

Execution and perception of older adults fallers and nonfallers performing dual task: cross-sectional study**Execução e percepção de idosos caidores e não caidores na realização da dupla tarefa: estudo transversal**

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ABSTRACT

Objective: To describe and compare the execution time and perception of older adults difficulty performing dual-task paradigm. **Methods:** This study is a cross-sectional. We included 30 older adults individuals aged 60 years or older of both sexes, 12 of whom were fallers and 18 were nonfallers. We excluded older adults with scores less than or equal to 22 on the Leganés Cognitive Test and severe mobility limitations that corresponded to scores lower than 4 on the Functional Ambulation Category scale. The evaluations were performed in a reserved room, in the afternoon shift of a single day, with an average duration of 50 minutes, by a trained examiner. **Results:** There was an increase in the execution time of the tests with a dual task condition, except for Time Up And Go test with a motor task when completed by the group of older adults fallers. **Conclusions:** The addition of motor and cognitive tasks to gait increased the execution time of the tests.

Keywords: Aging, accidental falls, gait, cognition.

RESUMO

Objetivo: Descrever e comparar o tempo de execução e a percepção dos idosos com dificuldade em executar a dupla tarefa. **Métodos:** Este estudo é do tipo transversal. Foram incluídos 30 indivíduos idosos com 60 anos ou mais de ambos os sexos, 12 que sofreram quedas e 18 que não caíam. Foram excluídos idosos com escore menor ou igual a 22 no Teste Cognitivo de Leganés, e graves limitações de mobilidade que correspondiam a escores menores que 4 na escala Categoria de Deambulação Funcional. As avaliações foram realizadas em sala reservada, no turno da tarde de um único dia, com duração média de 50 minutos, por um examinador treinado. **Resultados:** Houve um aumento no tempo de execução dos testes com uma condição de dupla tarefa, exceto no teste *Time Up And Go* com uma tarefa motora, quando realizado pelo grupo de idosos caídores. **Conclusões:** Com a adição de tarefas motoras e cognitivas à marcha, aumentou o tempo de execução dos testes.

Palavras-chave: Envelhecimento, Quedas acidentais, Marcha, Cognição.

1 INTRODUCTION

The aging of the Brazilian population occurs due to a decline in fecundity associated with an increase in life expectancy¹. According to data from the World Health Organization (WHO), it is expected that by 2025, the older adults population will consist of 50 million individuals, which is three times the number of young adults.

With senescence, several alterations occur in the systems of the human body, such as the musculoskeletal, nervous, somatosensory, visual and cardiorespiratory systems². These changes lead to large postural sways due to the insufficient control of compensatory movements and reactions to unexpected changes in support that are imposed daily by the physical environment, and this change

in posture can culminate in a decline in functionality and independence, as well as an increase in susceptibility to falls³⁻⁴.

Motor and cognitive tasks are performed simultaneously on a daily basis since they are necessary for the accomplishment of most important activities in daily life. The combination of two motor or cognitive tasks is called a dual-task (DT) paradigm⁵. With aging, changes occur that culminate in impaired function during DT activities, which is due to the decline in cognitive and physical functions that are necessary for the execution of routine motor activities⁶.

A dual-task paradigm, consisting of both motor and cognitive tasks, is capable of interfering with gait and causing, for example, a slow speed and a large variation in step and step lengths, which can be used as indicators of a predisposition to falls^{6,7}. During walking, greater attentional demand is required after the inclusion of a new motor and cognitive task, and inherent in this demand, efficient cognition is necessary for appropriate performance control⁸. Scientific evidence demonstrates that older adults fallers present worse execution time and perception of difficulty than comparison with nonfallers when they walk on straight tracks. The objective of the research was to describe and compare the execution time and perception of difficulty of older adults fallers and nonfallers in single-task and dual-task conditions in straight and nonstraight tracks.

2 METHODS

This research complied with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines⁹. It is a cross-sectional, observational and comparative study carried out in the municipality of Santa Cruz in the state of Rio Grande do Norte. The research began after the approval of the project by the Research Ethics Committee of the institution, under opinion number: 2,413,715.

