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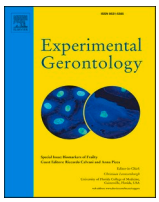

Cognitive and functional evolution in older adults with and without intellectual disability using a multicomponent intervention: A prospective longitudinal study

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ABSTRACT

Background: The global population is experiencing accelerated biopsychosocial aging. Cognitive impairment is frequently associated with functional impairment in basic and instrumental daily living activities. To maintain optimal cognitive and functional functioning, health professionals recommend that older adults participate in cognitive training.
Aims: This study examines the cognitive and functional evolution of older adults with and without Intellectual Disability and the factors associated with favourable evolution following the intervention of a multicomponent programme based on the human occupational model and the person-centred care model.
Methods and procedures: 247 people participated. Descriptive and univariate analyses were performed to examine baseline data. The Wilcoxon paired samples test was used to compare cognitive and functional evolution one year after the intervention. Linear regression was used to detect factors predicting favourable evolution.
Outcomes and results: Both populations improved cognitively. There was no change in basic activities of daily living. There was an improvement in instrumental activities of daily living in the group with Intellectual Disability. None of the variables collected was a predictor of greater improvement.
Conclusions and implications: This study demonstrated that older people with Intellectual Disability who have supports to cope with this life stage can improve their cognitive and functional abilities.

What this paper adds?

This study demonstrated multicomponent programs improve cognitive and functional performance in people with intellectual disabilities (ID). Also, adaptive skills training and individualized support are essential for people with ID.

1. Introduction

The world population is undergoing an accelerated biopsychosocial aging process (Maldonado Briegas et al., 2020), that in people with intellectual disabilities produces an acceleration of the physiological process, called premature aging (Palomino et al., 2019).

Successful aging depends on the preservation of cognitive abilities (Cohen et al., 2019), and those initially affected are information processing speed, memory and attention (Y. Chen et al., 2017; Dumas, 2017; Tannou et al., 2020). People with Intellectual Disability have greater difficulties in acquiring new skills and memory, as their attention and reaction capacity to stimuli is lower (Navas Macho et al., 2014; Santos et al., 2022). In addition, problem-solving skills, language and verbal expression are affected (Navas Macho et al., 2014).

Cognitive impairment in aging is often associated with functional impairment in basic (ADLs) and instrumental (IADLs) activities of daily living (Connolly et al., 2017), which in turn depends on the physical and

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sensory status and is related to morbidity and mortality (Heine et al., 2019; Wang et al., 2020). People with Intellectual Disability may need physical and social support in ADLs to participate successfully in the community (King et al., 2017; Oppewal et al., 2016).

To maintain optimal cognitive and functional functioning, health professionals recommend that older adults participate in cognitive training programmes that enhance brain neuroplasticity and aid in the recovery of losses related to senses, cognition, memory, and motor control (Bherer, 2015; Chapman et al., 2015; Connolly et al., 2017; Mahncke et al., 2006).

Several national and international studies have obtained cognitive and functional benefits in older adults with multi-component programs, whose base is cognitive stimulation, and to which components such as physical activity, healthy diet, art therapy, and music therapy are added (Carballo-García et al., 2013; Cavedo et al., 2018; Cordes et al., 2019; Gitlin et al., 2006; Hill et al., 2021; Miller et al., 2012; Ngandu et al., 2015; Tarazona-Santabalbina et al., 2016; Valencia Marín et al., 2008; Vaskivuo et al., 2018; Vemuri et al., 2014; Verstaen, 2020).

Multicomponent interventions in older adults are scarce, incipient and sporadic (Santos et al., 2022) and although it has been suggested that they could be a useful intervention (Kovačič et al., 2020), it is not possible to recommend how they can be routinely adapted (Doherty et al., 2018). However, it is considered that knowing the characteristics of people with Intellectual Disability in the aging process and the risk factors would be a starting point for developing intervention strategies to improve the quality of life of this group (Cox et al., 2010; Obrusnikova et al., 2021).

Kielhofner's model of human occupation (MOHO) (Kielhofner, 2011) is arguably the most widely used model in occupational therapy research worldwide (Lee et al., 2012). The MOHO provides a conceptual framework to explain how occupations of interest are selected, organized and performed within the environmental context (Kielhofner, 2011).

This model of occupational therapy interprets human beings as open and dynamic systems, highlighting "Occupational Behavior" as an organizing process. This model conceptualizes the person as a system composed of three components: Volition, Habituation and Performance Capacity. It gives vital importance to external elements such as the environment, external demand and performance feedback (Duncan, 2022).

The aging process is associated with a loss of roles both in people with normal cognition and in individuals with ID. In the case of ID, it should be noted that in addition to the aging process there are factors that hinder the performance of roles such as lack of self-determination, overprotection and lack of occupational experiences. Older people who cannot replace lost or diminished roles may experience mental boredom, loneliness and depression, physical and cognitive problems. The lack of community resources and services, as well as the existence of physical and social barriers, can significantly limit people's participation and interactions. There is no research on this subject in the population with intellectual disabilities (ID), which poses a challenge for health professionals (Lesende, 2014).

