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Psychomotor profile of elderly with Intellectual Disabilities: a comparison study with typical elders and with Alzheimer Disease

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Abstract

People with intellectual disability (ID) are living longer, creating new challenges in rehabilitation services. With a longer longevity, the risk of dementia is expected to increase also within this emerging group. The ageing process of persons with ID and the best program planning is a quite recent area of research and in psychomotor field there is a major need to better understand this process. This study aims to evaluate and analyze the psychomotor competences of elderly with Intellectual Disability (ID) through a comparison study with typical peers and elders with Alzheimer Disease (AD). The Portuguese version of *Éxamen Geronto-Psychomoteur* (EGP) was applied to 118 participants, between 45 and 94 (67.68±13.09) years-old, divided in three groups: 39 typical elders, 41 elderly with AD and 38 individuals with ID. Findings showed significant differences in psychomotor domains between participants with ID and typical peers**,** except in *Balance* and *Fine Motor Skills of Lower Limbs*. There were no statistically differences between participants with ID and AD in *Static Balance II, Fine Motor Skills of Upper Limbs, Praxis, Knowledge of Body Parts, Vigilance, Perceptive Memory, Communication, Spatial and Temporal Domains*. Elders with ID tend to present the lowest results in most domains. The identification of a psychomotor profile as well the relative role of ID and a comorbid disorder (e.g.: dementia) will contribute to more adequate decisions regarding proper services and interventions strategies.

Keywords: Aging, Elderly, Intellectual Disability, Psychomotor Evaluation, Psychomotor Profile

Introduction

People with intellectual disability (ID) are living longer (McCallion & McCarron, 2004). Life expectancy of persons with ID is estimated to be between 70 to 80 years-old, setting new challenges about the extent to which supports providers are prepared to meet the changing needs of this emerging group (McGhee & Dorset, 2011). As a result, special attention needs to be given to this growing elderly population in order to best recognize the ageing issues and how they may be appropriately identified, addressed and resolved (Bigby, 2004; Carmeli & Iman, 2014; David, Dudvevani, & Doron, 2015; McGhee & Dorset, 2011, Thorpe, Davidson & Janicki, 2000).

People with ID have higher support needs than their typical peers (Haveman et al., 2011) due to cognitive and adaptive behavior decline at an early age, with impact on independent functioning (Carmeli & Iman, 2014; Strydom, Chan King, Hassiotis & Livingston, 2013). These

persons often experience an early aging characteristics onset when compared with general population (Li, Wu, Lin, Lin, & Chu, 2011). Older adults with ID experience the same age-related conditions and chronic diseases as people who do not have life-long disabilities (e.g.: dementia) (Carmeli & Iman, 2014; Perkins & Moran, 2010; Strydom et al, 2013), although research on its proper identification and management, in this group, is still scarce and complex (Hawkins, Eklund, James & Foose, 2003; Perkins & Moran, 2010).

Dementia can have an atypical onset and manifestation in persons with ID and the perception of decline will vary with the premorbid level of ID, i.e., the cognitive-adaptive profile and with environmental impact (Strydom et al., 2009). Standardized dementia diagnostic methods are not yet validated for people with ID (Krinsky-McHale & Silvermann, 2013), restricting early detection (Krinsky-McHale & Silverman, 2013) and determining the ageing onset of dementia in individuals with ID (Robertson et al., 2000) which is expected to be present at a much younger age (Elliot-King et al., 2016). For these authors, dementia rates among persons with ID increase substantially between the ages of 40 and 60 years old and its "diagnostic evaluation should be targeted at this age group or before" (p. 127). Dementia Alzheimer's type occurrence rate of persons with intellectual and developmental disabilities appears to be about the same or higher as in general population (Strydom et al., 2013).

Aging usually involves changes in psychomotor skills, expressed in daily life activities functioning. Compared to their typical peers, elders with ID tend to present lower scores in balance (Christofoletti, Oliani, Gobbi & Stella, 2006; Olalla, 2011), spatial and temporal orientation (Yewá, Alladid, Shailajad, Hodgesa & Hornbergera, 2013), gross and fine motor skills (Ward, Cecato, Aprahamian, & Martinelli, 2015), surveillance (Vasquez et al., 2011), perception (Lee, Levi, Davies, Hodges, & Graham, 2007), memory (Cherry, Njardvik & Dawson, 2000), processing speed and visuospatial capacity (Hoogendam, Hofman, van der Geest, van der Lugt, & Ikram, 2014). These skills tend to decrease with age.

