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Original Article

Motor development of older adults: comparative study of gender and age group

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Abstract: Introduction: Aging in motor development is represented by a retrogenesis process that refers to gradual losses in motor components. Intrinsic and extrinsic factors can influence this process. Objective: The aimed of this study was to evaluate and compare the motor development of older adults considering the gender and age group. Method: A total of 218 healthy older adults aged 60-79 years old were included. Four groups were formed according to gender and age group: G1 (n=64) - female, 60-69 years old; G2 (n=45) - female, 70-79 years old; G3 (n=66) - male, 60-69 years old; G4 (n=43) - male, 70-79 years old. The Motor Scale for Older Adults (MSOA) was used. Statistical analysis was performed using Kruskal Wallis and Dunn post hoc test. Results: Most of the older adults presented Motor Development within the normal range. The group of older women of 70-79 years old presented low mean values ($\overline{x}$=87.7, SD=12.4), being statistically different when compared to the others groups. The areas: Global Coordination (p=0.001), Balance (p=0.001) and Body Scheme (p=0.012), presented significant statistical differences between the groups. In this analysis, women reached lower scores in most of the evaluated areas. Conclusion: The older women with more advanced age presented major impairment in motor development when compared to older men and older women with 60-69 years old.

Keywords: *Aging, Human Development, Motor Skills.*

Desenvolvimento motor de idosos: estudo comparativo de sexo e faixa etária

Resumo: Introdução: No desenvolvimento motor, o envelhecimento é representado pela retrogênese, processo que se refere às perdas gradativas nos componentes motores. Fatores intrínsecos e extrínsecos podem influenciar este processo. Objetivo: Avaliar e comparar o desenvolvimento motor de idosos considerando o sexo e a faixa etária. Método: Foram avaliados 218 idosos hígidos com idade entre 60 e 79 anos estratificados por sexo e faixa etária, constituindo quatro grupos: G1(n=64) - sexo feminino, 60-69 anos; G2 (n=45) - sexo feminino, 70-79 anos; G3 (n=66) - sexo masculino, 60-69 anos; G4 (n=43) - sexo masculino, 70-79 anos. O instrumento utilizado para coleta dos dados foi a Escala Motora para Terceira Idade (EMTI). Na análise estatística, empregou-se teste *H* de Kruskal Wallis e post hoc Dunn. Resultados: Observou-se que a maioria dos idosos apresentou desenvolvimento motor dentro da normalidade. O grupo do sexo feminino, 70-79 anos, foi o que apresentou valores médios inferiores ($\overline{x}$=87,7; DP=12,4), sendo diferente estatisticamente quando comparado os grupos. Nas áreas motoras, diferenças estatísticas significantes foram encontradas entre os grupos na Coordenação Global (p=0,001), Equilíbrio (p=0,001) e Esquema Corporal (p=0,012); nesta análise, as mulheres alcançaram pontuações inferiores aos homens na maioria das áreas avaliadas. Conclusão: As mulheres idosas com idade mais avançada apresentaram maior comprometimento no desenvolvimento motor quando comparadas aos homens idosos e mulheres idosas mais jovens.

Palavras-chave: *Envelhecimento, Desenvolvimento Humano, Destreza Motora.*

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1 Introduction

Motor Development is the process of motor transformations throughout life, starting at the conception and following to death (ROSA NETO, 2015). During aging, this process is evidenced by retrogenesis, in which gradual losses are revealed in the motor components (BORGES et al., 2010; RATHI et al., 2014). These losses can occur at different rhythms and intensities for each motor area, depending on the factors that the individual is exposed (PICCOLI et al., 2012; ROSA NETO; SAKAE; POETA, 2011; PICCOLI et al., 2016).

However, studies that address retrogenesis indicate a greater burden of intrinsic factors in the expression of losses during aging, especially related to neurological aspects (BORGES et al., 2010; RATHI et al., 2014; MASCALCHI et al., 2014). Death of neurons, reduction of the length and number of dendrites, demyelination of the large fibers, reduction of the amount of neurotransmitters and accumulation of anomalous substances in the extracellular environment are some neurological changes common to the process of retrogenesis, and result in a decrease in motor responses (FJELL et al., 2013; LOCKHART; DE CARLI, 2014).

