Farokhnezhad Afshar[1*], Kazem Malakouti[1] and Mojtaba Azadbakht[2]

Abstract

Introduction Intrinsic Capacity in integrated geriatric care emphasizes the importance of a thorough functional assessment. Monitoring the intrinsic capacity of older individuals provides standardized and reliable information to prevent early disability. This study assessed the relationship between intrinsic capacity and functional ability in older adults.

Method This cross-sectional study involved 210 older individuals aged 60 and above referred to Rasoul Akram Hospital. Data collection included ADL and IADL scales, the Snellen chart, the Hearing Handicap Inventory, the hand dynamometer, the TUG test, the AMT test, and the GDS. Data analysis was conducted using SPSS software v.26 via independent t-tests, ANOVA, Pearson correlation coefficient, and multiple regression analysis.

Results The participants were 70.13 ± 7.04 years. 57.6% were older females and 42.4% were older males. Age showed a significant and inverse correlation with both ADL ($P < 0.001$, $r = -0.23$) and IADL ($P < 0.001$, $r = -0.39$). The adjusted coefficient of determination (R^2) for the five domains of intrinsic capacity (sensory, cognitive, locomotion, psychological, vitality) as well as age and BMI was 0.16 for ADL and 0.32 for IADL.

Conclusion Age and TUG could only weakly explain ADL changes, while vision, hand grip strength, cognition, and age had moderate predictive ability of IADL. Therefore, by assessing these predictors, we can predict disability before it occurs and make necessary interventions.

Keywords Aged, Healthy aging, Functional ability, Activities of daily living, Instrumental activity daily living, Intrinsic capacity

Introduction

The world is experiencing a significant demographic shift from a young population to an older population [1]. This demographic change means an increased burden of physical, mental, and cognitive illnesses and disabilities, which have a significant financial impact on the health of older people, their families, and society as a whole [2].

Functional ability is an important health indicator in older adults [2, 3]. The risk of functional limitations is more than doubled in those with dual sensory loss or hearing impairment, significantly reducing older adults' ability to perform household tasks, travel, shop, prepare food, and walk [4]. Older adults' disability is assessed by

*Correspondence:
Pouya Farokhnezhad Afshar
farokhnezhad.p@iums.ac.ir
[1]Geriatric Mental Health Research Center, School of Behavioral Sciences and Mental Health (Tehran Institute of Psychiatry), Iran University of Medical Sciences, Tehran, Iran
[2]School of Medicine, Qom University of Medical Sciences, Qom, Iran

their difficulties in performing activities of daily living (ADL) and instrumental activities of daily living (IADL) [3]. The results show that in Iran, 6.6 to 23.3% and 28.5% of older adults had difficulties with ADL and IADL, respectively [5], resulting in a loss of independence and leading to increased dependency in older people [2].

The World Health Organization (WHO) released a global report on aging and health which introduced the concept of intrinsic capacity to define healthy aging [6]. Intrinsic capacity refers to the combination of a person's physical and psychological capabilities [7] and this is a multidimensional indicator that includes activity reserves in five components related to healthy aging, including vitality, locomotion, cognition, psychological capacity, and sensory capacity [8]. Intrinsic capacity shifts the concept of healthy aging from a disease-centered approach to a function-centered approach, creating the potential to delay disability through early interventions [2]. The results suggest that a decline in intrinsic capacity with age may be associated with an increased risk of negative health outcomes, such as disability in ADL and IADL, nursing home placement, and even mortality [8]. There is also evidence that each component of intrinsic capacity is a predictor of adverse health outcomes [2]. Visual and hearing impairments also have a significant impact on a person's health and ability to function [9].

Studies show that 30% of younger older adults (ages 60–79) and 40% of those over 85 have at least one disability [10–12]. ADLs are used collectively to describe the basic skills required for independent living including five essential categories: bathing, eating, dressing, changing, and mobility [13]. However, IADL is more complex and requires a higher level of personal independence. These activities indicate sufficient decision-making ability and greater interaction with the environment [3]. Functional disability in old age not only reduces the quality of life but also reduces society's limited resources for support. One way to bridge the gap between the increasing demand for healthcare and limited resources is to help older adults continue their lives successfully and independently in later years. The assessment of Intrinsic Capacity plays a key role as an indicator for assessing the physical and mental health status of older adults and related diseases [13]. Intrinsic capacity seems to be able to show changes in community-dwelling older adults earlier than functional indicators. However, there is limited research analyzing the interplay of the five components of intrinsic capacity as a new framework for negative health outcomes and functional performance in older adults [2, 14, 15].