Research reinforces the need to establish a baseline of a functional profile of elderly with ID (Krinsky-McHale & Silvermann, 2013) and caregivers should acknowledge the needs of this recent group (McGhee & Dorset 2011; Morais, Santos & Lebre, 2016; Strydom et al, 2013). Although there has been an increasing concern about the outcomes, services and supports for individuals with ID, relatively little attention has been given to their ageing process and little

empirical data exists about the psychomotor profile of elderly with ID (Antunes & Santos, 2015; Morais et al, 2016), as well its eventual relation with dementia.

Psychomotor Therapy is one of the supports provided by Portuguese institutions, as a complementary support to pharmacological interventions (Probst, Knapen, Poot, & Vancampfort, 2010) to promote independent functioning (Jardim & Santos, 2016; Valente, Santos & Morato, 2012). An accurate identification and evidence-based insight about such changes related to ageing of persons with ID are crucial, since they may be contributing to adequate timely detection, supports provision (Bigby, 2004; Doody, Markey & Doody, 2011) and for improvements in person's quality of life. McCallion and McCarron (2004) add the need to specifically address the challenges posed by dementia, because with the increase of longevity, greater number of individuals with ID will be at risk of developing dementia.

Therefore, this exploratory study aims to evaluate and analyze the psychomotor competences of elderly with ID, through a comparative study with their typical peers and with individuals with Alzheimer disease (AD). Besides the identification of a psychomotor profile of elders with ID, it was considered important to include these three groups for a better understanding of how the aging process in ID may differ from typical or pathological aging. Such knowledge would assist in the future psychomotor therapists supporting elderly with ID within the clinical evaluation and planning programs to promote independent functioning.

Methodology

Sample

A convenience sample (Table 1) comprised 118 participants, aged between 45 and 94 years (67.68±13.09), 76 females and 42 males divided into three groups: group with AD, group with ID and typical aging group. All participants with ID were institutionalized.

Table 1. Sample Socio-Demographic Description (N=118)

	Participants with AD (n=41) N (%)	Participants without ID (typical ageing process) (n=39) N (%)	Participants with ID (n=38) N (%)
Age	80.86±7.09	68.57±5.07	52.55±5.72
Gender			
Male	12 (29.3%)	11 (28.2%)	19 (50%)
Female	29 (70.7%)	28 (71.8%)	19 (50%)
Setting			
Institucionalization	28 (68.3%)	13(33.3%)	38 (100%)
Home	13 (31.7%)	26 (66.7%)	0
Educational schooling			
Special Education	0	0	9(23.7%)
<4 years	5 (12.2%)	15(38.5%)	20(52.6%)
4-9 years	18 (43.9%)	16(41%)	5(13.2%)
9-12 years	4 (9.8%)	6 (15.4%)	2(5.3%)
Bachelor Degree	5 (12.2%)	2(5.1%)	0
Master or PhD	9 (22%)	0	0
Medication			
Yes	27(65.9%)	14(35.9%)	27 (71.1%)
No	14(34.1%)	25(64.1%)	11(28.9%)
Regular Physical Activity			
Yes	8(19.5%)	15(38.5%)	20(52.6%)
No	33(80.5%)	24(61.5)	18(47.4%)

Instruments

All participants were evaluated with the Portuguese version of *Éxamen Geronto-Psychomoteur* (EGP) (Morais et al., 2016). This instrument, developed in France (Michel, Soppelsa & Albaret, 2011) is targeted to elderly over 60 years aims to assess the skills and psychomotor competences, establishing a psychomotor profile that facilitates diagnosis, intervention process and its effectiveness' (Michel et al., 2011). The instrument comprises quantitative aspects organized in 17 items: static and dynamic balance, joint mobilizations, praxis, fine motor skills of upper and lower limbs, knowledge of body parts, vigilance, perception, verbal and perceptive memory, spatial and temporal domain, nonverbal and verbal communication and qualitative aspects (e.g.: posture, quality of movement, functional aspects, tonic-emotional reactions) (Michel et al., 2011; Morais et al., 2016).. The application is performed at home or in institutional settings and it can be done in one or two sessions, with a flexible order, except for three items that assessing memory domain.

