Evaluación Neuropsicológica de la Atención: Test de Símbolos y Dígitos.

Neuropsychological Assessment of Attention: Symbols And Digits Test.

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Resumen

Introducción: El test de símbolos y dígitos es un reactivo de gran apoyo en la evaluación neuropsicológica. Su ejecución permite la valoración de funciones cerebrales como la percepción visual, el reconocimiento de estímulos, la atención (focalizada, selectiva y sostenida), supervisión de tareas, control de la interferencia y otras. **Objetivo:** En el presente artículo se reporta una investigación que tuvo como finalidad analizar los percentiles normativos de la ejecución del test, identificar las diferencias en el rendimiento del reactivo, según grupo etario y género de los valores del test al ser aplicado en una muestra de estudiantes universitarios. **Método:** La muestra estuvo conformada por 250 estudiantes universitarios, 142 (56,8%) hombres y 108 (43,2%) mujeres. El rango de edad de los participantes fue entre 18 y 34 años de edad (M=21,53, DE=2,25). Se utilizó un diseño de investigación cuantitativo, transversal, no experimental y alcance correlacional. **Resultados:** Se encontró que la media de aciertos en el test es de 52,83 (DE=13,60) y en el percentil P5 se encontraron 31,55 aciertos; el el percentil P25 existieron 46,00 aciertos, en el percentil P75 se hallaron 60,00 aciertos y en el percentil P95 se encontraron 74,45 aciertos. No se encontraron diferencias significativas en la media de errores del test, considerando el grupo etario $f(3, 246)=0,67$, $p=0,57$ y género $t(248)=0,68$, $p=0,49$ de los participantes como factor de comparación. **Conclusiones:** Se discuten los resultados en torno a investigaciones previas, mencionando la importancia de contar con un primer parámetro estadístico del test como base para la práctica clínica neuropsicológica en Ecuador.

Palabras clave: test de símbolos y dígitos, SDMT, universitarios, Ecuador, neuropsicología.

Abstract

Introduction: The symbol digit modality test is a reactive which provides great support in neuropsychological evaluation. Its execution permits to evaluate brain functions such as visual perception, stimuli recognition, attention (focal, selective and sustained), task supervision, interference control among others. **Object:** The purpose of the current research study was to analyze the normative percentiles of the execution of the test, to identify the performance activity of the reactive according to age group and gender; applying the test in a sample of college students. **Method:** The sample included 250 university students,142 (56.8%) males and 108 (43.2%) females. The age range of the participants was between 18 and 34 years old (M=21.53, DE=2.25). A transversal, non-experimental, quantitative research model with a correlational scope was used. **Results:** The correct answer average for the test was 52.83 (DE=13,60) and for percentile P5 31,55 right answers were found; for percentile P75 60,00 right answers, P25 had 46,00 right answers, and for P95 74,45 right answers were found. No significant differences were found for the mean of errors in the test in terms of age group $f(3, 246)=0,67$, $p=0,57$ and gender $t(248)=0,68$, $p=0,49$ of the participants as comparison factor. **Conclusions:** Results were discussed based on prior research pointing out the importance of counting with a first statistical parameter of the test as ground for neuropsychological clinical practice in Ecuador.

Keywords: Symbol Digit Modality Test, SDMT, university college students, Ecuador, neuropsychology.

Introduction

The Symbol Digit Modalities Test, also known for its acronym SDMT, is an experimental task for the detection of possible brain dysfunctions in children and adults. The activity performed during the test to be evaluated consists on converting a series of symbols, with different shapes, into numbers using the key provided on the test.[1]

SDMT is part of typical neuropsychological pen and paper type-specific tests, used to evaluate a particular neuropsychological function.[2] Its content is based on 120

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stimuli distributed into 8 rows per sheet for its application. It takes 5 minutes to be completed and it can be applied individually or collectively. There the possibility to use oral or visual versions.

The visual version of the SDMT (format of interest for the current study) allows evaluating quickly and as an initial exploration, the presence of brain problems with manual, motor, visual or learning implications. On the other hand, the oral version permits to analyze reading capabilities or difficulties, or speech impairments, and the state of connections in neurophysiological areas of visual recognition, comprehension and oral articulation can be appreciated.[1]

SDMT has been identified as an important tool for the evaluation and neuropsychological diagnosis of humans. For example, it has been stated that the test contributes to the evaluate focal or selective attention,[3] execution intelligence, discrimination and visual precision facing abstract stimuli, short term memory, cognition flexibility,[4-5] cognitive deterioration for multiple sclerosis.[6-7] It is also used as a tool to diagnose ADHD[8], cognitive functioning on patients suffering a major depression disorder,[9] information processing speed of patients with brain problems,[10] among other areas of interest in neuropsychology.

