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RELATION OF COGNITIVE ASPECTS AND WALKING PARAMETERS IN ELDERLY

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SUMMARY
The cognitive impairment in Alzheimer's disease (AD) may be associated with deficits in walking and a higher incidence of falls in this population. The aim of the study was to analyze the relationship among cognitive aspects and walking parameters. The correlation between clinical variables and stride length found in this study suggest the involvement of the cortex on walking. The deterioration caused by AD on cortex changes locomotor pattern and make these elderly people more committed. Thus, they need change the pattern to ensure success on the task, such as walking.

INTRODUCTION
The aging process leads to physical changes such as loss of muscle mass and cognitive decline, which may help explain the changes that this population has on gait [1]. The most common dementia in elderly people is Alzheimer's disease. (AD) is a progressive and neurodegenerative illness, which shows following neurophysiological characteristics: cortex atrophy, excess of beta-amyloid protein and senile plaque.. In addition to cognitive decline, the AD causes adjustments on walking, which are characterized by reduced stride length and walking velocity, and increased double support phase [1,3,7]. Due to deficits in both cognitive and walking, we could expect a relation between cognitive variables and walking parameters. So, the integrity of the cortex is related to the better performance during walking [2]. However, it is little knowledge which walking parameters are related to cognitive deficits. The aim of the study was to investigate the relationship of cognitive aspects and walking parameters.

METHODS
Thirty elderly people participated in this study. They were divided in two groups: group AD (78.33±5.23 years old) and control group (77.44±6.19 years old). The individuals were evaluated by a neuropsychiatry. The AD group was classified through the Clinical Dementia Rate Scale (CDR) [8]. The cognitive aspects were evaluated: a) Frontal Assessment Battery [6] designed to evaluate cognitive functions of the frontal cortex; b) Mini-Mental State Examination [4] designed to assess orientation from time to short-term memory; c) Clock Drawing Test [5] designed to assese the executive functions of planning, logical sequence, among others. The walking task required participants to walk, at preferred speed, along a pathway (8 m long by 1.4 m wide). The individuals performed 5 trials to analyze gait parameters (stride length, step width, simple support, double support, stride duration, stride velocity). Clinical variables and gait parameters were statistically analyzed with SPSS 18.0 for Windows®. The relationship among cognitive aspects and walking parameters were evaluated though Pearson's correlation ($p<0.05$).

RESULTS AND DISCUSSION
The Pearson's correlation indicated relation between stride length and the results of Frontal Assessment Battery ($r = 0.51$, $p<0.01$), Mini-Mental State Examination ($r = 0.57$, $p<0.01$) and Clock Drawing Test ($r = 0.44$, $p<0.02$), and between stride velocity and Mini-Mental State Examination **(**$r = 0.45$, $p<0.01$). The results indicated that better punctuation in the cognitive variables was related to greater stride length and stride velocity.

Table 1. Relation among cognitive aspects and walking parameters. FAB: Frontal Assessment Battery; MEEM: Mini-Mental State Examination; CDT: Clock Drawing Test.

		FAB	**MMSE**	**CDT**
Length	**r**	0.51	0.57	0.44
	p	**0.01**	**0.01**	**0.02**
Width	**r**	0.02	0.18	0.14
	p	0.91	0.35	0.46
Single support	**r**	-0.10	-0.22	-0.13
	p	0.60	0.25	0.49
Double Support	**r**	-0.11	-0.22	-0.12
	p	0.56	0.25	0.53
Stride duration	**r**	-0.14	-0.28	-0.16
	p	0.47	0.14	0.41
Stride velocity	**r**	0.33	0.45	0.34
	p	0.08	**0.01**	0.07

Higher scores in cognitive tests are related to greater stride length. These results suggest that a great impairment in the executive function becomes the walking more compromised. The reduction in the stride length is one of the earliest signs of AD [3], which indicates an early of cognitive impairment.

The deterioration of the cortex adds to inherent physical decline aging [1], makes the walking even more compromised. The patient with AD, due to this impairment, reduces stride length and, therefore, speed, to make the walking more cautiously and reduce risk of falls. Although the automatic walking component, the higher cognitive functions may also be associated with control of walking, since the correlation between length and clinical variables can be considered strong. The reduction of walking speed and stride length are associated with decrease of stability on gait [1,2,3]. This behavior in addition with the deficits in the balance of elderly may increase the risk of falls.

CONCLUSIONS

The cognitive deficits were directly related to the worst performance of the elderly during walking. The preservation of cognitive functions, may also reflect improvements in walking parameters.

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