Each item is scored on a six-point scale, ranging from 0 (no success) to 6 (best performance) and the application time is about 60 minutes (Michel et al., 2011; Morais et al., 2016). The Portuguese version of EGP showed good psychometric properties (Morais et al., 2016) namely the content validity indices with scores of .89 in experts agreement proportion, IVCs ranging from .92 to .98 and *Cohen Kappa* ranging from .30 to .90; internal consistency, through the Cronbach alpha showed domains reliability exceeding .90 with an EGP total score of .92 (domains' Pearson correlations coefficients ranged from .64 (Communication) to .92 (Dynamic Balance II) with a total score of .97, and exploratory factorial analysis revealed three factors explaining 48% of the overall variance; strong correlations between domains were found and EGP was able to differentiate persons with and without dementia (Morais et al., 2016).

Procedures

Research protocol was approved by the ethical board of the Hospital Garcia de Orta. All participants and primary caregivers in case of participants with dementia or intellectual disability, provided informed consent for participation in the study. The study adheres to the Declaration of Helsinki for research involving human subjects. The application of the instrument was performed according to the protocol by psychomotor therapists with training on EGP application. All applications were performed in therapeutic rooms or at home of the participants and took on average 60 minutes.

All statistical analyses were performed using the Statistical Package for Social Sciences version 22 (SPSS; IBM Corp. Released, 2012).

Results

The present study is based on a descriptive and quantitative research design. Descriptive measures, including mean and standard-deviation, are presented in table 2, as well internal consistency, through Cronbach alpha (**α)** and intra-class correlations (ICC). The critical value for statistical significance was set at a $p<.05$. Differences were investigated through *One-Way Anova* test. Results confirm the existence of differences (ANOVA ($F(2,115)=50.94$, $p=<.001$) and *post-hoc Tukey test* was used to for the comparison between the three groups (all a very similar sample sizes per group).

From the results obtained it was observed that participants with a typical ageing process, showed higher scores, which allow us to say that they have better performances in almost all domains of EGP than participants with ID or dementia (*except Static Balance I and Dynamic Balance I*).

Table 2. Internal Consistency (Cronbach alpha), ICC, Mean e Standard deviation and Tukey Test

Domains EGP	**α (*n*=118)**	**ICC (*n*=118)**	**Typical Ageing (*n*=39)**	**Participants with AD (n=41)**	**Tukey Test typical vs. AD**	**Participants with ID (*n* = 38)**	**Tukey test: typical vs. ID**	**Tukey test: AD vs. ID**
SB I	.81	.81	5.71±.88	4.80±1.85	.005	5.81±.69	.939	**.002**
SB II	.82	.82	4.02±1.51	1.68±1.60	<.001	2.13±1.29	**<.001**	.373
DB I	.81	.81	5.82±.85	4.39±2.20	<.001	5.84±.67	.998	**<.001**
DB II	.80	.80	5.11±1.56	1.93±2.40	<.001	4.73±2.81	.693	**<.001**
JMUL	.92	.92	5.39±1.02	4.81±1.33	.057	1.40±.94	**<.001**	**<.001**
JMLL	.89	.90	5.03±1.39	4.14±1.68	.014	1.89±1.00	**<.001**	**<.001**
FMSUP	.81	.91	4.43±1.45	2.87±1.55	<.001	2.93±1.19	**<.001**	.286
FMSLL	.87	.85	5.65±.96	3.97±1.60	<.001	5.61±.89	.991	**<.001**
P	.77	.82	4.67±1.27	2.7±1.54	<.001	2.32±1.36	**<.001**	.456
KBP	.83	.83	5.24±.89	3.37±1.72	<.001	3.21±1.55	**<.001**	.864
V	.90	.90	5.23±1.22	3.57±2.1	<.001	2.78±2.04	**<.001**	.145
PM	.92	.92	4.33±1.50	1.00±.92	<.001	1.67±1.47	**<.001**	.067
SD	.86	.86	4.89±1.24	2.58±1.86	<.001	2.39±1.67	**<.001**	.861
VM	.78	.78	4.41±1.40	2.46±1.26	<.001	1.69±1.47	**<.001**	**.040**
Percp	.76	.76	4.89±1.16	3.48±1.48	<.001	2.51±1.30	**<.001**	**.004**
TD	.88	.88	4.93±1.48	2.07±1.57	<.001	1.57±.164	**<.001**	.326
C	.80	.80	5.38±1.24	2.75±2.42	<.001	3.07±1.46	**<.001**	.707
Total	.95	.96	85.21±15.06	52.65±18.7	<.001	51.22±16.44	**<.001**	.924