While the relationship between intrinsic capacity and functional ability has been studied in other countries, the results of these studies may vary. This highlights the need for further global research to better understand this relationship. By examining this relationship in countries with different social, cultural, family, and financial structures, it is possible to identify factors that are common in the aging experience in other countries, as well as factors that are influenced by the specific conditions of each country. This research can reveal global patterns in the aging process while identifying patterns specifically shaped by each country's social and economic factors. This study assessed the relationship between intrinsic capacity and functional ability in older adults.

Method

Participations

This descriptive-analytical study was designed as a cross-sectional study. In this study, 210 older people aged 60 and over were examined. The sample size was calculated using a valid formula from previous studies, considering $r = 0.2$, $\beta = 0.2$, and $\alpha = 0.05$. This resulted in a sample size of 194 participants, to which an additional 10% was added to account for possible incomplete completion of questionnaires. The final sample size was 210 older people [16]. These calculations were carried out to ensure the statistical significance of the correlation coefficient between intrinsic capacity and daily and instrumental activities of older people. We selected participants using a convenience sampling method from patients referring to Rasool Akram Hospital clinics for their other problems. The choice of this hospital was due to the presence of specialized departments and clinics in geriatric care, which offered a specialized and relevant environment to carry out the sampling procedure. Inclusion criteria include 60 years and above, communication ability and hearing, and not taking medications that impair consciousness; Exclusion criteria include cognitive impairment, incomplete questionnaires, or repetitive answer patterns.

To ensure the accuracy and validity of the responses during the data collection process, the interviewer read the questionnaire and recorded their responses to older adults with a lower level of formal education or those who could not read the questionnaire.

Measures

Outcome variable

In this study, daily and instrumental life activities were examined as dependent variables. These two types of activities are defined as follows:

ADL: The term ADL refers to a set of basic and essential activities for daily living, including personal hygiene, eating, dressing, transferring, walking, bathing, controlling bowel and bladder functions, and using the toilet. The Activities of Daily Living (ADL) questionnaire was designed by Katz and colleagues and we used the Persian version [17]. The sensitivity and specificity of ADL

were 0.75 and 0.96, respectively. Each question had three answer options: dependent (Zero points), needs support (1 point), and independent (Two points). The total score for this section ranged from Zero to 16, and people were divided into one of the following three groups based on their score: dependent (Zero to 7 points), needy (8 to 11 points), and independent (12 to 16 points).

IADL: Instrumental activities of daily living require greater levels of individual independence and relate to tasks that require greater decision-making and interaction with the environment. These activities include using the phone, taking medications, preparing food, doing household chores, shopping for essentials, using vehicles, and managing finances. The IADL Questionnaire was designed by Lawton and colleagues in 1969 and its validity and reliability were confirmed by Dr. Taheri and colleagues [17]. The sensitivity and specificity of IADL were 0.71 and 0.77, respectively. Similar to the ADL section, this section had three answer options for each question: dependent (Zero points), requires support (One point), and independent (Two points). The total score for this section ranged from Zero to 14, and people were divided into the following groups based on their score: dependent (Zero to 6 points), needs help (7 to 10 points), independent (11 to 14 points).

Independent variable

Intrinsic capacity

Cognition: The Abbreviated Mental Test (AMT) assesses cognitive status. This questionnaire, designed by Holdkinson in 1972, was published in Iran and checked for validity and reliability [18]. The AMT consists of 10 questions and can also be administered to illiterate people. The cutoff point for this test is a score of less than 7, which is considered evidence of cognitive impairment. Persian version of AMTs was found to be less dependent on education than other cognitive tools.

Depression: The Geriatric Depression Scale (GDS-15) was used to assess mental performance. This tool for assessing depression in the elderly, developed by Yesavij, was introduced in 1986 as a 15-point short form for diagnosing depression in hospitalized patients. In 2006, its validity and reliability were confirmed by Dr. Malakouti and colleagues [19]. The reliability of the 15-item form of this scale in the Iranian elderly population was assessed by Cronbach's alpha, split-half, and test-retest methods with values of 0.90, 0.89, and 0.58, respectively. The score for this questionnaire ranges from Zero to 30, with scores of 0 to 9 indicating no depression, 10 to 19 indicating moderate depression, and 20 to 30 indicating severe depression. In the short form with 15 items, the score is between 0 and 15, higher scores are divided by two.