The study population was composed of healthy older adults who lived in the city of Santa Cruz or in the surrounding municipalities. The sample group consisted of individuals who were selected from the list of attendees and the waiting list of the Physiotherapy School Clinic of Faculty of Health Sciences of Trairi, Federal University of Rio Grande do Norte, and who voluntarily participated in the research.

We included individuals aged 60 years or older. We excluded older adults with scores less than or equal to 22 on the Leganés Cognitive Test and severe mobility limitations that corresponded to scores lower than 4 on the Functional Ambulation Category scale.

A record was used to collect sociodemographic data, life habits, clinical-functional data and a history of falls. The groups were divided based on the self-report of falls in the last 12 months.

Individuals who reported 1 or more falls were included in the group of fallers, and those who did not report falls were entered into the group of nonfallers.

For cognitive evaluations, the Leganés Cognitive Test (LCT) was developed, and the test was developed for populations with low formal education levels. The total score ranges from 0 to 32; higher scores are associated with better performance, and the cutoff point of cognitive impairment is 22 points¹⁰.

The Functional Ambulation Category (FAC) scale was used as a way of assessing the degree of independence of the individual in ambulation with six classifications ranging from 0 to 5. A higher score corresponded to a greater degree of independence¹¹.

In the Timed Up and Go (TUG) test, the individual must walk a straight stretch of 3 meters, turn (pivot) and sit down, and the total time to complete the course is counted¹². Times greater than 11 seconds indicate an increased risk of falls and worse gait performance. The test was performed in three ways: 1) in a single-task condition, where the TUG test was performed without interference; 2) in a DT condition, where the TUG test was performed with the motor task of holding a disposable cup with 150 mL of water with the dominant limb; and 3) in a DT condition, where the TUG was performed with the cognitive task of pronouncing fruit names.

The Figure-of-Eight Walk test (F8W) evaluates dynamic balance, speed and gait functionality. The F8W is a test composed of a track with a total distance of 10 meters in length and 15 cm in width, and it is necessary to walk in the visual form of the figure 'eight'¹³. The test was performed with three variations: 1) in a single-task condition, where the F8W was performed without secondary interference; 2) in a DT condition, where the F8W was performed with the motor task of transferring buttons of varying sizes between the pockets of a standard apron with side pockets; 3) in a DT condition, where the F8W was performed with the cognitive task of pronouncing the months from the end to the beginning of the year. The measures TUG and F8W were applied in non-controlled environment which represents the natural demands by older adults in their daily lives.

To evaluate the perception of difficulty of dual tasking, the 10-item Dual-Tasking Questionnaire was used, which consists of 10 questions that evaluate the frequency that the individual experiences daily difficulties in performing two tasks simultaneously, which is classified as a score from 0 to 4; a higher score corresponds to a greater degree of difficulty in dual tasking¹⁴.

Participants were informed regarding the research and signed the terms of free and informed consent form and the authorization terms for use of images form. The evaluations were performed in a reserved room, in the afternoon shift of a single day, with an average duration of 50 minutes, by a trained examiner. Older adults were recruited in August 2017 and were evaluated between September 2017 and February 2018.

The variables F8W (and variations), TUG (and variations) and DTQ were used for comparison. The data were analyzed by the statistical software IBM SPSS Statistics 22.0, version for Windows. A normal distribution of the quantitative variables was detected by the Shapiro-Wilk test, and a descriptive analysis of the numerical and categorical variables of the sample was performed and expressed in frequency, percentage, mean and standard deviation. To compare the independent groups, we used the Chi-square test and the independent t-test, and to compare the related variables, we used the paired t-test. Values of p less than 0.05 were considered statistically significant.

3 RESULTS

A total of 143 older adults were contacted via telephone, and 36 people attended the evaluation. Six older adults were excluded from the study, one of whom had a history of stroke, one of whom was in the recent postoperative period, two of whom had mild cognitive impairment, and two of whom had a FAC score equal to two, resulting in 30 older adults in the final sample. Among the recruited individuals, 12 reported at least one fall in the last year, and these individuals comprised the group of fallers, while the remaining 18 were allocated to the group of nonfallers (figure 1).