*p<.05; Legend: SBI=Static Balance I; SBII=Static Balance II; DBI=Dynamic Balance I; DBII=Dynamic Balance II; JMUP= Joint mobilization UP ; JMLL= Joint mobilization LL ; FMSUL=Fine motor skills UP; FMLL=Fine motor skills LL; P=Praxis; KBP=Knowledge of body parts, V=Vigilance; PM=Perceptive memory; SD=Spatial domain; VM=Verbal memory; Perc=Perception; TD=Temporal domain ; C=Communication

Discussion

This article aims to compare the psychomotor competences of older persons with ID, with AD and with typical ageing process. Despite this study relevance at a national level, the findings are also interesting at international level: not only contributing for a deeper knowledge of psychomotor profile of elders with ID, and its relationship with other types of aging (typical and pathological), as well for all countries where psychomotor therapy is being provided as a support strategy.

Aging seems to begin earlier in people with ID as well as a functional decline seems to be intensified (Campos, Arias Fernandez & Castro, 2007). In order to adequate interventions and programs it is essential to better understand the aging process of such subgroup. Therefore, were analyzed the psychomotor competences of a group of participants with ID, which were compared with a group of typical peers and with AD, to identify similarities and differences in ageing process. The identification of a psychomotor profile as well the relative role of the ID and a comorbid disorder, such as dementia, will contribute to more adequate decisions regarding proper services and strategies.

Generally speaking, and as expected, statistically significant differences were noted in most EGP domains, between participants with ID and their typical peers, except in *Balance* (Static I and Dynamic I & II) and *Fine Motor Skills of Lower Limbs* domains. These results may allow us to identify that balance supposedly is one of the domains being stimulated with elders with ID, within psychomotor therapy intervention, because all participants will ID were benefitting of such intervention and 52.6% also practiced physical activity. Additionally, the greater risk of falling in senior's population, independently of diagnosis (Carmeli, Bar-Chad, Lotan, Merrick & Coleman, 2003a), and regardless of age, lead psychomotor interventions to continuously promote balance skills (Santos & Morato, 2007).

The group with ID presented the lowest scores. It was the case of *Balance Static II* (e.g.: staying on the tips of one or both feet), which can be explained by a higher level of task complexity (Carmeli et al., 2003a) combined with motor performance decline more visible in older persons with ID (Lahtinen, Rintala & Malin, 2007). It is important to notice that some age-related biological changes (Lahtinen et al., 2007) have consequences in daily life, limitations in postural control, decreased motor skills and perceptive limitations. This data and the poorer involvement stimulation that characterizes the ID ageing process, can justify this lowest results in this domain (Evans, 2012). However, due to the characteristics of the participants, it is not possible to conclude definitively that lower scores are due to the ageing process or to the ID diagnosis only, or it's combination.

Tonus and body awareness limitations (Burke, McCallion & McCarron, 2014; Juhel, 2010), deficits in movements discrimination (Kioumourtzoglou, Batsiou, Theodorakis and Manauromatis, 1994; Shinkfield, Sparrow & Day, 199), manual dexterity limitations (Lahtinen et al., 2007), dyspraxia, visuomotor integration, lack of coordination (Maes, Fryns, Van

Walleghem & Van den Berghe, 1994), slower reaction time (Carmeli, Bar-Yosef, Ariav, Levy & Liebermann, 2008a), are also possible explanations for differences in psychomotor domains of participants with ID, which are intensified by ID' higher level of severity. Cognitive limitations, poor stimulation and overprotection, may also contribute for the differences between groups (Santos, 2014; Santos & Morato, 2007).

