

BRAZILIAN VERSION OF THE MATTIS DEMENTIA RATING SCALE

Diagnosis of mild dementia in Alzheimer's Disease

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ABSTRACT - Objectives: To verify the diagnostic accuracy of the Brazilian version of the Mattis Dementia Rating Scale (DRS) in the diagnosis of patients with mild dementia in Alzheimer's disease (AD); to verify the interference of the variables age and schooling on the performance of the DRS. **Method:** The DRS was administered to 41 patients with mild AD and to 60 controls. In order to analyze the effects of age and schooling on the performance of the tests, patients and controls were separated into three age groups and three levels of schooling. **Results:** The cutoff score of 122 showed a sensitivity of 91.7 % and specificity of 87.8 %. Age and schooling interfered in the DRS total score and in the scores of its subscales. **Conclusion:** The DRS showed good diagnostic accuracy in the discrimination of patients with mild AD from the control individuals. In the sample examined, the effects of schooling were more marked than age.

KEY WORDS: Alzheimer's disease, dementia, neuropsychological assessment, education.

Versão brasileira da escala de avaliação de demência de Mattis: diagnóstico de demência leve na doença de Alzheimer

RESUMO - Objetivo: Verificar a acurácia diagnóstica da versão brasileira da Escala de Avaliação de Demência (DRS) no diagnóstico de pacientes com doença de Alzheimer (DA) leve; verificar a interferência das variáveis idade e escolaridade no desempenho da DRS. **Método:** A DRS foi aplicada em 41 pacientes com DA provável, de intensidade leve, e em 60 controles. Para análise das variáveis idade e escolaridade, pacientes e controles foram divididos em três grupos de idade e em três níveis de escolaridade. **Resultados:** A nota de corte 122 demonstrou sensibilidade de 91,7% e especificidade de 87,8%. Idade e escolaridade interferiram no escore total e nos escores das subescalas da DRS. **Conclusão:** A DRS demonstrou boa acurácia diagnóstica na discriminação entre pacientes com DA leve e indivíduos controles. Na população estudada, os efeitos da escolaridade foram mais acentuados que os da idade.

PALAVRAS-CHAVE: doença de Alzheimer, demência, avaliação neuropsicológica, educação.

The neuropsychological tests for dementia assessment should contain sensitive tasks to detect the most frequent cognitive domains likely to be impaired such as memory, language, orientation, attention and praxis. Schooling, age and cultural factors interfere in test accuracy, showing the importance of adequate norms to different populations. In Brazil, researchers have studied the performance of the Brazilian population in the Mini- Mental State Examination (MMSE)¹, in the *Consortium to Establish a Registry for Alzheimer's Disease* (CERAD)², in the CAMDEX³,

as well as Alzheimer Disease Assessment Scale (ADAS-cog)⁴ and in the NEUROPSI⁵, which are widely used batteries for the diagnosis of dementia.

The Mattis Dementia Rating Scale - DRS⁶⁻⁷ is used in the assessment of general cognitive status, considered by many researchers to be a very useful instrument for rating patients with dementia⁸⁻¹¹ and has frequently been used both in clinical practice and in research. It is easy to apply and briefly administered, lasting about 30 to 40 minutes in patients with dementia. The 36 tasks are grouped into 5 subscales,

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each one evaluating different cognitive areas. These are: Attention, Initiation/Perseveration (I/P), Construction, Conceptualization and Memory. In comparison with other brief batteries, the DRS presents some advantages: it provides more detailed information about the cognitive functions that are impaired or preserved, since it performs a more in-depth evaluation of a greater number of cognitive areas¹²⁻¹³, as well as having greater sensitivity to more severe forms of Alzheimer's disease (AD)⁹. The value of the DRS has been reaffirmed in that an increasing number of studies have mentioned the use of this scale in the diagnosis and discrimination of patients with AD from those with other forms of dementia, such as Parkinson's disease¹⁴, Huntington's disease¹⁵ and vascular dementia^{11,16}.