Vision: The Snellen chart, designed by Herman Snellen in 1960, evaluates vision. This table contains letters that decrease in size from top to bottom based on the American Academy of Ophthalmology (AAO) standards and the recommendations of the Iranian Ophthalmology Society. The vision assessment was performed six meters from the table, with participants identifying the letters (E) first with their right eye and then with their left eye. Older people with a score of 10/10 were classified as having good vision, while those with a score below were classified as having poor vision.

Hearing: The 10-item version of the Hearing Handicap Inventory for the Elderly – Screening Version (HHIE-S) was used to assess hearing ability. Lutman in 1991 and Ventry and Weinstein in 1982 developed a 25-item version of the HHIE to examine the psychosocial disability associated with hearing impairment in the elderly. In 1986, the 10-item version of the HHIE-S was widely used and developed as a screening tool to detect hearing loss. This questionnaire was evaluated for validity and reliability by Leila Behboodi and colleagues in 2021 [20], with a Cronbach alpha coefficient of 0.85 and a test-retest reliability value of 0.73, showing good internal consistency. The HHIE-S consists of 10 items selected from the original 25-item version. The HHIE includes two domains: (1) Emotional and (2) Social. Of the ten items, five assess emotional consequences (HHIE-E), while the remaining five examine social or situational consequences (HHIE-S). The answer options are: Yes (score = Four), Sometimes (score = Two), and No (score = Zero). Ratings are divided into three levels: mild handicap (Zero to 10), moderate handicap (12 to 24), and major handicap (26 to 40).

The Timed Up and Go Test (TUG) was used to assess locomotion. This test was developed by Podsiadlo et al. and evaluated for validity and reliability by Aslankhani and colleagues in Iran [21]. A Cronbach alpha of 0.81 and a test-retest reliability of 0.98 were determined. It consists of three stages: getting up from a chair, walking three meters, turning around, and returning to the starting point. Participants must complete these stages as quickly as possible without losing their balance. People who took longer than 12 s to complete the test were considered poor performers, while people who took less than 12 s were considered high performers.

Hand Grip: The electronic hand dynamometer model 14192-709e examines vitality. In this test, participants sit in a chair, bend their arms at a 90-degree angle, and press the device with maximum force three times with each hand, holding it for 10 s. A break of 30 s was allowed between each trial. Handgrip strength was defined as the average maximum strength of each hand. Handgrip strength less than 16.5 kg (for males) and less than 10 kg (for females) was considered undesirable, while values above were desirable.

Other covariates

Previous studies have identified various factors that influence the functioning of older adults, including demographic, social, and clinical variables. In this study, demographic and social variables were used to analyze the various impacts on older people's performance, including age (60–74 years, 75–89 years, >90 years), sex (male and female), educational status (below high school, high school, university), marital status (married, widowed, divorced) and work status (employed, retired, unemployed, housewife).

To examine clinical variables, the number of comorbidities was divided into zero, one, and two diseases. The body mass index (BMI) included desirable: 21 to 26.9, undesirable: less than 21, and more than 27.

Analysis

We used descriptive and inferential statistical methods for data analysis via SPSS software v.26. We checked the Kolmogorov–Smirnov test for normal distribution, and the K-S test showed that the data had a normal distribution. We assessed the differences between groups using independent t-tests, analysis of variance (ANOVA with Least Significant Difference), the relation between variables through the Pearson correlation coefficient (weak: <0.2 moderate: 0.2–0.4, strong: >0.6), and multiple linear regression analysis using the enter method.

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the Iran University of Medical Sciences (Ref: IR.IUMS.REC.1402.036). We explained the objectives to the participants and obtained informed written consent and confirmed that this study followed the guidelines and regulations of the Declaration of Helsinki.

Table 1 Demographic variables in participants

		Frequency	%
Age (in years)	60–75	164	78
	75–90	44	21
	>90	2	1
BMI (Kg/M^2)	21-26.9	95	45.2
	<21 and >27	115	54.8
Educational status	Elementary	171	81.4
	High school	23	11
	University degree	16	7.6
Work status	Employed	17	8.1
	Retired	75	35.7
	Housewife	105	50
	Unemployed	13	6.2
Sex	Female	121	57.6
	Male	89	42.4
Marital status	Married	134	63.8
	Widowed	67	31.9
	Divorced	9	4.3

Results

One hundred twenty-one (57.6%) were female and 89 (42.4%) were male. The mean age of the participants was 70.13 ± 7.04 years. (Details in Table 1).