Limitations in executive functions (e.g.: attention and concentration) (Burt et al., 2005) and in discriminating relevant inputs (Richards, Brady & Taylor, 2015) impact *Vigilance*, with participants with ID presenting lower performances. Lower results of ID group in *Perceptive* and *Verbal Memory Domains* suggest an early aging (Hawkins et al., 2003). Significant neuronal degradation, impaired cognitive reserve, limited cognitive functioning (e.g.: slower processing tasks), lack of stimulation and overprotection may explain results (Burt et al., 2005; Hawkins et al, 2003; Zigman et al., 2004). Nevertheless, all participants tend to show a decline of memory skills related to age.

In *Space* and *Temporal Domains*, significant differences between groups were expected resulting from limitations in spatial cognition, work memory and abstract constructs (e.g.: time concepts such night vs. day) comprehension (Benejam, 2009). Changes in somatosensory perception (Evans, 2012) and in tactile system (Uyanik & Kayihan, 2010), and visual limitations compromise mobility and senior independence (Connolly, 2006) with a negative impact in *Perception* domain. Only 7.9% of participants with ID read successfully a text (vs. 56.4% of typical peers), revealing limitations at: syntax, word identification, lower reading speed. Differences may be justified by a dysfunction of automatic senses processing (e.g.: hearing, vision and touch - Evans, 2012; Hawkins et al, 2003) and by difficulties in understanding nonverbal and abstracts instructions (Maes et al., 1994), discriminating and selecting important clues for solving a problem (Santos, 2014).

The decline of adaptive behaviors (Santos & Morato, 2007) constraints in executive functions (e.g.: working memory and inhibition), communication and language limitations, as well challenging behaviors explain differences between groups in *Communication* domain, again with participants with ID presenting the lowest results (Ball, Holland, Treppner, Watson & Huppert, 2008). Typical elderly seems to preserve these skills (Garcia & Mansur, 2006).

Comparing participants with ID and AD, there are no statistically significant differences in *Static Balance II, Fine Motor Skills of Upper Limbs, Praxis, Knowledge of Body Parts,*

Vigilance, Perceptive Memory, Communication, Spatial and Temporal Domains, presenting both groups major limitations (Carmeli et al, 2003a; Christofoletti et al, 2006).

Cognitive and motor limitations related to age may explain the lower results of both groups inhibiting voluntary actions (Castro et al., 2011). Major limitations at psychomotor development (Santos & Morato, 2007), associated to musculoskeletal impairments, sensory limitations and perceptive or proprioceptive deficits (Cox, Clemson, Stancliffe, Durvasula & Sherrington, 2010), seems to explain the worse performance of both groups. Medication and its effect is another variable to be considered (Lindsay, 2011).

Apraxia is often associated to persons with dementia (Yaari & Corey-Bloom, 2007) and ID (Aylward, Burt, Thorpe, Lai & Dalton, 1997), which will influence motor performance. Both groups present an illegible handwriting that will impact social and personal responsibilities (Aubert & Albaret, 2001; Woodford, 2007). Agnosia associated to physical changes age-related will have impact in self-image (Woodford, 2007) as well in space and time awareness (Guariglia & Nitrini, 2009; Juhel, 2010). The disorientation may result from slow speed information (Evans, 2012) and neurological degeneration (Giannakopoulos, et al., 2000).

Vigilance and *Perceptive Memory Domains* do not show significant differences. Impairments in attentional mechanism and memory capacity are reported in both groups (Hawkins et al., 2003; Yaari & Corey-Bloom, 2007). Executive functions deficits associated to sensory limitations are present since the early AD and ID' stages, compromising constructive skills, abstract thinking, language and sustained or divided attention (Baudic et al., 2006; Danielsson, Henry, Rönnberg & Nilsson, 2010).

In persons with AD memory limitations affect fast access to words, with impact in communication (Yaari & Corey-Bloom, 2007). It is also recognized a poor and disorganized speech, as well phonological and articular difficulties in persons with ID (Jacobson, Mullick & Rojahns, 2007). Additionally, challenging behaviors and deficits in behavioral inhibition create more daily life limitations.