Several studies have related the DRS to neuroimaging, such as Magnetic Resonance^{13,17} and SPECT¹⁸, emphasizing the importance of this scale and specifically its subscales for establishing clinical-topographical correlations. In spite of the considerable use of the psychometric properties of the DRS, most of them have not been very well documented^{12,19,20}. In New York, USA, Coblenz et al.²¹ applied the DRS to 11 normal individuals and 20 patients with organic mental syndrome. The control subjects, with a Wechsler Intelligence Adult Scale (WAIS) intelligence quotient above 85 presented scores ranging from 140 to 144. Montgomery and Costa²² applied the DRS to a sample of 85 normal elderly people, with a mean age of 74 and a mean schooling of 12.4 years. The average for the total DRS score in this sample was 137.3 (± 6.9). The accuracy of the cutoff point of the DRS was investigated in another study carried out by Montgomery and Costa⁷ in which groups of patients with depression, psychological disorders, focal cerebral lesions and dementia were examined. None of the patients with depression, 12% of the patients with psychological disorders and 36% of the patients with focal cerebral lesion had scores below 123. However, 62% of the patients with dementia had scores below 123. The sample sizes of these studies were small and both the socio-economic level and the level of schooling of the subjects in the Montgomery sample are very high²². Thus, the data derived from these studies are not considered representative, which has led researchers to validate the scale in specific populations^{12,22,23}. Recent studies have shown the influence of age and schooling on performance in the DRS, suggesting that a single cutoff score is not appropriate for all groups of elderly people^{20,23-25}.

The main objective of this study is to verify the accuracy of the Brazilian version of the Mattis DRS in the diagnosis of mild dementia in AD and to verify the interference of age and schooling on performance in this battery.

METHOD

This study involved 41 patients with probable AD, with mild intensity dementia, aged from 53 to 88 years (mean 71.59 ± 8.41), there being 15 men and 26 women, with schooling ranging from 1 to 16 years (mean = 9.07 ± 5.31); and 60 control subjects, aged from 51 to 84 years (mean = 69.65 ± 8.49), schooling from 1 to 16 years (mean = 8.05 ± 4.62), 21 men and 39 women. The diagnosis of mild dementia was based on the criteria of the Diagnostic and Statistical Manual of Mental Disorders, Third Edition, revised (DSM-III-R)²⁶ and the diagnosis of probable AD according to the criteria developed by the National Institute of Neurological Diseases and Communicative Disorders and Stroke-Alzheimer's Disease and Related Disorders Association (NINCDS-ADRDA)²⁷. All the patients were attended by members of the Behavioral and Cognitive Neurology Unit of the Department of Neurology of the University of São Paulo School of Medicine, Brazil, and were submitted to extensive neuropsychological assessment, neurological examination, laboratory testing and neuroimaging (Computed Tomography (CT) or Magnetic Resonance (MR) of the skull). The neuropsychological evaluation consisted of the Mini-Mental State Examination (MMSE)²⁸ and tests to evaluate visual and verbal memory (subtest Visual Reproduction - Wechsler Memory Scale - WMS²⁹, Rey Complex Figure delay³⁰, Logical Memory - WMS²⁹, Rey Auditory Verbal Learning Test²², constructive skills (Block Design - Wechsler Intelligence Adult Scale-WAIS³¹, copy Rey Complex Figure³⁰, visual perception (Hooper Visual Organization Test)³², language Boston Naming Test³³ and executive functions (Trail Making Test)²².

The control group was composed of spouses or consorts of the patients, or volunteers from the community, with no memory disorders and self-sufficient in terms of daily activities. The information for inclusion or exclusion of the controls was obtained via a semi-structured interview, conducted by the researcher previous to the application of the DRS. The interview was composed of questions about memory, daily activities, medications, history of depression, brain injury, cerebral vascular accident, diabetes and arterial pressure. Subjects with neurological diseases, history of alcoholism, depression, other psychiatric disorders, non-corrected visual or auditory disorders, motor disorders, or people who consumed psychotropic drugs that could affect cognitive functions were excluded. Chronic diseases such as arterial hypertension, diabetes mellitus and cardiopathic disorders, when under good control, were not criteria for exclusion.