Table 1 presents a description of the demographic characteristics of the groups of older adults fallers and nonfallers. The groups were similar in age, sex distribution, schooling, and FAC score. The clinical-functional variables of the two groups are summarized in Table 2.

It was verified that in both groups, the predominant sex was female, and the majority of the evaluated individuals had completed elementary education. There was an increase in time to complete the tests with a dual-task (DT) condition compared to those with a single-task condition for both groups, except for the TUG test with a motor task when completed by the group of older adults fallers. There was a significant difference between Timed Up and Go (TUG) test times and TUG cognitive between groups (Table 2).

Regarding the 10-item Dual-Tasking Questionnaire, it was observed higher scores of group of old adults fallers, but the difference did not reveal statistical significance when compared to the group of nonfallers (Table 2).

Figure 1 - Flowchart of recruitment and allocation of individuals

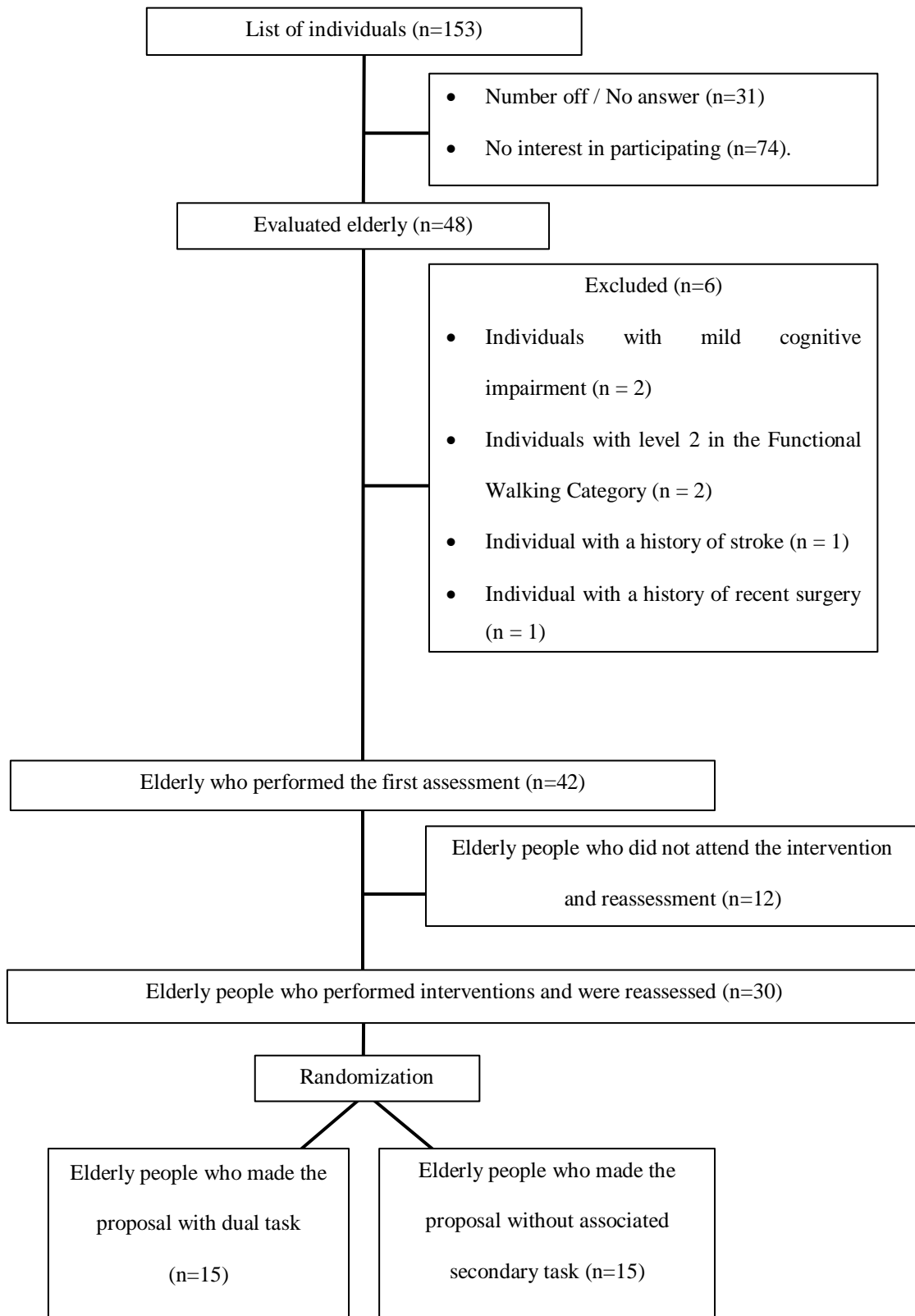


Table 1 - Demographic description of the sample populations

| Variables | Group of nonfallers (n= 18) | Group of fallers (n= 12) | p-value |
|---------------------------------------|--------------------------------|-----------------------------|---------|
| | Mean \pm SD or n (%) | Mean \pm SD or n (%) | |
| Age (years) | 68.5 \pm 5.8 | 70.4 \pm 7.5 | 0.464 |
| Sex (M/F) | 7/11 (38.9 / 61.1%) | 2/10 (16.7 / 83.3%) | 0.193 |
| Schooling | 8 | 5 | |
| Did not complete elementary school | (44.5%) | (41.7%) | 0.615 |
| Completed primary or higher education | 10 (55.5%) | 7 (58.3%) | 0.615 |

M = male; F = female; SD: standard deviation; n = number; fallers= older adults who reported one or more falls in the 12 months; p-value obtained by the Chi-square test or independent t -test.

Table 2 – Cognitive, mobility and dual task performance, group of old adults nonfallers and group of old adults fallers.

| Variables | Group of nonfallers (n= 18) | Group of fallers (n= 12) | p-value ** |