Person- or patient-centered models of care enable individuals to share responsibility for their health, enhance personalization of care, and enable them to make informed decisions about how to manage their needs (Coulter and Oldham, 2016). This shift demonstrates a recognition of the importance of underpinning care practices with humanizing principles, such as empathy and respect for people's dignity, agency, uniqueness, sense of place, personal journey and holistic well-being. Person-Centered Care Planning is an intervention methodology that embraces the principles of independence, autonomy, self-determination and dignity, as well as the coordination of necessary supports with the goal of increasing the quality of life of people with ID (Busch et al., 2019; Todres et al., 2009).

The huge increase in the number of older persons with intellectual disabilities worldwide and the advocacy capacity achieved by them, culminating in the Convention on the Rights of Persons with Disabilities (CRPD), occurred in parallel with changes in the way services are delivered. Specifically, in recent decades, many countries examined how to improve their welfare, in accordance with the principles of equity, solidarity and participation. A new political and socio-health care model was born, called "person-centered care", in which users are the protagonists of their life project (Camoni et al., 2020).

The main objective of this study was to compare the cognitive and functional evolution after one year of a multicomponent intervention in older adults with and without Intellectual Disability. The secondary objective was to detect which factors predicted greater benefit from the intervention.

Our hypotheses are the following

1- That the group without Intellectual Disability will improve cognitively and maintain their functional level and the group with Intellectual Disability will maintain their cognitive level and improve their functional level.
2- That certain sociodemographic, educational, occupational, physical and sensory factors will be predictors of a favourable evolution in both populations. In individuals with Intellectual Disability, factors such as Down syndrome, epilepsy, lower educational level and less support could be indicative of a more unfavorable evolution.

2. Methodology

2.1. Design and participants

A longitudinal study was carried out to detect differences in aging among people with Intellectual Disability and without Intellectual Disability one year after the intervention in two non-profit institutions. The data were compiled between June 2018 and December 2019. Inclusion criteria were a score on the cognitive mini-test (MEC-35) (Lobo et al., 1979) of 27–35 for patients aged ≥65 years and a CAMDEX (Esteba-Castillo et al., 2013) score of 50–109 for patients with Intellectual Disability aged ≥60 years or patients with DS aged ≥45. The final sample comprised 247 patients, 146 without Intellectual Disability and 101 with Intellectual Disability. The minimum sample size for each group (with and without Intellectual Disability) was set at 97, and a difference of 1.5 points was attested in the main variable, with a potency of 80 % and a significance level of 5 % (Fernandez, 2011); it was predicted that up to 35 % of the initial participants would drop out.

2.2. Instruments

Socio-demographic, clinical and occupational variables were collected in this study (Tena-Bernal et al., 2021). Socio-demographic variables that were collected included sex, age, level of education, marital status, formal and informal support and technical aids.

On the other hand, clinical variables were collected, such as neurological disorders (memory alteration, mild cognitive impairment [MCI], dementia/Alzheimer, Parkinson's disease and epilepsy), and associated pathologies (respiratory insufficiency, Down's Syndrome), the presence of sensory processing disorders (vision and hearing problems), psychiatric diagnosis, number of cardiovascular risk factors (arterial hypertension [AHT], diabetes, cholesterol, obesity, heart disease, smoker and cardiovascular accident [CVA], stroke/transient ischemic attack [TIA]). The sum of the cardiovascular risk factors will be considered. These clinical data were collected from the medical records provided by the participants at the centres.

Finally, the occupational status of the participants was assessed by asking them whether they had ever had a job.

The main outcome variables were cognitive and functional. Two tools were used to measure the cognitive level:

- **The Spanish version of MMSE (MEC-35)** (Lobo et al., 1999) is considered one of the most widely used short cognitive tests to study cognitive abilities in primary care. It evaluates eight components: spatial and temporal orientation (10 points), fixation memory (3 points), attention (3 points), calculation (5 points), short-term memory (3 points), language and praxis (11 points). Its sensitivity is 85–90 % and its specificity is 69 %.
- **The set-test** (Pascual et al., 1990) measures categorical verbal fluency. The information is collected by means of a hetero-administered questionnaire adapted and validated by Pascual et al. for the Spanish population. Its scores vary between 0 and 40, with 0 being the minimum score and 40 the maximum. It has been proposed as a diagnostic aid in elderly patients with dementia, with a cut-off point of 27 points for the elderly, and a lower score being indicative of dementia. It has a sensitivity of 87 % and a specificity of 67 %.

To measure the functional level:

- **The Barthel scale (BI)** assesses the level of independence of 10 basic ADLs (BADLs). The maximum BI score is 100, where scores above 60 denote low dependence on ADLs and scores below 20 demonstrate high dependence on ADLs. Internal consistency was 0.90, with the Kappa index of interobserver reliability between 0.47 and 1.00, and the Kappa index of interobserver reliability between 0.84 and 0.97. Cronbach's alpha was 0.90–0.9228 for the assessment of internal consistency (Shah et al., 1989).
- **The Lawton and Brody scale (L-B)** assesses the degree of autonomy in eight IADLs necessary for independent living in the community. The assessment is made according to a score on a scale from 0 to 8 (maximum dependence and independence, respectively. Its sensitivity is 0.57, and its specificity is 0.92 (Pfeffer et al., 1982). The minimum significant change in the Lawton ADI scale is about half a point. The certainty of this conclusion is reduced by the variation between calculation methods (Suijker et al., 2017).
- **The Tinetti test** measures static and dynamic balance in elderly patients. The scale has two domains: gait and balance; its main purpose is to detect the elderly at risk of falls, and it has a higher predictive value than muscle testing. The scale is composed of nine balance items and seven gait items. It is considered that between 19 and 24, the risk of falls is minimal, and at <19, the risk of falls is high (Sánchez-Barrera and Vázquez-Chacón, 2020); the test has a sensitivity of 53 % and a specificity of 86 % (Guevara and Lugo, 2012).