In order to perform the analysis of interference of age and schooling, the two groups, patients and controls, were

divided into three age groups: Group 1 from 50 to 65 years, Group 2 from 66 to 75 years and Group 3 above 75 years. Group 1 was composed of 8 patients with AD (mean age = 57.3 ± 4.74 ; mean schooling = 8.75 ± 5.35 , there being 5 men and 3 women) and 18 control subjects (mean age = 59.28 ± 5.56 ; mean schooling = 8.00 ± 4.67 ; 6 men and 12 women); Group 2, 17 patients with AD (mean age = 71.18 ± 2.40 ; mean schooling = 9.76 ± 5.11 ; 7 men and 10 women) and 27 controls (mean age = 71.11 ± 2.71 ; mean schooling = 8.26 ± 4.69 ; 8 men and 19 women); and, Group 3, 16 AD (mean age = 79.00 ± 3.08 ; mean schooling = 8.50 ± 5.76 ; 3 men and 13 women; and 15 controls (average age = 79.47 ± 2.61 ; mean schooling = 7.73 ± 4.73 ; 7 men and 8 women).

The same procedure was carried out to verify the influence of schooling, dividing the group into three levels of schooling: group of schooling (GRSC) 1 with 1 to 4 years of schooling, GRSC 2 with 5 to 11 years of schooling and GRSC 3 with more than 11 years of schooling. GRSC 1 consisted of 15 patients with AD (mean age = 73.00 ± 8.23 ; mean schooling = 3.20 ± 1.21 , 4 men and 11 women) and 26 control subjects (mean age = 70.31 ± 7.93 ; mean schooling = 3.62 ± 0.90 ; 5 men and 21 women); GRSC 2, 14 patients with AD (mean age = 69.07 ± 8.40 ; mean schooling = 9.64 ± 1.86 ; 6 men and 8 women) and 20 controls (mean age = 69.95 ± 8.41 ; mean schooling = 9.05 ± 1.61 ; 7 men and 13 women); and, GRSC 3, 12 AD (mean age = 72.75 ± 8.70 ; mean schooling = 15.75 ± 0.62 ; 5 men and 7 women; and 14 controls (mean age = 68.00 ± 9.95 ; mean = 14.86 ± 0.77 ; 9 men and 5 women).

The DRS was translated and adapted to a Brazilian version under the supervision of Dr. Beatriz Lefèvre, at that time head of the Psychology Service of the Neurology Unit of the Hospital das Clínicas of the University of São Paulo School of Medicine, with care being taken to adapt the items in this scale to the Brazilian reality. The Brazilian version of the DRS was applied to all the subjects individually in a single session and in the order prescribed by the author. The DRS tasks are presented in a fixed order, and only the Attention tests are not grouped in a sequence, as they also serve as distractors to the Memory subscale. Within each subscale, the most difficult tests are presented in first and second place, and, if performed well, subsequent items in the subscale are credited as being a correct performance. The advantage of this procedure is that it permits the shortening of the total testing time for individuals whose cognitive function are better preserved. The number of points credited for the correct response varies in accordance with the tasks and the total of points in each subscale score provides a partial score for that subscale. The partial scores are: Attention, 37 points; Initiation/Perseveration (I/P), 37 points; Construction, 06 points; Conceptualization, 39 points; and Memory, 25 points. The total possible score is 144 points.

Eight out of the 41 patients were taking cholinesterase inhibitors (donepezil or rivastigmine), six were receiving neuroleptics (mostly atypical) and 15 were taking benzo-

diazepines by the time of the neuropsychological evaluation. The dose regimens varied from patient to patient, but most of the cases were receiving low doses.

The Chi Square, Mann-Whitney, Kruskal-Wallis tests, in addition to sensitivity and specificity calculations through ROC (receiver operating characteristics) curves were used in the statistical analysis. All of the statistical analysis was carried out using the program Statistical Package for the Social Sciences (SPSS), 10.0.

RESULTS

There was no statistically significant difference between the two groups (AD and controls) in relation to gender ($p=0.87$), schooling ($p=0.31$) and age ($p=0.26$).

The mean total score on the DRS for the AD patients was $109.68 (\pm 12.03)$ and the control group, $132.55 (\pm 9.47)$. A significant difference was found in relation to the mean total score between the AD group and the controls ($p=0.000$) and in the subscales: Attention ($p=0.001$), I/P ($p=0.000$), Construction ($p=0.025$), Conceptualization ($p=0.000$) and Memory ($p=0.000$). The *box-plots* shows the differences between patients and controls in the total score (Fig 1).