Thus, the age appears as the main determinant for motor changes from the Motor Development perspective. Studies have demonstrated the gradual loss in the motor areas over the years (CRITCHLEY et al., 2014; BORELLA et al., 2014; GOMES et al., 2015). These changes result in decreased functional capacity, making the individual more susceptible to falls, fragility, institutionalization, depression and other comorbidities (NUNES et al., 2017; FIALHO et al., 2014; KAGAWA; CORRENTE, 2015). However, it is important to investigate the differences between the ages of the elderly person to monitor the intensity of the losses in the age groups to plan appropriate interventions to the needs of each moment in Motor Development.

Another intrinsic factor that seems to influence the Motor Development of the elderly is the gender, since due to physiological differences between men and women, the motor changes occur in different ways between the genders (PINHEIRO et al., 2013; SOUSA; GUEDES, 2016). Associated with this, there are socio-cultural aspects that can also contribute to the differences between the genders in the Motor Development, since the social rules of the time in which these elderly people were adults differentiated by gender the type of work and motor experiences (SOUSA; GUEDES, 2016). Understanding the motor differences between the genders in the elderly population can help health professionals to develop intervention programs that consider the specificities of each gender, favoring the adherence of the elderly person.

In this sense, considering the impact of these motor changes on the functional capacity of the elderly individuals and, consequently, their independence and autonomy, considering its determinants, the Motor Development study is an important tool for professionals working with the elderly people, since this knowledge enables the development of more effective interventions, aiming at the specific needs of each group. Therefore, the objective of the study was to evaluate and compare Motor Development of the elderly population considering gender and age group.

2 Method

This study is characterized as a transversal and descriptive paper. Participant´ consent was obtained through the signing of the Informed Consent Term, and the research was approved by the Research Ethics Committee with Human Beings of UDESC, protocol CAAE 50685515.9.0000.0118.

2.1 Participants

The sample consisted of 218 healthy elderly people belonging to the database of the Human Development Laboratory (LADEHU), aged 60 to 79 years old, stratified by gender and age group, constituting four groups: G1 (n=64) - female, 60-69 years old ($\bar{x}$=64.5 SD 2.8 years old); G2 (n=45) - female, 70-79 years old ($\bar{x}$=73.0 SD 2.6 years old); G3 (n=66) - male, 60-69 years old ($\bar{x}$=64.9 SD 3.0 years old); G4 (n=43) - male, 70-79 years old ($\bar{x}$=73.9 SD 2.6 years old). The elderly who presented complete information in the database, referring to gender, age and motor variables were included. Data were collected in 2016. Elderly patients with clinical diagnosis of neurodegenerative diseases such as Parkinson's and/or Alzheimer's; with recent fractures (six months); who used mobility aids such as wheelchairs, crutches; who presented hearing and/or vision compromised to the point of not being able to carry out the proposed tests were excluded.

2.2 Instruments

The instrument used to obtain the data was the Motor Scale for Older Adults (MSOA) (ROSA NETO, 2009). Published in its first edition in 2009, it has

good validity regarding reproducibility (r=0.93) and good reliability (0.80) for the internal consistency (ROSA NETO; SAKAE; POETA, 2011).

The EMTI evaluates the Motor Development of the elderly person through the areas: fine motor skills, global coordination, balance, body schema, spatial organization and temporal organization. The collection procedures last approximately 30 to 45 minutes and occur individually. The instrument consists of 10 tasks in each evaluated area, which present progression of difficulty in the execution. At the time the task is unsuccessful, the attempts are stopped and the points acquired with each test are counted, resulting in the score value for that determines areas. The arithmetic mean of the score achieved in the six areas indicates the General Motor Aptitude (AMG), which represents the Motor Development of the individual. The classification takes place according to the values reached in the AMG. Results classified as "low" and "very low" indicate vulnerability in Motor Development (ROSA NETO, 2009).

2.3 Statistical analysis

The statistical analysis was performed in the IBM SPSS Statistics 20.0 program. The mean, standard deviation and frequencies were used in the descriptive analysis. To verify the normality of the data, the Komogorov Smirnov test was used indicating non-normal data. Thus, for the comparison of groups, the Kruskal Wallis H test and Dunn's post hoc test were used.

3 Results

From the Motor Development assessment of the 218 elderly participants of the study, it was possible to verify that most of the elderly participants reached classifications within normality in the four groups (Table 1).

Among the four groups evaluated ($\bar{x}$=87.7, SD=12.4), the differences between the groups were statistically significant (p<0. 05) (Table 2).