The initial evaluation was carried out in the first quarter of 2018, and the second evaluation was carried out in the first quarter of 2019, were performed by multidisciplinary teams that received adequate information for the homogeneous application of the assessment instruments and tools. In the initial assessment, the information sheet, the informed consent form and the different cognitive and functional assessment scales were administered. In the final evaluation, one year after the intervention, only the scales were administered again.

2.3. Intervention programme

All participants from the centres of both institutions participated in the multidisciplinary programmes of active and healthy aging. In the general application of the intervention, we applied ergonomic and environmental factors in the work room, and in the group in general, specific applications of the human occupation model as cognitive facilitators and the person-centred care and planning model.

An individualized care plan was developed considering the characteristics and interests of each participant. The workshops were developed in groups, but in those cases in which the need for a higher level of support was detected, the interventions were carried out individually. In this programme, specific interventions of occupational therapy, physiotherapy, nursing and psychology were carried out from Monday to Friday for 5 h a day, specifically defined jointly by both entities.

There is evidence that demonstrates the efficiency and efficacy of these programmes in improving performance in activities of daily living, cognitive function and quality of life in aging persons (Brenes et al., 2019; Gschwind et al., 2013; Levasseur et al., 2022; Lyu et al., 2018; Matilla-Mora et al., 2016; Robertson, 2017; Saba and Blanchet, 2021; Schepens et al., 2019; Schulze et al., 2022). For people with Intellectual Disability, studies are showing that health care provision, dementia care, end-of-life care, life history work, future planning and support for IADL are crucial (Schepens et al., 2019).

The interventions were designed in combination with the ACP and MOHO models, and the programs, objectives and activities were determined on the basis of these two models. Both the ACP model and the MOHO model consider occupation as an engine that generates quality of life and well-being of the person, proposing meaningful activities whose main purpose is centered on participation in daily activities, whose performance is part of the person's daily life and has meaning for him/her, where he/she can recognize him/herself, show his/her autonomy and reinforce his/her identity (Jean Tinney et al., 2007). The specific interventions that were developed in parallel and in common agreement in both entities are shown in Table 1.

2.4. Statistical analysis

Firstly, the Kolmogorov-Smirnov normality test was used to examine whether the variables were normally distributed. As the variables were not normally distributed, non-parametric tests were used. Secondly, a descriptive analysis (frequencies and percentages, and means and standard deviation) and a univariate analysis (Kruskal-Wallis test and chi-square test) were used to examine the data and tested whether there were baseline differences between groups. Thirdly, to address the main objective we used the paired samples Wilcoxon test and the independent samples Mann-Whitney U test with the following variables: MEC-35 total and subscales, set-test, BI, L-B and the Tinetti test.

Moreover, to address the second objective we used linear regression. To overcome possible problems of asymmetry in the distribution of the variables and sources of inaccuracy, a wild bootstrapping analysis with 5000 samples (Hardle and Marron, 1991; Wu, 1986) and with the bias-corrected-and-accelerated (BCa) bootstrap method (Efron, 1987) was carried out. The dependent variables are the pre-post difference of the MEC-35, set-test, BI and Lawton scale; the independent variables are socio-demographic and clinical variables. The level of significance adopted was $p < 0.05$. The data were analyzed using IBM SPSS Statistics (Version 25) (IBM Corp, 2020).

2.5. Ethical considerations

The project was endorsed by the Ethical Research Committee of Aragón (CEICA, C.P.-C.I.PI18/152). Personal data protection regulations were followed and patients or their legal guardians signed informed consent forms. The study adhered to the guidelines set out in the Declaration of Helsinki (World Medical Association, 2013), good clinical practices and current legislation. The relationships with the participants in both institutions are based on their empowerment and self-determination. Their participation in the study does not in any way affect the care they receive in their centres or their relationship with the research team.

Specifically and in relation to the Intellectual Disability group, the United Nations Convention on the Rights of Persons with Disabilities promotes the active and responsible participation of this group of people in decision making. To protect the validity of the informed consent we ensured the reception, analysis and understanding of the information given through personalized and person-focused support and accommodations such as visual aids and a pretest of desirability to ensure that consent was not influenced by the desire to present oneself as a socially

Table 1
The specific interventions that were developed in both entities.