The cutoff score obtained for the overall DRS was 122, with sensitivity of 91.7 and specificity of 87.8 (Fig 2). The areas under the curves, cutoff scores with respective sensitivity and specificity are presented in Table 1.

Upon analysis of the age groups 1 (50 to 65 years), 2 (66 to 75 years) and 3 (greater than 75 years), it was noted that there was no statistically significant difference between patients with AD and controls in relation to gender, schooling and age. In the three age subgroups, there is no statistically significant difference in relation to schooling, both between patients with AD ($p=0.754$) and controls

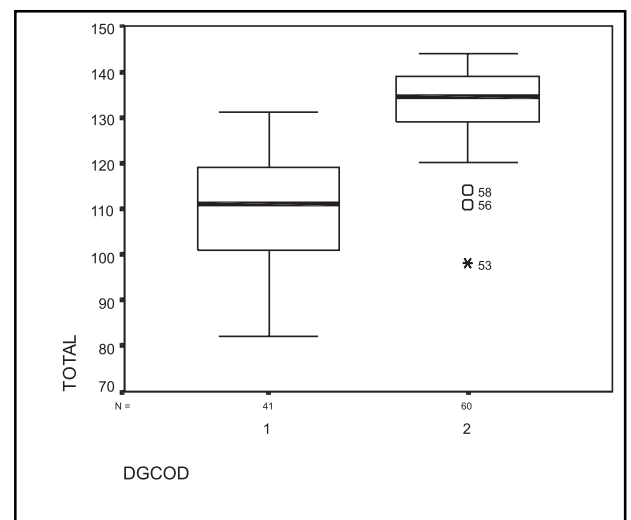


Fig 1. Differences between patients and controls in the DRS total score. DGCOD = diagnosis (1 = AD; 2 = controls).

Table 1. Areas under the Curves, Cutoff, Sensitivity and Specificity Scores for the DRS.

DRS	AUC (SE)	Maximum Points	Cutoff score*	Sensitivity	Specificity
Total	0.943 ± 0.023	144	< 123	91.7	87.8
Attention	0.694 ± 0.052	37	< 36	60.0	73.2
I/P	0.829 ± 0.041	37	< 33	73.3	78.0
Construction	0.590 ± 0.059	6	< 6	88.3	29.3
Conceptualization	0.786 ± 0.046	39	< 34	71.7	65.9
Memory	0.980 ± 0.011	25	< 19	93.3	92.7

DRS, Dementia Rating Scale; I/P, initiation/perseveration; AUC, area under curve; SE, standard error. *individuals with score below the cutoff score are impaired.

Table 2. Performance of patients with AD and controls, in each age group, on total DRS and subscales.

DRS	GROUP 1		GROUP 2		GROUP 3	
	AD	Controls	AD	Controls	AD	Controls
N	8	18	17	27	16	15
Attention						
Mean	33.5	35.33	34.41	35.19	34.00	35.47
SD	1.41	2.06	2.29	1.82	2.00	1.64
p	0.01		0.243		0.034	
I/P						
Mean	29.5	34.33	28.88	34.07	26.63	32.67
SD	3.66	4.38	5.51	3.7	5.66	5.09
p	0.003		0.001		0.002	
Construction						
Mean	5.38	5.78	5.71	5.78	5.25	5.87
SD	0.92	0.65	0.77	0.8	1.18	0.35
p	0.145		0.558		0.099	
Conceptualization						
Mean	28.25	34.28	30.59	35.52	28.88	35.00
SD	8.31	6.09	4.95	3.68	6.24	4.93
p	0.115		0.001		0.002	
Memory						
Mean	11.38	23.39	13.88	22.41	11.75	21.8
SD	3.02	1.72	3.92	2.02	2.98	3.95
p	0.000		0.000		0.000	
Total						
Mean	108.00	133.11	113.47	133.15	106.5	130.8
SD	14.21	11.42	10.15	6.33	12.38	11.86
p	0.000		0.000		0.000	

I/P, initiation/perseveration subscale; SD, standard deviation. Mann-Whitney Test ($p < 0.05$).