Most EGP domains present statistically significant differences between both groups. Participants with ID seem to perform lower although in balance, in general, reported higher scores, as a result of more psychomotor (Santos & Morato, 2007) and physical activity stimulation (Carmeli, Merrick, Kessel, Masharawi, & Carmeli, 2003b), in institutional intervention. In *Joint Mobilization* domains participants with AD performed better. The

limitation in imitation usual in persons with ID (Shinkfield et al., 1997) may be the main cause. Reduced amplitude movement and toughness are conditions reported in AD (Aubert & Albaret 2001) and ID groups (Gabbai, 2004).

As mentioned before, participants with ID presented worst results in cognitive skills, such as memory (e.g.: remember where objects were left or daily events) and perceptive competences (Aylward et al., 1997). Lowest performances in *Verbal Memory* Domain can result from the reduced abstraction skills, limitations in symbolic thinking and short-term memory in ID. Both groups have *Perceptive* limitations (Lee et al, 2007; Maes et al., 1994; Uyanik & Kayihan, 2010) but the less positive results of the participants with ID can result of co-morbilities (vs. peers with AD) involving vision and hearing deficits. Globally, similar performance between both groups was evident, with statistical significant differences with typical elderly. The knowledge of aging process of persons with ID is still limited and its association with AD is not well understood or documented (Zigman et al., 2004). The "long term" limitations, associated to aging process, requires specific and validated methodologies (Silverman et al., 2004) and the need of establishment of individual profiles performances of participants with ID over time, for a more adequate supports provision.

Conclusion

Although the numbers of ageing adults with ID are increasing (Doody et al., 2011), current services and systems are still not prepared to meet their needs. In Portugal, the experience of services supporting persons with ID in their ageing process is still limited. More research is needed to identify needs and to direct policies and strengthen practices aiming to support ageing adults with ID (Pinheiro e Santos, *in press*) in order to ensure the best possible quality of life through the planning of an individual tailor-fit interventions. Although not representative of the ageing population with ID, findings of the current study showed significant differences in most of psychomotor domains, when elderly with ID and elderly with AD vs. typical peers were compared. The group with ID presented the lowest scores when compared to their typical peers. Participants with ID had more positive results in physical domains, whereas participants with AD presented better performances in cognitive domains, when ID and AD group are compared. Although participants with ID were younger, findings points out the early ageing process as well of the dementia onset of persons with ID (Elliot-King et al., 2016; Robertson et al., 2000).

An assessment combining motor and cognitive functions "may provide better predictive value for dementia" (Mirelman et al., 2014, p. 2) and for persons with ID. The definition of a psychomotor profile of the elders with ID, and the identification of motor and cognitive declines over time, seems to be an important resource in psychomotor intervention (Antunes & Santos, 2015; Jardim & Santos, 2016). It will allow psychomotor therapists to design a more appropriate psychomotor program either with elderly - with or without dementia (Michel, Soppelsa, & Albaret, 2011) or persons with ID (Antunes & Santos, 2015).

As far as we know, this is the first study on psychomotor therapy field in Portugal focused on aging persons with ID and their psychomotor profile. It is expected that we add some knowledge and preliminary evidences for supporting future psychomotor interventions (Morais et al., 2016) for elderly with ID, since so far, there are no absolute scientific evidences establishing a typical ID aging process (Burt et al., 2005).

This study has some limitations. One is the convenience sample that restricts generalizations of results. Therefore, more studies are recommended, such as longitudinal studies and those with representative samples, in order to better identify changes associated with aging or for those individuals with ID with early signs of dementia (Burt et al., 2005). Further, all groups had different sociodemographic characteristics and some differences were expected since age, gender and institutionalization, among others, are variables with impact in psychomotor functioning. Because its influence was not analyzed, one of our recommendations is that research at this level has to be addressed at national and international level. Further, dual-diagnosis, chronical medical conditions and pharmacology are also variables to be consider (Bigby, 2007; Burt et al., 2005; Haveman et al., 2009). Another concern may be the identification of biological and environmental factors that may influence the risk of age-related functional decline in persons with ID (Strydom et al., 2009). There is an emergent need to strengthen research in the evaluation of interventions effectiveness (McGhee e Dorset, 2011).

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