There are significant differences between the sex and the IC components, including the hand grip, left vision, cognition, and, depression. Furthermore, significant differences were observed between age and IC components, including vision, right and left-hand grip strength, hearing, cognition, and the TUG. Regarding marital status, significant differences were found between marital status and IC components such as right-hand grip strength, hearing ability, depression, and cognition. In addition, there is also a significant relationship between educational level and IC components, including left vision, hand grip strength, hearing, and cognition. Significant differences were observed between work and IC components, including hand grip strength, depression, cognition, and the TUG (Table 2).

Correlation analysis between demographic variables, including age, BMI, diseases, ADL, and IADL with five domains of IC showed that age had a significant negative association with vision in both eyes (right and left) and grip strength in both hands (right and left) has left) and cognitive abilities. In addition, age also shows a significant association with hearing and performance in the TUG. In addition, there is a significant negative association between vision of both eyes, grip strength of both hands, cognitive abilities, and diseases, while the TUG shows a significant association with diseases. However, no significant association was observed between BMI and the five domains of IC. There is also a significant negative association between age and both ADL and IADL. However, no significant association was observed between these performances and BMI and diseases (Table 3).

The multiple regression analysis showed that age and the TUG significantly predicted ADL. In addition, the vision of both eyes, left-hand grip strength, cognitive ability, and age were identified as significant predictors of IADL (Table 4).

Discussion

This study assessed the relationship between intrinsic capacity and functional ability in older people. The results showed that age and TUG could only weakly explain ADL changes, while vision in both eyes, left-hand grip strength, cognitive ability, and age had moderate predictive ability of IADL. Older adults experience a decline in physical abilities due to decreased muscle strength and flexibility, so this can impact ADL [22]. TUG has a predictive ability about disability in ADL [23].

Table 2 Comparison of Mean of intrinsic capacity variables based on demographic variables