Interventions	Program	Definition and objectives	Activities
COGNITIVE STIMULATION	REMINISCENCE PROJECT: MY LIFE STORY	Reminiscence is a therapeutic activity that aims to stimulate memory and emotional well-being through the evocation of past memories and experiences.	• Guided conversations • Presentation and manipulation of antique objects • Projection of old images and videos • Listening to old music and songs • Reading personal diaries • Visiting significant places • Creating scrapbooks with photographs and memories related to their past life
	COGNITIVE STIMULATION	Motivate and cognitively stimulate to maximize their current function and reduce the risk of cognitive decline associated with aging through the guided execution of tasks that address different cognitive areas (spatiotemporal orientation, orientation to reality, memory, language, attention and executive functions) and training of activities of daily living.	• Cognitive stimulation workbooks adapted and personalized for each person according to their abilities and interests. • Group dynamics with visual aids.
PHYSICAL ACTIVATION AND PREVENTION	GERONTOGYMNASTICS AND PSYCHOMOTRICITY WORKSHOP	Improve and/or maintain psychomotor functions Improve and/or maintain physical aspects To train cardiorespiratory adaptation to exertion To train sensory tuning	Sessions of 45 min where we work on • body scheme • laterality • inhibition and expectancy • spatial orientation • temporal control and adaptation to rhythm, • reasoning and frontal programming • verbal language and body expression • postural control and muscle tone • joint travel • strength • balance • flexibility • coordination • vestibular system • gross motor skills and proprioception.
EMOTIONAL CARE	AFFECTIVE-EMOTIONAL WORKSHOP	Provision of tools to facilitate the ability to process situations emotionally, through the observation of emotion as an adaptive reaction to the environment.	• Mindfulness • Relaxation • Emotional journaling • Group and individual emotional education
ADL*s*	ADL SUPPORT AND TRAINING PRODUCTS	Provision of support products necessary for greater autonomy in ADL*s*.	The choice of support products will be made based on the individual needs of each person. Some examples of support products are listed below: • Seat elevators • Sponges with elongated handles • Feeding utensils with thickened handles
ACTIVE PATIENT AND HEALTHY AGING	HEALTH EDUCATION OR HEALTHY AGING WORKSHOP	Promote involvement in the aging process and encourage a healthy lifestyle through information sessions on different health topics to establish personal goals and draw conclusions for improvement.	• Nutrition workshops • Skin care workshops • Medication awareness and management workshops • Disease prevention talks
PROMOTION OF SOCIAL INCLUSION	PROJECT CORRESPONDENCE	Facilitate communication and social connection between older people with and without ID, allowing them to share experiences, advice and friendship through written correspondence.	• Matching: Information is collected about their interests, hobbies and life experiences. • Affinity matching: Project coordinators match seniors based on their shared interests and backgrounds. • Written communication: Participants exchange letters or postcards on a regular basis, sharing life stories, advice, anecdotes and reflections. • Social events: Occasionally, social events are organized where participants meet and share time together.
	LIFETIME PROJECT	Initiative between elderly people with and without disabilities with the following objectives: - Enhance roles by creating the role of friend and increase the socio-family support network.... - Promote lifelong learning and stimulate lifelong learning by allowing participants to share knowledge, skills and experiences. - Support mental health and contribute to the emotional well-being of older adults by providing a space to share life stories and feelings.	• Planning of an annual schedule with a common theme to be worked on in each center on a monthly basis. • Elaboration of a detail to be given as a gift, once a month, to the users of the other center. • Meetings between people from both centers once a month.
	PROJECT SIT AT MY TABLE	Initiative among elderly people with and without disabilities with the objectives of: - Encourage socialization and provide seniors with the opportunity to interact with their peers, reducing social	• Meetings between people with ID and volunteers from a Senior Citizens Association to share a table and coffee once a month.

(*continued on next page*)

Table 1 (*continued*)

Interventions	Program	Definition and objectives	Activities
		isolation and loneliness. - To generate a sense of community and establish an environment in which participants feel valued and connected to other members of the community.	
	VOLUNTEER PROJECT	Volunteer actions in different areas with the objective of increasing their participation in the community.	• Food bank • Animal shelter • Elderly people's homes
LEISURE	INCLUSIVE AND COMMUNITY LEISURE PROJECT	This project aims to promote social inclusion and community cohesion through shared leisure activities both inside and outside the centers.	Programmed parties, outings, excursions and social events.
RETIREMENT SUPPORT	PROGRAM TO ACCOMPANY RETIREMENT	Design of a support system that contemplates flexible adaptation itineraries towards the activity, reinforcing affected areas and especially those related to the loss of the worker's role.	The activities in this program are individualized and personalized in each case.
COUNSELING TO FAMILIES ABOUT THE AGING PROCESS	FAMILY COUNSELING SERVICE	It provides guidance and information on resources and services to meet present and future needs at this stage of the life cycle.	The activities in this program are individualized and personalized in each case.

acceptable person.

As stated by various authors, including Cummins and Lau (Cummins and Lau, 2005), on many occasions people with intellectual disabilities may tend to respond in a condescending manner. To avoid that the answers are conditioned by this type of response, this pretest is performed to select the informants. Following the pretest proposed by Cummins and Lau (Cummins and Lau, 2005), the following pretest was used as a filter:

Point out some garment worn by the interviewee and ask:

A. Is this garment (name of the garment) yours?
B. Do you make your own clothes?
C. Do you know your neighbors?
D. Have you chosen your neighbors?

If the answer is affirmative in questions B and/or D, the pre-test and, therefore, the interview would end, thanking the interviewee for his/her participation.

In those cases in which the person had a legal guardian for legal reasons, the consent was given after consultation with the user by his/her guardian (Cummins, 2005)."

3. Results

Firstly, the descriptive analysis showed that of the 247 participants, 146 were without Intellectual Disability (mean age = 77.86, SD = 7.41) and 101 were with Intellectual Disability (mean age = 62.27, SD = 8.42). There were 52.05 % women without Intellectual Disability and 47.52 % women with Intellectual Disability. There were differences between groups in age, level of education, marital status, formal support, technical aids, occupation, respiratory insufficiency, Down's Syndrome, psychiatric diagnosis, number of cardiovascular risk factors, the presence of neurological disorders, MEC-35 total, MEC-35 temporal orientation, MEC-35 spatial orientation, MEC-35 fixation memory, MEC-35 calculation, MEC-35 attention, MEC-35 language, MEC-35 praxis, set-test, L-B and the Tinetti test static balance (Table 2).