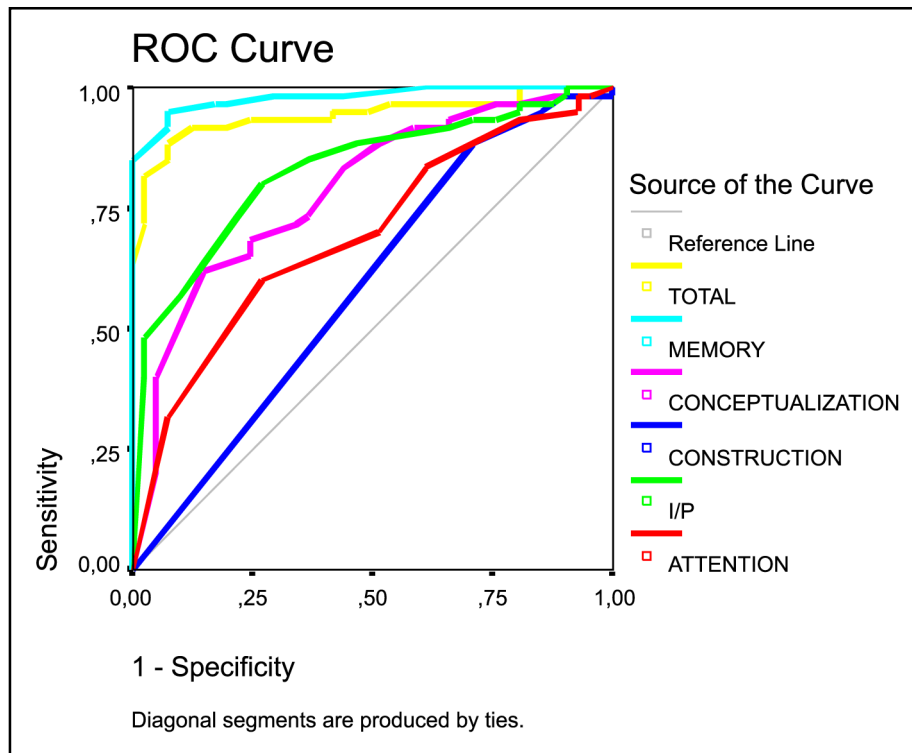


Fig 2. ROC curves (receiver operating characteristics) for the total and subscales of the DRS.

($p=0.957$). The performance of the patients with AD and controls, total and in the subscales of the DRS, was compared in each age group (Table 2).

In the intergroup analysis, there were no significant differences between the age groups for both AD patients and controls, in both the subscales and the total scores for the DRS ($p>0.1$).

There was no statistically significant difference between AD patients and controls in relation to the variables gender and age when we analyzed the three levels of schooling: GRSC 1 (1 to 4 years), GRSC 2 (5 to 11 years) and GRSC 3 (greater than 11 years). The schooling of patients and controls was statistically different in GRSC 3: AD, mean of 15.75 ($=0.62$) and median of 16; controls, mean of 14.86 ($=0.77$) and median of 15 ($p=0.002$). Table 3 shows the performance of patients with AD and controls in both the total DRS and the subscales.

The performance of the AD patients within each group by years of schooling was compared and a statistically significant difference was established in the subscales Attention ($p=0.043$), Conceptualization ($p=0.004$), Memory ($p=0.047$) and for the total score ($p=0.005$). The same procedure was followed for the control group and a statistically significant difference was established only in the I/P subscale.

There were no significant differences between the performance of patients on treatment either with

cholinesterase inhibitors, neuroleptics and benzodiazepines and those who were not on treatment with these drugs on the DRS (data not shown).

DISCUSSION

The Brazilian version of the DRS is relatively easy to apply and, in the population studied, presented good diagnostic accuracy, differentiating patients with mild AD from the control group. The cutoff score of 122 showed sensitivity of 91.7% and specificity of 87.8%. Difficulties with memory and verbal fluency are recognized as being associated with the first stages of AD, which would explain the significant differences between the patients with AD and the control subjects in the Memory and I/P subscales. The high degree of sensitivity of the I/P subscale is due to the verbal fluency test, accounting for 75% of the total score of this subscale^{12,34}.