|-------------------------|--------------------------------|-----------------------------|------------|
| | Mean \pm SD or n (%) | Mean \pm SD or n (%) | |
| FAC (level 4 / level 5) | 2 / 16 (11.1 / 88.9%) | 2/10 (16.7/83.3%) | 0.661 |
| Number of falls | | | |
| 1 | | 7 (58.3%) | - |
| 2 | | 2 (16.7%) | - |
| 3 | | 1 (8.3%) | - |
| 4 or more | | 2 (16.6%) | - |
| LCT | 28.4 \pm 1.9 | 28.4 \pm 3.0 | 0.978 |
| F8W | 14.9 \pm 3.0 | 15.7 \pm 3.6 | 0.533 |
| F8W M | 18.7 \pm 6.2 * | 22.1 \pm 7.0 * | 0.151 |
| F8W C | 17.5 \pm 6.2 * | 20.5 \pm 5.4 * | 0.175 |
| TUG | 9.9 \pm 2.8 | 11.6 \pm 2.5 | 0.097 |
| TUG M | 10.9 \pm 2.6 * | 11.9 \pm 2.5 | 0.415 |
| TUG C | 12.1 \pm 3.2 * | 15.1 \pm 3.9 * | 0.022 |
| DTQ | 16.8 \pm 4.5 | 18.2 \pm 6.4 | 0.500 |

n = sample number; FAC = Functional Ambulation Category; LCT = Leganés cognitive test; F8W = Figure-of-Eight Walk test (M = motor, C = cognitive); TUG = Timed Up and Go (M = motor, C = cognitive); DTQ = 10-item dual tasking questionnaire; fallers= older adults who reported one or more falls in the 12 months; *p <0.05 obtained by comparison with the single-task condition by the Wilcoxon test; **p <0.05 obtained by the comparison between groups by the Chi-square or Wilcoxon test.

4 DISCUSSION

The present study verified that there was an increase in the temporal duration of test completion after the addition of motor and cognitive tasks in both groups, except for the addition of the motor task with the TUG test in older adults fallers. The fallers required more time to perform the

mobility test (TUG test) when combined with the cognitive task in comparison to those who did not fall. Performance in the single-task conditions was not different between groups. Regarding the perception of difficulty of the dual-task conditions, no significant difference was observed between the groups.

Age, sex distribution, degree of ambulation and schooling were similar between groups. Traldi and Santos¹⁵ also found a similar distribution of the variables age, sex distribution and schooling among a group of older adults fallers and nonfallers.