		Vision right	Vision left	Hand grip right	Hand grip left	HHIE-S	GDS	AMT	TUG
		M ± SD	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD	M ± SD
Sex	Female	6.12 ± 2.06	6.25 ± 2	14.56 ± 4.99	13.74 ± 4.64	5.71 ± 9.14	5.93 ± 4.04	8.12 ± 1.85	14.64 ± 3.77
	Male	6.06 ± 2.12	6.26 ± 2.04	22.17 ± 7.95	21.25 ± 8.39	5.61 ± 9.10	4.43 ± 3.50	8.77 ± 1.37	13.99 ± 3.44
	P_{t-test}	0.81	0.97	< 0.001	< 0.001	0.93	0.006	0.006	0.20
	T	-0.23	0.03	8.49	8.27	-0.07	-2.79	2.79	-1.27
	df	208	208	208	208	208	208	208	208
Age	60–74	6.34 ± 2.06	6.45 ± 2.02	18.59 ± 7.38	17.75 ± 7.65	4.47 ± 8.13	5.21 ± 3.88	8.60 ± 1.52	13.74 ± 3.12
	75–89	5.27 ± 1.98	5.57 ± 1.87	14.97 ± 7.09	13.82 ± 6.09	9.13 ± 10.50	5.52 ± 3.99	7.59 ± 2.06	16.55 ± 4.53
	> 90	4.50 ± 2.12	5 ± 1.41	13.87 ± 1.02	17.37 ± 1.52	28 ± 5.65	7.50 ± 2.12	9.50 ± 0.70	17.50 ± 3.53
	P_{ANOVA}	< 0.001	0.001	0.65	< 0.001	0.008	0.01	0.02	0.006
	f	12.20	6.97	0.43	11.70	4.96	4.55	3.80	5.29
	df	2	2	2	2	2	2	2	2
Marital	Married	6.24 ± 2.01	6.49 ± 1.90	18.97 ± 7.53	17.76 ± 7.84	4.38 ± 7.89	4.74 ± 3.70	8.73 ± 1.48	13.92 ± 3.56
	Widowed	5.90 ± 2.09	5.85 ± 2.05	15.75 ± 6.65	15.64 ± 6.11	8.05 ± 10.85	6.29 ± 4.07	7.65 ± 1.89	15.18 ± 3.79
	Divorced	5.44 ± 3.04	5.67 ± 2.91	15.45 ± 8.30	14.04 ± 9.73	7.11 ± 8.83	6.11 ± 3.95	8.88 ± 1.45	14.89 ± 2.93
	P_{ANOVA}	0.06	< 0.001	0.02	0.02	0.08	0.009	0.07	0.34
	f	2.81	10.30	3.86	3.85	2.52	4.83	2.69	1.06
	df	2	2	2	2	2	2	2	2
Education	Elementary	5.95 ± 2.05	6.09 ± 2.01	17.42 ± 7.46	16.56 ± 7.20	6.59 ± 9.77	5.45 ± 3.94	8.11 ± 1.73	14.53 ± 3.72
	High school	6.61 ± 2.29	6.74 ± 1.95	17.38 ± 6.84	16.24 ± 7.50	1.30 ± 2.38	4.69 ± 3.88	9.52 ± 0.66	13.96 ± 3.61
	University	6.88 ± 1.96	7.25 ± 1.84	22.33 ± 6.68	21.80 ± 8.92	2.12 ± 3.30	4.50 ± 3.26	9.87 ± 0.34	13.13 ± 2.65
	P_{ANOVA}	0.28	< 0.001	0.47	0.08	0.02	0.03	0.04	0.11
	f	1.25	15.40	0.75	4.92	3.81	3.30	3.21	2.23
	df	2	2	2	2	2	2	2	2
Occupation	Employed	6.76 ± 2.68	7 ± 2.12	21.70 ± 9.28	20.81 ± 9.86	3.29 ± 6.63	5.17 ± 3.94	8.76 ± 1.14	12.35 ± 4.37
	Retired	6.16 ± 2.09	6.28 ± 2.06	21.78 ± 7.32	20.55 ± 7.86	4.50 ± 7.95	4.12 ± 3.36	8.94 ± 1.37	13.55 ± 2.80
	Unemployed	6.02 ± 2	6.14 ± 2.01	14.22 ± 5.13	13.54 ± 4.75	6.30 ± 9.61	6.08 ± 4.10	7.93 ± 1.89	14.95 ± 3.89
	housewife	5.46 ± 1.76	6 ± 1.63	18.41 ± 7.36	18.23 ± 7.80	10.46 ± 12.16	5.92 ± 3.59	8.53 ± 1.26	16.92 ± 2 0.49
	P_{ANOVA}	< 0.001	0.001	0.008	0.08	< 0.001	< 0.001	0.41	0.37
	f	6.49	5.91	4	2.20	18.42	21.93	0.95	1.05
	df	3	3	3	3	3	3	3	3

M: Meam, SD: Standard Deviation, df: degrees of freedom, ANOVA: Analysis of variance, HHIE-S: Hearing Handicap Inventory for the Elderly – Screening, GDS: Geriatric Depression Scale, AMT: Abbreviated Mental Test, TUG: Timed Up and Go Test

Table 3 Pearson correlation between IC and age, BMI, diseases, ADL, and IADL

		Age		BMI		Diseases		ADL		IADL	
		r	*p*	*r*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Vision	right	-0.27**	< 0.001	-0.01	0.77	-0.16*	0.01	0.02	0.68	0.16*	0.01
	left	-0.22**	0.001	0.02	0.76	-0.14*	0.03	0.10	0.11	0.25**	< 0.001
Hand grip	right	-0.22**	0.001	-0.05	0.46	-0.22**	0.001	0.26**	< 0.001	0.23**	< 0.001
	left	-0.21*	0.002	-0.02	0.78	-0.14*	0.03	0.24**	< 0.001	0.26**	< 0.001
HHIE-S		0.27**	< 0.001	-0.02	0.75	0.08	0.24	-0.14*	0.03	-0.17*	0.01
GDS		0.06	0.05	0.04	0.48	0.04	0.55	-0.13	0.06	-0.16*	0.01
AMT		-0.29**	< 0.001	-0.03	0.58	-0.18**	0.006	0.19*	0.005	0.41**	< 0.001
TUG		0.40**	< 0.001	0.04	0.56	0.23**	0.001	-0.02	0.69	-0.33**	< 0.001

* $p \leq 0.05$, ** $p \leq 0.001$

IC: Intrinsic Capacity HHIE-S: Hearing Handicap Inventory for the Elderly–Screening, GDS: Geriatric Depression Scale, AMT: Abbreviated Mental Test, TUG: Timed Up and Go Test, BMI: Body Mass Index, ADL: Activities of Daily Living, IADL: Instrumental Activities of Daily Living, r: correlation