Secondly, Table 3 shows the mean pre-post changes for each group and the inter-groups differences. On the one hand, after the intervention, the without- Intellectual Disability group significantly improved the MEC-35 total, the MEC-35 temporal orientation, MEC-35 language and the set-test. On the other hand, the with- Intellectual Disability group significantly improved the MEC-35 total, the MEC-35 fixation memory, MEC-35 attention, MEC-35 praxis and the L-B. Also, this group significantly worsened in the MEC-35 calculation, MEC-35 language and the Tinetti test-dynamic balance.

Between groups, on the one hand, the without- Intellectual Disability group significantly improved more in MEC-35 language. On the other hand, the with- Intellectual Disability group significantly improved more in MEC-35 fixation memory, MEC-35 attention, MEC-35 praxis, L-B, and got worse in The Tinetti test.

Regarding the multivariate analysis, the variables that predicted a higher pre-post difference in the MEC-35, set-test, BI and L-B are shown in the Table 4 of the Supplementary Material.

Regarding MEC-35, being younger ($b = -0.069$; $p < 0.001$), being a woman ($b = 0.490$; $p = 0.02$), having a partner ($b = 1.487$; $p < 0.001$), having a lower education level ($\beta = -0.736$; $p < 0.001$), having formal support ($b = 0.518$; $p = 0.015$), not having neurological disorders ($b = -1.125$; $p < 0.001$), not having sensory disorders ($b = -1.207$; $p < 0.001$) and having fewer cardiovascular risk factors ($b = -0.223$; $p = 0.009$) were predictors of having a further improvement in the MEC-35 in the without- Intellectual Disability group. This model explains 15 % of the overall variance [R^2 adjusted = 0.15, $F(12,86) = 2.437$, $p = 0.009$]. There were no predictors of having a further improvement in the MEC-35 in the with- Intellectual Disability group [R^2 adjusted = 0.057, $F(14,80) = 1.405$, $p = 0.170$].

Regarding the set-test, there were no predictors of having a further improvement in the set-test in either of the two groups [without Intellectual Disability: R^2 adjusted = −0.03, $F(12,86) = 0.766$, $p = 0.684$; with Intellectual Disability: R^2 adjusted = −0.04, $F(14,80) = 0.741$, $p = 0.728$].

Regarding the BI, there were no predictors of having a further improvement in the BI in either of the two groups [without Intellectual Disability: R^2 adjusted = 0.07, $F(12,86) = 1.618$, $p = 0.102$; with Intellectual Disability: R^2 adjusted = −0.025, $F(14,82) = 0.832$, $p = 0.633$].

Regarding the L-B, being younger ($b = -0.031$; $p = 0.005$), having a partner ($b = 0.702$; $p < 0.001$), having a higher level of education ($b = 0.236$; $p = 0.020$), not having neurological disorders ($b = -0.432$; $p = 0.003$), having sensory disorders ($b = 0.518$; $p = 0.004$), not having a psychiatric diagnosis ($b = -0.528$; $p < 0.001$), not having technical aids ($b = -0.629$; $p < 0.001$) and suffering from respiratory insufficiency ($b = 0.528$; $p < 0.001$) were predictors of having a further improvement in the L-B in the without- Intellectual Disability group. This model explains 11.6 % of the overall variance [R^2 adjusted = 0.116, $F(12,86) = 2.068$, $p = 0.027$]. There were no predictors of having a further improvement in the L-B in the with- Intellectual Disability group [R^2 adjusted = 0.014, $F(14,82) = 1.098$, $p = 0.372$].

4. Discussion

This longitudinal comparative study has reported the cognitive and functional evolution and the predictive factors of this evolution in two groups of older adults, with and without Intellectual Disability, one year after the application of an interdisciplinary and multicomponent

Table 2
Sociodemographic and clinical characteristics of the sample at baseline.