Based on this explanation, it is of vital importance to have SDMT parameters in Ecuador so we can use the test in our context, and specially, on our line of research, to apply SDMT on university students.

Reviewing the mail research databases such as Scopus, Thomson Reuters, Scielo and Latindex, it was evidenced that there is a lack of studies where the performance of students of all educational levels in Ecuador has been analyzed; even less where clinical population results have been studied. In this sense, and based on the lack of prior research, proposing a research study where normative and descriptive performance values can be analyzed for this test was eminent. The resulting data can be useful to determine reference values of great utility for the clinical and scientific Ecuadorian context interested in the analysis of neuropsychological functions involved during the execution of SDMT.

Method
Participants
The sample included 250 young university students, 142 (56,8%) men and 108 (43,2%) women. The age range was between 18 and 34 years old (M=21,53, DE=2,25). All the students belonged to private universities of Quito, Ecuador. As far as the socioeconomic level of the participants, they all belong to middle, upper-middle and high class. All college students who participated showed a neuropsychological development within normal parameters during their evaluation.

Information Gathering Procedure
The visual version of the SDMT was applied in groups of 25 students.

Data Analysis Plan
For the descriptive analysis, central tendency and dispersion measures were used. In terms of inference processes, we applied Pearson correlation, Student's t-test for group comparison and Anova for one factor.

Results
In terms of percentiles (P), the number of right answers show that P5 had 31,55 correct answers; P25 had 46; P75 had 60; and p95 had 74,45 right answers. Table 1 illustrates descriptive statistics of the resulting scores.

The analysis of means between men and women found that for total errors $t_{(248)}=0,68$, p=0,49 and total omissions $t_{(248)}=1,54$, p=0,12 the result does not show statistical differences of significance. Nevertheless, for total hits, there were significant differences, where women had a higher performance with respect to men $t_{(248)}=2,07$, p=0,04 (see figure 1).

Table 1. Bivariate associations between population characteristics and the presence or not of having cardiovascular diseases in the US in 2013.

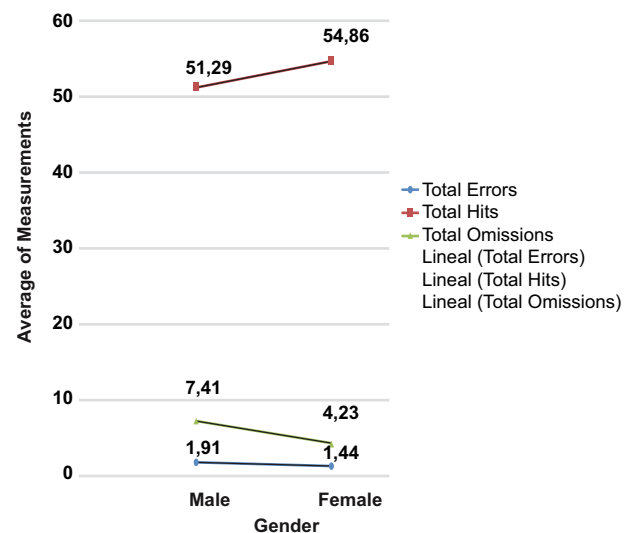|	N	Minimum	Maximum	Media	Standard Deviation
Total errors	250	0	78	1,70	5,39
Total hits	250	10	108	52,83	13,60
Total omissions	250	0	82	6,03	16,22

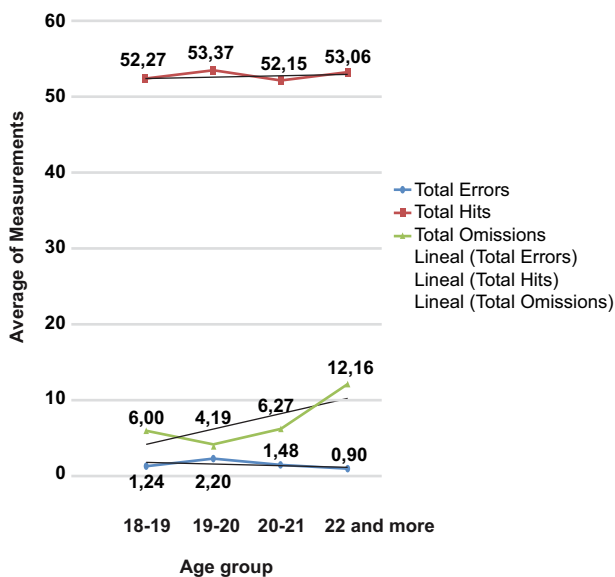**Figure 1.** Men and women mean differences.