Clear vision, hand grip strength, and cognitive ability enable older adults to use the phone, take medications, prepare food, do household chores, shop, and manage finances. It has been stated that hand grip strength was independently associated with functional independence even every ten-kilogram increase in grip strength was associated with about a 40% reduction in IADL impairment [24]. IADL functions have a higher complexity than ADL functions, and therefore more likely to be sensitive to early deficits [25]. Intrinsic capacity was able to show

Table 4 Multiple regression analysis and identification of predictors of functioning in older adults

	ADL				IADL			
	B	**β**	***p***	**T**	**B**	**β**	***p***	**T**
Vision right	-0.19	-0.23	0.06	-1.98	-0.39	-0.28	0.008	-2.26
Vision left	0.17	0.20	0.09	1.70	0.44	0.31	0.004	2.93
Hand grip right	0.04	0.17	0.20	1.27	-0.06	-0.16	0.17	-1.35
Hand grip left	0.01	0.05	0.67	0.41	0.09	0.24	0.03	2.03
HHIE-S	-0.004	-0.02	0.76	-0.29	0.01	0.03	0.59	0.53
GDS	-0.03	-0.07	0.30	-1.02	-0.04	-0.06	0.36	-0.91
AMT	0.11	0.11	0.11	1.58	0.47	0.27	< 0.001	4.23
TUG	0.08	0.17	0.02	2.24	-0.10	-0.13	0.06	-1.94
Age	-0.05	-0.21	0.007	-2.71	-0.10	-0.25	< 0.001	-3.64
BMI	0.01	0.04	0.49	0.68	0.007	0.01	0.83	0.20
R	0.39				0.56			
R^2	0.16				0.32			
ADR	0.11				0.29			
F	3.77				9.52			
p	< 0.001				< 0.001			

HHIE-S: Hearing Handicap Inventory for the Elderly–Screening, GDS: Geriatric Depression Scale, AMT: Abbreviated Mental Test, TUG: Timed Up and Go Test, BMI: Body Mass Index, ADL: Activities of Daily Living, IADL: Instrumental Activities of Daily Living. ADR: Adjusted R-squared, B: coefficient of determination, β: Standardized Coefficient, p: P-value

changes in older adults earlier than functional indicators. Therefore, if we consider that IADL is faster than ADL to indicate functional problems, then intrinsic capacity can predict functional deficits faster than IADL.

There is a significant negative association between age and vision, grip strength, and cognition while hearing and the Timed Up and Go test are also significantly associated with age. A reduction in physical activity leads to muscle weakness and grip strength. Joint flexibility, particularly in the knees and hips, also decreases with age, which has a negative impact on the mobility of older people. Additionally, higher education is associated with better access to health services and greater awareness of muscle-strengthening exercises and maintaining cognitive health. The type of work also influences grip strength and cognitive abilities; Physical work increases muscle strength, while cognitive work helps improve cognitive abilities.

Feyzi and colleagues showed in their research that males have greater grip strength in both hands compared to females [26]. In addition, Yazdkhasti found a higher prevalence of depression in older females [27], and Yuewen and colleagues found that older females are more prone to cognitive disorders compared to males [28]. Research by Aslankhani and colleagues shows that with increasing age, performance on the TUG is associated with more difficulty [21]. Furthermore, Feyzi and colleagues have emphasized that grip strength steadily decreases with age [26]. In addition, Shahabi reported a decline in cognitive performance associated with increasing age [29]. Studies also suggest that hearing and vision gradually decline with age [26, 30]. Mortezavi notes in his study that demographic variables, including age, have an impact on the level of daily living and instrumental activities of older people [5]. These results are consistent with the results of the present study. Zeng and colleagues identified cognitive decline as a predictor of dependence on IADL after one year of hospitalization [31]. Moselhy and colleagues also highlighted the role of vision and locomotion in predicting ADL [13]. The study by McGrath and colleagues also showed that increased muscle strength over two years was associated with a lower risk of decline in IADL [32].

Conclusion

The results of this study suggest that there is a significant negative association between age and vision, grip strength, and cognition; In addition, hearing ability and locomotion are also significantly linked to age. Age, right-eye vision, and locomotion were identified as predictors of ADL, while vision in both eyes, left-hand grip strength, cognition, and age were identified as predictors of IADL. Therefore, ADL and IADL can be determined based on age, vision, vitality, cognition, and locomotion in older adults.