Variables	Without Intellectual Disability ($n = 146$)	With Intellectual Disability ($n = 101$)	*p*-value
Age, *Mdn (IQR)*	79 (12)	63 (10.5)	< 0.001
Sex, *female n (%)*	76 (52.05)	48 (47.52)	0.484
Education			
Illiterate, *n (%)*	0 (0)	33 (32.67)	<
Incomplete primary studies, *n (%)*	28 (19.18)	64 (63.37)	0.001
Primary studies, *n (%)*	74 (50.68)	4 (3.96)	
Secondary school-higher education, *n (%)*	44 (30.14)	0 (0)	
Marital status			
Without a partner, *n (%)*	73 (50)	88 (87.1)	<
With a partner, *n (%)*	73 (50)	13 (12.9)	0.001
Residential status			
With family/in family home, *n (%)*	115 (78.77)	27 (26.73)	<
Institution, *n (%)*	2 (1.37)	71 (70.30)	0.001
Living alone, *n (%)*	29 (19.86)	3 (2.97)	
Formal support, *n (%)*	57 (39)	80 (79.2)	< 0.001
Informal support, *n (%)*	139 (95.21)	97 (96.04)	0.755
Neurological disorders, *yes n (%)*	65 (44.5)	26 (25.7)	0.003
Down's Syndrome, *yes n (%)*	0 (0)	29 (28.7)	< 0.001
N° of cardiovascular risk factors, *Mdn (IQR)*	2 (2)	1 (2)	< 0.001
Psychiatric diagnosis, *yes n (%)*	90 (61.6)	32 (31.7)	< 0.001
Sensory processing disorder, *yes n (%)*	72 (49.3)	46 (45.5)	0.605
Respiratory insufficiency, *yes n (%)*	32 (21.9)	17 (16.8)	0.324
Technical aids, *yes n (%)*	61 (41.8)	16 (15.8)	< 0.001
Occupation, *yes n (%)*	146 (100)	9 (8.9)	< 0.001
MEC-35 total, *Mdn (IQR)*	29 (4)	18 (7)	< 0.001
MEC-35 temporal orientation, *Mdn (IQR)*	4 (2)	3 (3)	0.002
MEC-35 spatial orientation, *Mdn (IQR)*	5 (1)	4 (1)	< 0.001
MEC-35 fixation memory, *Mdn (IQR)*	3 (0)	3 (1)	< 0.001
MEC-35 calculation, *Mdn (IQR)*	5 (1)	0 (0)	< 0.001
MEC-35 attention, *Mdn (IQR)*	3 (2)	0 (1)	< 0.001
MEC-35 short-term memory, *Mdn (IQR)*	2 (2)	1 (2)	0.951
MEC-35 language, *Mdn (IQR)*	6 (1)	5 (3)	< 0.001
MEC-35 praxis, *Mdn (IQR)*	4 (1)	1 (3)	< 0.001
Set-test, *Mdn (IQR)*	36 (7)	28 (12.5)	< 0.001
Barthel index, *Mdn (IQR)*	95 (20)	95 (15)	0.755
Lawton and Brody scale, *Mdn (IQR)*	4 (4)	1 (4)	< 0.001
The Tinetti test, *Mdn (IQR)*	25 (5)	26 (3)	0.175

Note. Kruskal-Wallis test for age, number of cardiovascular risk factors, MEC-35 total and subscales, set-test, Barthel index, Lawton and Brody scale, the Tinetti test and the chi-square test for the remaining variables. MEC-35, Spanish version of mini-mental state examination (MMSE).

intervention. At baseline, both populations had different sociodemographic and clinical characteristics. People without Intellectual Disability were older, had a higher educational and occupational level, were married and had a higher cognitive and functional status. In addition, they had more cardiovascular risk factors and psychiatric and neurological pathology. In contrast, the elderly with Intellectual Disability received more formal support, were more frequently institutionalised and had more Down's syndrome.

However, despite these important initial differences, one year after the intervention, both groups improved cognitively in the MEC, exceeding our first hypothesis in the case of the Intellectual Disability, in which we expected cognitive maintenance but no improvement. Thus, we respond to the literature that points out that multicomponent cognitive training contributes to the maintenance and even improvement of cognitive functions, but we add that research is needed to know who benefits most from these programmes (Roheger et al., 2021). Since 2006, and especially since 2012, studies have added other components to the cognitive area in order to transfer the results to the physical, functional and psychological areas (Carballo-García et al., 2013; Cordes et al., 2019; Gitlin et al., 2006; Miller et al., 2012; Ngandu et al., 2015; Tarazona-Santabalbina et al., 2016; Vemuri et al., 2014; Verstaen, 2020). In older adults with Intellectual Disability, for these programmes to produce cognitive improvements (Heller et al., 2014; Kovačič et al., 2020; Santos et al., 2022; Torra Moreno et al., 2021), components such as health promotion and treatment of chronic conditions should be added (Anderson et al., 2013; Connolly et al., 2017; Heller et al., 2014).

Our study adds an analysis of cognitive domains. In people without Intellectual Disability, as in our study, working on temporal orientation through the calendar and reality orientation therapies produces cognitive improvements (Calatayud et al., 2020), extrapolated to the level of global cognitive functioning (Persson et al., 2022) and functional level (Nishiura et al., 2021) and the improvement found in language could help prevent MCI and dementias (Sahraoui and Lefebvre, 2019). The worsening found in the language in people with Intellectual Disability is consistent with other studies (Torra Moreno et al., 2021) but the use of easy-to-read documents is recommended for assessing actual language ability (Buell et al., 2020; Heller et al., 2014). Calculus requires complex cognitive skills, such as abstract thinking, for the understanding of basic arithmetic, which is a barrier in training people with Intellectual Disability (Sarango and Torres, 2015). Attention, on the other hand, has improved in people with Intellectual Disability despite being a cognitive area that is initially affected by aging (Santos et al., 2022). With respect to the results obtained in praxis, other studies obtain, in the same way, results that can be extrapolated to ADL with the teaching of imitation skills (Cantone et al., 2018; Vanvuchelen and Vochten, 2011). Finally, the improvement in fixation memory, which is related to the retrieval of information after the presentation of stimuli, would account for the effectiveness of our programme (E. M. B. Hernández, 2013) and being the simplest repetition strategy used for improving memory in people with Intellectual Disability (Pérez-Sánchez et al., 2006).