When we compare the performance of the AD patients and controls it is possible to observe a significant difference in all the subscales and in the overall DRS. However, when we separate these same subjects into groups by age and level of schooling, it is possible to see differences that demonstrate the influence of these factors in the DRS. As far as age is concerned, significant differences were observed in each of the age groups between AD patients and

Table 3. Performance of patients with AD and controls, in each schooling group, on total DRS and subscales.

DRS	GRSC 1		GRSC 2		GRSC 3	
	AD	Controls	AD	Controls	AD	Controls
N	15	26	14	20	12	14
Attention						
Mean	33.4	34.69	33.79	35.85	35.25	35.64
SD	2.13	2.04	1.89	1.79	1.60	1.08
P	0.053		0.001		0.632	
I/P						
Mean	26.67	32.81	28.79	33.2	29.17	36.50
SD	4.76	4.61	5.01	4.51	6.22	1.16
P	0.000		0.004		0.000	
Construction						
Mean	5.07	5.77	5.79	5.95	5.58	5.64
SD	1.22	0.59	0.43	0.22	1.00	1.08
P	0.024		0.149		0.870	
Conceptualization						
Mean	26.8	34.5	28.21	35.3	34.25	35.57
SD	5.73	5.17	5.89	4.40	4.09	4.72
P	0.000		0.000		0.181	
Memory						
Mean	10.8	22.69	13.93	21.85	13.17	23.29
SD	2.46	2.04	3.81	3.51	3.61	1.77
P	0.000		0.000		0.000	
Total						
Mean	102.73	130.65	110.5	132.15	117.42	136.64
SD	10.57	9.67	11.26	10.67	10.13	5.94
P	0.000		0.000		0.000	

I/P, initiation/perseveration; SD, standard deviation. Mann-Whitney Test ($p < 0.05$).

controls in the total score and some subscales. In the Conceptualization subscale, the differences between AD and controls occurred only in the two older groups, not in the age group from 50 to 65 years. As for the Attention subscale, significant differences were observed in the age groups 50-65 and > 75. The I/P and Memory subscales were statistically different in all the age groups. With respect to level of schooling, significant differences occurred among patients with AD in the subscales Attention, Conceptualization, Memory and in the total DRS. The analysis of the performance among the controls in the three different groups by level of schooling showed a significant difference only in the I/P subscale. Significant differences between patients and controls were observed in all the groups of schooling, among patients and controls, in the I/P and Memory subscales and in the total DRS. Patients and controls with a low level of schooling (GRSC 1) differed significantly in the Construction subscale. The Concep-

tualization subscale presented a statistically significant difference between patients and controls in GRSC 1 and 2, but not in GRSC 3, whilst the Attention subscale presented a significant difference in the GRSC 2.

The results found in this study confirm the influence of the variables age and schooling in the DRS^{12,20,24,25}. The Conceptualization subscale, which contains tasks related to abstraction and semantic memory, showed sensitivity both to the variables age and schooling. In a study conducted by Bennett et al.²⁴, elderly people in their eighties and nineties, without dementia, showed poor performance in tasks involving abstraction and verbal fluency, suggesting that the cognitive decline associated with age is related to symptoms of frontal lobe dysfunction. Our findings suggest that the decline observed by these authors is even more accentuated in patients with AD. The interference of schooling in the Conceptualization subscale could be detected only in those individuals with less than 11 years of schoo-

ling, permitting the conclusion that impairment to semantic memory and abstraction is more intense in the initial phases of AD where schooling is less than 11 years.

The Construction subscale, considered to have little sensitivity to the effects of age and schooling²⁴, appeared to be influenced by low levels of schooling. The tasks in this subscale are the copying of geometrical figures and writing the name, which although relatively easy, become more complex for individuals with very low levels of schooling. Normal elderly people with less than 11 years of schooling present worse performance in the I/P subscale, demonstrating the influence of schooling on this subscale. The results found in relation to the Attention subscale deserve further investigation as they are not usually referred to in the literature on the subject.

Our findings reaffirm the value of the DRS in the differential diagnosis between mild AD and controls and shows the importance of norms for this scale for the Brazilian population, taking into account the effects of age and schooling. In this sample population, the effects of the variable schooling were more evident than the effects of the variable age. Further work is being planned to validate these findings for the Brazilian population.

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