Limitations

This study was not a longitudinal study, which somewhat reduces the certainty of the results. The sampling method was non-random, so it may affect the generalizability of the results.

Abbreviations

ADL	Activities of Daily Living
IADL	Instrumental Activities of Daily Living
IC	Intrinsic capacity
AMT	Abbreviated Mental Test

GDS-15	Geriatric Depression Scale questionnaire
HHIE-S	Elderly–Screening Version
TUG	Timed Up and Go Test
WHO	World Health Organization
BMI	Body Mass Index

Acknowledgements
This study is not an experimental study and a clinical trial, so it does not have a clinical trial number.

Author contributions
S.A., P.F.A., K.M., and M.A. were involved in the original conception and design of the study. S.A. and P.F.A. data collection and statistical analysis. K.M. and P.F.A. prepared the initial. All authors read and approved the final manuscript.

Funding
A specific project grant does not fund this study.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
This study was approved by the Ethics Committee of the Iran University of Medical Sciences (Ref: IR.IUMS.REC.1402.036). We explained the objectives to the participants and obtained informed written consent and confirmed that this study followed the guidelines and regulations of the Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 27 October 2024 / Accepted: 16 January 2025
Published online: 25 January 2025

References

1. Roser M. The global population pyramid: how global demography has changed and what we can expect for the 21st century. Our World in Data. 2019. Retrieved from: https://ourworldindata.org/globalpopulation-pyramid
2. Muneera K, Muhammad T, Pai M, Ahmed W, Althaf S. Associations between intrinsic capacity, functional difficulty, and fall outcomes among older adults in India. Sci Rep. 2023;13(1):9829.
3. Millán-Calenti JC, Tubío J, Pita-Fernández S, González-Abraldes I, Lorenzo T, Fernández-Arruty T, Maseda A. Prevalence of functional disability in activities of daily living (ADL), instrumental activities of daily living (IADL) and associated factors, as predictors of morbidity and mortality. Arch Gerontol Geriatr. 2010;50(3):306–10.
4. Mercan Y, Selcuk KT, Sayilan AA. The relationship between types of physical disabilities and the Instrumental activities of Daily Living (IADL) in the elderly. Family Med Prim Care Rev 2021, 23(1).
5. Mortazavi H, Tabatabaeichehr M, Taherpour M, Masoumi M. Investigating the Status of Daily Life activities (Basic, Instrumental, Advanced) and related factors in the Elderly. North Khorasan Univ Med Sci. 2020;12(2):88–95.
6. George PP, Lun P, Ong S, Lim W. A rapid review of the measurement of intrinsic capacity in older adults. J Nutr Health Aging. 2021;25(6):774–82.
7. Zhou Y, Ma L. Intrinsic capacity in older adults: recent advances. Aging Disease. 2022;13(2):353.
8. Lim K-Y, Lo H-C, Cheong I-F, Wang Y-Y, Jian Z-R, Chen I-C, Chan Y-C, Lee S-D, Chou C-C, Yang FL. Healthy eating enhances intrinsic capacity, thus promoting functional ability of retirement home residents in Northern Taiwan. Nutrients. 2022;14(11):2225.
9. Cesari M, Araujo de Carvalho I, Amuthavalli Thiyagarajan J, Cooper C, Martin FC, Reginster J-Y, Vellas B, Beard JR. Evidence for the domains supporting the construct of intrinsic capacity. Journals Gerontology: Ser A. 2018;73(12):1653–60.
10. Chatterji S, Byles J, Cutler D, Seeman T, Verdes E: Health, functioning, and disability in older adults—present status and future implications. The Lancet. 2015;385(9967):563–575.
11. Freiberger E, Sieber CC, Kob R. Mobility in older community-dwelling persons: a narrative review. Front Physiol. 2020;11:881. https://doi.org/10.3389/fphys.2020.00881
12. Pashmdarfard M, Azad A. Assessment tools to evaluate activities of Daily Living (ADL) and instrumental activities of Daily Living (IADL) in older adults: a systematic review. Med J Islam Repub Iran. 2020;34:33.
13. Mohamed Moselhy M, Sayed Mohamed H. Intrinsic capacity factors and activities of Daily Living among older adults residents of geriatric homes. Egypt J Health Care. 2022;13(2):718–36.