When the motor areas were analyzed separately, it was possible to observe that the women presented inferior scores to the men in almost all the areas. In the Global Coordination, the significant difference was found in the comparison of the female group of 70-79 years old with the others. In Balance, significant differences were observed in the comparison of the male group of 60-69 years old and the two female groups, and between the female and male groups in the 70-79 age group. In the Body Scheme, significant differences were found in the comparison of the female groups. In the areas of Fine Motor Skills, Spatial Organization and Temporal Organization, no statistically significant differences were identified (Table 2).

4 Discussion

This study evaluated and compared Motor Development of older people stratified by gender and age group, resulting in Motor Development classification within normality for most of the elderly participants, although changes in some specific motor areas have been identified. These findings are in agreement with other (PICCOLI et al., 2009; ROSA NETO; SAKAE; POETA, 2011) and corroborate the idea that, despite the motor changes predicted in retrogenesis, the organism has adaptive mechanisms that aim to preserve essential functions for life (FUJIWARA et al., 2012; FLING; SEIDLER, 2012; RATHI et al., 2014).

However, when Motor Development is classified below normality, this adaptive ability is compromised, generating vulnerability in the motor capacities, which reflect difficulties in the execution of tasks considered simple in the day to

Table 1. Classification of the Motor Development in the elderly participants by group.

Classification	Female 60-69 years old % (n)	Female 70-79 years old % (n)	Male 60-69 years old % (n)	Male 70-79 years old % (n)
Very high	1.5 (1)	–	–	–
High	4.6 (3)	–	15.4 (10)	–
Normal high	10.8 (7)	6.7 (3)	9.2 (6)	25.6 (11)
Mean normal	56.9 (37)	22.2 (10)	47.7 (31)	44.2 (19)
Low normal	12.3 (8)	24.4 (11)	21.5 (14)	20.9 (9)
Low	12.3 (8)	44.4 (20)	3.1 (2)	4.7 (2)
Very low	1.5 (1)	2.2 (1)	3.1 (2)	4.7 (2)
Total	100% (65)	100% (45)	100% (65)	100% (43)

Table 2. Comparison of mean values of motor development and motor areas between groups.

	Gender	Age group	$\bar{x}$ (SD)	p-value**
MD	F	60-69 years old	96.8 (14.2)[a,c,d]	0.001*
		70-79 years old	87.7 (12.4)[b]	
	M	60-69 years old	99.3 (15.4)[a,c,d]	
		70-79 years old	97.1 (14.4)[a,c,d]	
FM	F	60-69 years old	100.7 (20.4)[a]	0.654
		70-79 years old	99.6 (22.9) [a]	
	M	60-69 years old	104.4 (21.3) [a]	
		70-79 years old	102.7 (24.0) [a]	
GC	F	60-69 years old	76.3 (20.4)[a,c,d]	0.001*
		70-79 years old	54.3 (20.1)[b]	
	M	60-69 years old	78.9 (27.1)[a,c,d]	
		70-79 years old	72.1 (22.7)[a,c,d]	
B	F	60-69 years old	93.2 (27.6)[a,d]	0.001*
		70-79 years old	80.7 (21.0)[b]	
	M	60-69 years old	106.0 (28.5)[a,c,d]	
		70-79 years old	102.7 (25.2)[a,c,d]	
BE	F	60-69 years old	116.7 (22.7)[a,c,d]	0.012*
		70-79 years old	100.3 (29.1)[b,c,d]	
	M	60-69 years old	109.5 (27.0)[a,b,c,d]	
		70-79 years old	107.4 (26.3)[a,b,c,d]	
SO	F	60-69 years old	101.9 (16.4)[a]	0.402
		70-79 years old	101.1 (15.4)[a]	
	M	60-69 years old	101.9 (12.4) [a]	
		70-79 years old	99.3 (12.9) [a]	
TO	F	60-69 years old	92.7 (25.8)[a]	0.977
		70-79 years old	89.9 (23.4)[a]	
	M	60-69 years old	94.7 (27.7)[a]	
		70-79 years old	95.3 (28.1)[a]	

F = female; M = male; $\bar{x}$ = mean; SD = standard deviation; MD = Motor Development; FM = Fine Motor Skills; GC = Global Coordination; B = Balance; BE = Body Scheme; SO = Space Organization; TO = Temporal Organization; ***H* de Kruskal Wallis test, post hoc Dunn; *p-value ≤0.05. Different letters = significant statistical difference.

day, like communicating or moving, for example (NUNES et al., 2017; BARBOSA et al., 2017). In these cases, the motor intervention becomes essential to recover the performance of such activities (SANTOS et al., 2014; MARTINS et al., 2014). In our study, vulnerability is present in 17.43% of the elderly participants.