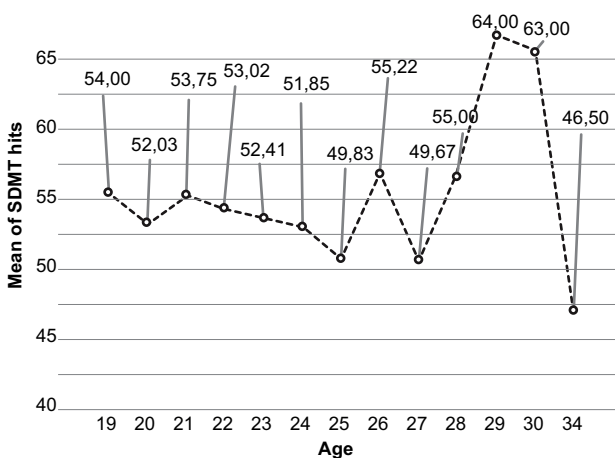**Figure 2.** SDMT performance variables according to age group range.

Figure 3. Central Tendency Values according to participant´s age.

The correlation analysis between the different variables evaluated during the SDMT found that total hits is inversely correlated to total errors (r=-025, p<0,001) and total omissions (r=-0,17, p=0,007).

Comparing means of total hits $f_{(3, 246)}$=0,14, p=0,94; total errors $f_{(3, 246)}$=0,67, p=0,57 and total omissions $f_{(3, 246)}$= 1,98, p=0,12 when considering four factors of age rages, showed there are no significant statistical differences (see figure 2). Figure 3 illustrate the means of hits of the applied SDMT according to the age of the subjects.

Discussion

The current paper has made a normative and descriptive analysis for the interpretation of the SDMT test when applied to a sample of college students of Ecuador. Findings showed the average hits or correct answers for young participants, 18 years old or older, will be 52,83; which is concordant with prior research results, such as one of Spain where the hits mean was 49,10 for a sample of 1036 subjects over 20 years old.[7] Another normative study of SDMT performed in Spain as well that counted with 1307 young participants between 18 and 24 years of age, with normal development, of similar characteristics as the ones of our study, shows an average of 54,40 hits, while for participants 25 to 34 years old the mean was 53,30 for hits on the test.[1] Finally, a study performed in Italy found a mean for errors of 56,3 in a sample of 273 young adults without any pathology.[12]

As far as percentile values, prior research in Spain reported the following findings: 25 (P5), 42 (P25), 50 (P75), 57 (P75) and 59 (P95), while in our research results were 31 (P5),55 (P25), 46 (P50), 60 (P75), 74,45 (P95). These are similar results which enlighten us, at least basically, since there is no prior research, and will lead us to further research to understand normal and pathological performance during the SDMT test of university students.

As far as the difference between men and women, our research shows a similar performance for both of them. On the other hand, in terms of number of hits, women reach a higher score in the SDMT. This result is not concordant with prior research[1,7,13] where findings state that gender has no inference in the performance of attention evaluation instruments. Nevertheless, our study shows a 3,5 error difference and la minimum level of significance; which can´t lead to a significance difference with certainty specially at a clinical level.

With respect to the relationship between SMDT performance and the age of the participants, as seen in prior research papers, findings show that this variable has no significant correlation for subjects 18 to 30 years old. This result makes complete sense when compared to nervous system theoretic background which states that for humans 18 years old or older, brain processes involved with visual perception are completely mature; hence there will be no change during this age range.[11]

A constraint that needs to be highlighted for this study lays in the fact that the sample used for the research was taken only from one city of Ecuador, which means that results will apply for the described context. Although there is no prior research data, this paper is an important contribution and can be used as reference in order to interpret SDMT resulting data.

On this line, as further research, we seek to analyze the oral version of the SDMT and relate its performance results with the findings obtained from the current study. Furthermore, it will be interesting to analyze the correlation of the test with other psychometric instruments used to evaluate similar cognitive functions.

Conflict of Interest Statement

Authors affirm there are no relevant conflicts of interest present on this study.

Sources of Financing

The current research did not receive any kind of financing.

Ethical Compliance Statement

All procedures applied during this research followed Helsinki´s Statements. The physical and psychic integrity of subjects were preserved at all times. An informed content was signed by all participants once all the objectives of the study were explained and prior to taking the SDMT.

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