14. Ashikali E-M, Ludwig C, Mastromauro L, Périvier S, Tholomier A, Ionita I, Graf C, Busnel C. Intrinsic capacities, functional ability, physiological systems, and Caregiver support: a targeted synthesis of effective interventions and international recommendations for older adults. Int J Environ Res Public Health. 2023;20(5):4382.
15. Zhou J, Chang H, Leng M, Wang Z. Intrinsic capacity to predict future adverse health outcomes in older adults: a scoping review. Healthcare. 2023;11(4):450.
16. Cohen J. Statistical power analysis for the behavioral sciences. routledge; 2013.
17. Taheri Tanjani1 P, Azadbakht M. Psychometric properties of the Persian Version of the activities of Daily Living Scale and Instrumental Activities of Daily Living Scale in elderly. J Mazandaran Univ Med Sci. 2016;25(132):103–12.
18. Bakhtiyari F, Foroughan M, Fakhrzadeh H, Nazari N, Najafi B, Alizadeh M, Arzaghi M, Sharifi F, Shoaee S, Mostafa Q, VALIDATION OF THE PERSIAN VERSION OF ABBREVIATED MENTAL TEST. (AMT) IN ELDERLY RESIDENTS OF KAHRIZAK CHARITY FOUNDATION. Iran J Diabetes Lipid Disorders. 2014;13(6):487–94.
19. Malakouti K, Fathollahi P, Mirabzadeh A, Salavati M, Kahani S. Validation of geriatric depression scale (GDS-15) in Iran. Res Med. 2006;30(4):361–9.
20. Behboodi L, Chattu VK, Adelirad F, Heizomi H, Asghari-Jafarabadi M, Allahverdipour H. The Psychometric properties of the Persian Version of the hearing handicap inventory screening scale (HHIE-S) among older adults. J Commun Disord. 2022;100:106257.
21. Aslankhani MA, Farsi A, Fathirezaie Z, Zamani Sani SH, Aghdasi MT. Validity and reliability of the timed up and go and the Anterior Functional Reach tests in evaluating fall risk in the Elderly. Salmand: Iran J Ageing. 2015;10(1):16–25.
22. Milanović Z, Pantelić S, Trajković N, Sporiš G, Kostić R, James N. Age-related decrease in physical activity and functional fitness among elderly men and women. Clin Interv Aging. 2013;8:549–56.
23. Donoghue OA, Savva GM, Cronin H, Kenny RA, Horgan NF. Using timed up and go and usual gait speed to Predict Incident Disability in Daily activities among Community-Dwelling adults aged 65 and older. Arch Phys Med Rehabil. 2014;95(10):1954–61.
24. Gopinath B, Kifley A, Liew G, Mitchell P. Handgrip strength and its association with functional independence, depressive symptoms and quality of life in older adults. Maturitas. 2017;106:92–4.
25. Overdorp EJ, Kessels RPC, Claassen JA, Oosterman JM. The combined effect of neuropsychological and neuropathological deficits on instrumental activities of Daily living in older adults: a systematic review. Neuropsychol Rev. 2016;26(1):92–106.
26. Feyzi V, Hasheminejad N, Jafari Roodbandi AS. Relationship between visual, Hearing and Memory Disabilities and hand grip strength and the systems Usability available to the Elderly living in Nursing Homes in Kerman, Iran. Salmand: Iran J Ageing. 2017;11(4):484–93.
27. Yazdkhasti F. A study on cognitive and depressive disorders in the elderly and their correlation with each other. 2010.
28. Liu Y, Yu X, Han P, Chen X, Wang F, Lian X, Li J, Li R, Wang B, Xu C. Gender-specific prevalence and risk factors of mild cognitive impairment among older adults in Chongming, Shanghai, China. Front Aging Neurosci. 2022;14:900523.
29. Shahabi R. Normal cognitive aging: age related cognitive changes in elderly. Aging Psychol. 2019;5(2):101–16.
30. Jafari Z, Malayeri S, Rashedi P. Effects of Age on the auditory system and process of Presbycusis in the Audiology Centers of Tehran. Salmand: Iran J Ageing. 2007;2(3):358–64.
31. Zeng X, Shen S, Xu L, Wang Y, Yang Y, Chen L, Guan H, Zhang J, Chen X. The impact of intrinsic capacity on adverse outcomes in older hospitalized patients: a one-year follow-up study. Gerontology. 2021;67(3):267–75.

32. McGrath R, Robinson-Lane SG, Peterson MD, Bailey RR, Vincent BM. Muscle strength and functional limitations: preserving function in older Mexican americans. J Am Med Dir Assoc. 2018;19(5):391–8.