There was a predominance of females in the study groups. Studies show that the frequency of falls can be influenced by sex, with a higher frequency in females over 60 years of age^{16,17}, this result is in line with the present study, which had predominantly females among the older adults fallers group.

The Leganés Cognitive Test and the Functional Ambulation Category presented similar scores between the groups. Studies have used the Mini-Mental State Examination (MMSE) to ensure that the individuals assessed did not present cognitive dysfunction¹⁸; however, these studies do not compare the scores of individuals who are walkers and non-walkers^{19,20}. Balsalobre-Fernández et al²¹ found a weak, positive correlation between cognitive function (by MMSE) and mobility (sit-to-stand test) in older adults with a low risk of falls.

The cognitive tasks addition to TUG and F8W tests involved semantic and or episodic memory. One of the findings of the present study was the increase in gait time of older adults fallers when subject to the TUG test with a simultaneous cognitive task, inferring the reduction of walking speed. Despite the temporal difference between the faller and nonfaller groups, the two groups are similar regarding the cognitive reserve evaluated by the Leganés Cognitive Test. Factors such as motor and balance conditions may have influenced this difference.

With the F8W, the cognitive and motor task additions caused increased completion times of the test for both groups. For the TUG test, this result also occurred, except the addition of the motor task did not cause the completion time to increase. The justification for this finding is that the motor actions required for the F8W were more complex (transfer of buttons between pockets).

In his study with active older adults, Fatori et al¹⁹. used the TUG test to associate it with the motor or cognitive task. It was observed that there was an increase in the execution time of the DT condition, especially after adding the motor task, which may have occurred because the secondary motor task used in the study was more challenging than the task used in the present study. In the mentioned study, the motor task used with the TUG test was the transfer of coins between pockets, while in the present study, the task was to carry a glass with one third filled with water. The task

adopted by Fatori et al. involved bimanual coordination, whereas transporting a glass required a single limb in a static position, revealing the discrepancy in attentional demand.

During walking, rapid adjustments in direction and pivot movements occur, either to reach an object on the side or to deviate from an obstacle, and these situations can result in falls of the height of the individual. It is known that older adults are more likely to fall during changes of direction²².

The present study verified the use of the single-task and DT conditions in the nonlinear lane of the F8W in both groups, and it was verified that the addition of motor or cognitive tasks extended the time of execution of walking in a figure 8. Studies show that the F8W seems to be more sensitive to the speed of cognitive processing and may be suitable for use in older adults with balance problems or at risk of falls²³.

Despite the 4-second difference between the groups, the dual task in figure 8 caused more challenging changes of direction for both groups compared to the TUG, as this track requires more attention compared to the linear track. The daily demands of gait of the elderly can be better represented by the F8W, constituting the contribution of this study.

There was no significant difference in gait ability to walk in a figure 8 between the group of fallers and nonfallers, either for the single-task form of the test or for the dual-task form with a motor or cognitive task.

The TUG test execution time was lower than that postulated in the literature for older adults (13 seconds), while the duration of the F8W was expected than that documented in the study by Hess et al.¹³ who verified that older adults completed the test in 10 to 49 seconds. When imposed the cognitive task, the group of old adults fallers revealed a significant increase in time of the TUG test, above the time postulated in the literature, compared to the non-fallers group.

Regarding the 10-item Dual-Tasking Questionnaire, the perception of performance during the dual-task conditions was similar between the groups. The use of the Likert scale with its categories (very often, often, occasionally, rarely or never) may have influenced the older adults understanding and accuracy of the reported difficulty of dual tasking in daily life. In addition, the absence of Brazilian validation of the 10-item Dual-Tasking Questionnaire and FAC is a limitation of the study. The small sample size limits the ability to detect a potential sex difference between groups.

5 CONCLUSION

The addition of motor and cognitive tasks to gait increased the time of execution of the tests for older adults in both groups. Older fallers revealed a higher completion time of the TUG test with a cognitive task. Performance in single-task conditions was not different between groups for the TUG test. No differences were found between the gait efficiency of walking in a figure 8 between the group

of fallers and nonfallers for the single-task and dual-task conditions. Regarding the perception of difficulty of the dual-task condition, no significant difference was observed between the groups.

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