In relation to verbal fluency, although both populations improved, it was only statistically significant in people without Intellectual Disability. Multicomponent training programmes are an effective therapy to improve verbal fluency (Sáez de Asteasu et al., 2019) as they involve active learning and social relationships (Kelly et al., 2017; Uemura et al., 2018), although higher subjective age would relate to lower verbal fluency (Stephan et al., 2021). People with Intellectual Disability show significant deficits in this area due to problems in the speed of access to lexical items and cognitive decline itself (Danielsson et al., 2010; Wissing et al., 2022), yet assessment of language skills is necessary to detect dementia in adults with Intellectual Disability (Pulsifer et al., 2020; Strydom et al., 2013).

With regard to the functional and physical levels, our hypothesis has been verified. In ABVD there was maintenance, possibly due to a ceiling effect (Calatayud et al., 2020; Srisuwan et al., 2020). However, there was an improvement in IADL in the group with Intellectual Disability. Long-lasting, high-intensity multicomponent programmes have a positive effect in the functional area (Daniels et al., 2008), especially if the focus of the programme is on both IADL training and IADL development opportunities in the community (Buntinx and Schalock, 2010; World

Table 3
Analysis of the mean pre-post changes for each group.

Variables	Without Intellectual Disability			With Intellectual Disability			
	Mean (SD)	95 % CI for *M*	*p*-value	Mean (SD)	95 % CI for *M*	*p*-value	Inter-Groups Differences *p*-value
				MEC-35 total, *M* (*SD*)			
T0	29.44 (2.28)			17.62 (5.66)			
T1	30.19 (2.62)			19.05 (5.84)			
T1-T0	0.92 (2.55)	[0.43, 1.41]	**< 0.001**	1.224 (3.45)	[0.53, 1.92]	**0.001**	0.844
				MEC-35 temporal orientation, *M* (*SD*)			
T0	3.93 (1.17)			3.25 (1.61)			
T1	4.23 (1.08)			3.44 (1.56)			
T1-T0	0.30 (1.07)	[0.09, 0.50]	**0.008**	0.143 (1.06)	[−0.07, 0.35]	0.222	0.143
				MEC-35 spatial orientation, *M* (*SD*)			
T0	4.67 (0.55)			3.5 (1.18)			
T1	4.74 (0.55)			3.71 (1.21)			
T1-T0	0.08 (0.68)	[−0.04, 0.21]	0.135	0.173 (1.11)	[−0.05, 0.39]	0.134	0.624
				MEC-35 fixation memory, *M* (*SD*)			
T0	3 (0)			2.38 (0.91)			
T1	3.00 (0.00)			2.64 (0.72)			
T1-T0	–	–	–	0.26 (0.96)	[0.06, 0.45]	**0.011**	**0.008**
				MEC-35 calculation, *M* (*SD*)			
T0	4.4 (0.82)			0.34 (1.03)			
T1	4.35 (0.93)			0.00 (0.00)			
T1-T0	0.01 (1.01)	[−0.18, 0.20]	0.800	−0.34 (1.03)	[−0.54, −0.13]	**0.003**	0.074
				MEC-35 attention, *M* (*SD*)			
T0	2.05 (1.13)			0.62 (1.07)			
T1	2.03 (1.20)			1.29 (1.89)			
T1-T0	0.10 (1.34)	[−0.15, 0.36]	0.350	0.64 (1.53)	[0.33, 0.95]	**< 0.001**	**0.020**
				MEC-35 short-term memory, *M* (*SD*)			
T0	1.41 (1.08)			1.41 (1.15)			
T1	1.62 (1.06)			1.62 (1.20)			
T1-T0	−0.12 (1.12)	[−0.34, 0.09]	0.230	−0.21 (1.30)	[−0.47, 0.04]	0.114	0.615
				MEC-35 language, *M* (*SD*)			
T0	5.59 (0.59)			4.73 (1.71)			
T1	5.75 (0.47)			3.38 (1.04)			
T1-T0	0.22 (0.66)	[0.09, 0.34]	**0.001**	−1.44 (1.43)	[−1.72, −1.15]	**< 0.001**	**< 0.001**
				MEC-35 praxis, *M* (*SD*)			
T0	4.40 (0.64)			1.37 (1.30)			
T1	4.47 (0.63)			3.05 (0.67)			
T1-T0	0.05 (0.73)	[−0.05, 0.22]	0.233	1.74 (1.36)	[1.46, 2.01]	**< 0.001**	**< 0.001**
				Set-test, *M* (*SD*)			
T0	35.12 (4.72)			26.77 (8.78)			
T1	35.97 (4.64)			27.39 (8.75)			
T1-T0	0.77 (3.83)	[0.035, 1.51]	**0.030**	0.48 (4.83)	[−0.49, 1.45]	0.190	0.886
				Barthel index, *M* (*SD*)			
T0	85.38 (20.98)			87.03 (16.87)			
T1	83.84 (21.77)			85.90 (20.39)			
T1-T0	−1.44 (10.62)	[−3.49, 0.60]	0.229	−1.00 (10.82)	[−3.15, 1.15]	0.632	0.877
				Lawton and Brody scale, *M* (*SD*)			
T0	3.97 (2.33)			2.22 (2.23)			
T1	3.95 (2.50)			2.63 (2.02)			
T1-T0	−0.028 (1.38)	[−0.29, 0.24]	0.787	0.45 (1.29)	[0.19, 0.71]	**0.002**	**0.005**
				The Tinetti test, *M* (*SD*)			
T0	23.67 (4.65)			24.75 (3.39)			
T1	23.79 (4.35)			24.08 (4.69)			
T1-T0	0.48 (2.46)	[−0.008, 0.96]	0.063	−0.80 (3.16)	[−1.44, −0.16]	**0.006**	**0.002**

Note. Significant differences ($p < 0.05$) are highlighted in bold font. CI, confidence interval; MEC-35, Spanish version of mini-mental state examination (MMSE).