Regarding the findings related to gender and age, the study indicated that women of more advanced age presented a greater impairment in Motor Development when compared to the other age groups and to the male participants since they were classified more frequently vulnerable for dependency conditions. Thus, women over 70 years old may need special care in the intervention context because of this finding.

The association between two factors, gender, and age, seems to be an important determinant for more pronounced motor loss. The literature has shown that the advancement of age is associated with the intensification of these losses, both related to the neurological and musculoskeletal components (RUBIO et al., 2013; FATORI et al., 2015). Moreover, the literature still indicates that the women is more susceptible to non-transmissible chronic diseases, frailties and dementias when compared to men, especially at more advanced ages (BARBOSA et al., 2017; FHON et al., 2012; ALEXANDRE et al., 2014).

Factors such as hormonal changes and losses in physical components, which in women begin during middle age, reflect a more pronounced decline in motor functions, becoming more evident from the 70s. In men, these changes appear later and, therefore, motor losses are less evident when compared to women of the same age group (ABAD-DIEZ et al., 2014; ALEXANDRE et al., 2014).

These differences between male and female motor losses still seem to be influenced by sociocultural factors, especially those related to the context in

which the current elderly lived (BARBOSA et al., 2017). Social rules established determining roles for each gender, in which women were dedicate to their care of the home, mainly performing tasks in the private sphere, such as the activities of daily life, favoring light activities, while men were in charge of the family support, in jobs that, for the most part, demanded physical aspects, and in their free time they performed more vigorous activities (SOUSA; GUEDES, 2016). This contrast between the motor experience of men and women, mainly related to the aspects that incorporate the physical valences, can be reflected in this difference between the genders (TEIXEIRA et al., 2012; SOUSA; GUEDES, 2016).

In the study of specific motor areas, the Global Coordination had more relevant and interventional results, since the elderly people of the study presented greater commitments in this area, regardless of gender or age group. The Global Coordination refers to the coordination of large movements that demand mainly physical valence, strength, flexibility, speed and agility for its execution, which are affected notoriously by the decline of the organic functions due to the advancing age (DALY et al., 2013; SILVA; MENEZES, 2014). Research has shown that there is a gradual loss in the physical valences, and at 65 years old the individual already shows a 25% decline in his muscular performance, for example (GOUVEIA et al., 2013), and from the 70 years old to improve the independence and autonomy of the elderly person (PINHEIRO et al., 2013; SILVA; MENEZES, 2014).

Thus, in the context of motor intervention, the Global Coordination appears as a key element to be approached in the work with older people, with Motor Development within or below normal, since this area involves aspects essential for the performance of activities of daily life, such as getting up from bed, climbing stairs, walking, etc.

5 Conclusion

The results of this study indicated that the elderly person, regardless of gender or age, presented Motor Development within normal range. However, the older age seemed to negatively influence the results, especially in the women, with the elderly women being 70-79 years old the group that presented Motor Development close to the vulnerability threshold. Regarding the motor areas, the Global Coordination was the one that presented greater commitment to the elderly person of the study.

Thus, it is important that interventions are developed to minimize the motor losses predicted in retrogenesis, especially in the Global Coordination area, which directly influences the independence and autonomy of the elderly person. The motor characteristics of each gender should also be observed for the development of more effective interventions.

There is the cross section as a limitation of the study, which did not allow to establish a causal relationship of the variables studied and the age group addressed, which did not include elderly people aged 80 or over, restricting the scope of the study. Thus, longitudinal cohort studies that allow the deepening of the knowledge related to Motor Development are suggested.

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Author's Contributions

Lucia Maria Andreis: construction of the methodology, data collection and analysis, article construction and review of the text. Cassiana Luiza Pistorello Garcia: data collection, article construction and review of the text. Fernanda Christina de Souza Guidarini: methodology construction, data collection and analysis, article construction and review of the text. Angela Fernandes Machado: construction of the article and review of the text. Francisco Rosa Neto: orientation of the research, construction of the methodology and review of the text. All authors approved the final version of the text.