Health Organization, 2002). With regard to impaired dynamic balance, people with Intellectual Disability have less-efficient strategies to maintain balance (H. L. Chen et al., 2015), possibly because of the aforementioned premature aging (Carmeli et al., 2003; Enkelaar et al., 2013). In any case, such interventions can reduce the risk of mortality in older people living in the community (Gitlin et al., 2006).

Our second hypothesis has not been fully tested. In older adults without Intellectual Disability, the variables that predicted cognitive and functional improvement in IADL were being young, being female, having a partner and not having neurological, psychiatric or sensory disorders. These factors have been found in the literature and also include low socio-economic status, a factor that has not been analyzed in our study (Asaduroglu et al., 2015; Connolly et al., 2017; de León-Arcila et al., 2009; van Lieshout et al., 2018). In contrast, other authors have concluded that cardiorespiratory fitness and physical fitness are significant predictors of a decrease in IADL (Oppewal et al., 2015, 2016). Age is identified as one of the most consistent factors of cognitive and functional impairment (Asaduroglu et al., 2015), and the effects of training on cognition appear to be moderated by educational level (Basak et al., 2020).

However, in the group of people with Intellectual Disability, none of the variables collected was a predictor of additional improvement. That is, people with Intellectual Disability improved independently of their health status and socio-demographic characteristics. It is necessary to consider the heterogeneity of this group in order to target health and preventive care services, improve staff training and introduce working methods that provide aging-related support (Landes et al., 2019; Maes and Van Puyenbroeck, 2008) and reduce the barriers identified in the final stage of their lives (Wark et al., 2017). Some studies have shown that the impact of chronic diseases may be greater for people with Intellectual Disability compared to the non- Intellectual Disability population (Buntinx and Schalock, 2010) However, in our study, it was lower. This could be explained by current problems of accessibility and underdiagnosis in the health care of people with Intellectual Disability (Leturia et al., 2014) because the residential care of a large percentage of participants in the study has functioned as a protective factor for them, as some studies have shown, due to greater participation in prevention and health promotion activities (Martínez-Leal et al., 2011) and/or because they are less exposed to risk factors, such as smoking, stress or static standing work, to which a significant burden of chronic disease can be attributed (Banegas et al., 2002; Raetz et al., 2019; Steptoe and Kivimäki, 2012).

In summary, in aging, multi-component programmes are low-cost interventions that have the potential to improve cognitive and functional performance, especially in pre-dementia states, and although the effects are greater for directly trained outcomes, there is also a carry-over effect in untrained aspects (Mewborn et al., 2017; Rezola-Pardo et al., 2022).

The limitations of our study include the use of tools not adapted to Intellectual Disability for cognitive assessment and which are commonly used in primary care. On the other hand, our smaller sample size may be less suitable for making more precise statements in people with Intellectual Disability when we talk about associated chronic pathologies (van den Bemd et al., 2022).

5. Conclusions

In conclusion, by means of a longitudinal study, we have shown that after one year of intervention through a multi-component programme, both groups improved at a cognitive level according to the global SCM, and people with Intellectual Disability improved in the performance of IADLs. The improvement in attention, praxis and fixation memory may not be accidental, as their training can be extrapolated to more complex praxis, such as the performance of ADLs. On the other hand, given that calculation worsened, working on different mental calculation strategies and techniques could facilitate the maintenance of some IADLs in the long term. With regard to language, the need to reinforce interventions that favour language development is highlighted, given that with appropriate support these can be trained and improved.

Adaptive skills training, individualized support design and the provision of personal development opportunities have generated favourable outcomes for people with Intellectual Disability, without being influenced by any of the socio-demographic, clinical or occupational variables studied. The design of these supports should be carried out by professionals with an in-depth knowledge of their aging processes and Intellectual Disability.

These results have clinical relevance for preventing cognitive decline and for maintaining and/or improving functionality in older people with Intellectual Disability.

Multicomponent intervention programs with people with intellectual disabilities in the aging process, based on the MOHO and the ACP Model, have played a crucial role in improving their functional and cognitive abilities and their community participation.

The adaptation of the environment to the changes experienced by people with ID at this stage of life allows to effectively address the new demands of individuals.

The promotion of community participation activities has favored the empowerment, autonomy and independence of people with ID by strengthening their connections with the community, which improves their autonomy, independence and sense of belonging.

In summary, the work done by professionals with in-depth knowledge of ID and aging using these models provides a personalized approach that respects their dignity, supports their adaptation to the biopsychosocial changes of this stage and fosters their integration into the community, which has ultimately improved their functional and cognitive abilities.

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Declaration of competing interest

No conflicts of interest have been declared.

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Ethical considerations

The project was endorsed by the Ethical Research Committee of Aragón (CEICA, C.P.-C.I.PI18/152). Personal data protection regulations were followed and patients or their legal guardians signed informed consent forms. The study adhered to the guidelines set out in the Declaration of Helsinki (World Medical Association, 2013), good clinical practices and current legislation. The relationships with the participants in both institutions are based on their empowerment and self-determination. Their participation in the study does not in any way affect the care they receive in their centres or their relationship with the research team.

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