



ORIGINAL

Intellectual Quotient and Cognitive Indices in children with and without ADHD in the city of Tepatitlán de Morelos, Jalisco

Coeficiente Intelectual e Índices Cognoscitivos en niños con y sin TDAH de la Ciudad de Tepatitlán de Morelos, Jalisco

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Cite as: Tornel Avelar JL, Cruz Alcalá LE. Intellectual Quotient and Cognitive Indices in children with and without ADHD in the city of Tepatitlán de Morelos, Jalisco. *Seminars in Medical Writing and Education*. 2024; 3:482. <https://doi.org/10.56294/mw2024482>

Submitted: 01-10-2023

Revised: 21-02-2024

Accepted: 07-05-2024

Published: 08-05-2024

Editor: PhD. Prof. Estela Morales Peralta 

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ABSTRACT

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder that is between 5 and 8 % of the child population. It was classified clinically by the presence of attention deficit, hyperactivity and impulsivity. Recent research will indicate the presence and the increase in time in school activities in the region of Los Altos de Jalisco, which points to the need to obtain a precise cognitive profile in this regard. With the previous objective, we describe the results of the Intelligence Scale for Children, Fourth Edition (WISC-IV), applied to children with ADHD and children without the disorder, including the range of 6-11 years of age, in a population total of 89 children, 44 with ADHD (49,4 %) and 45 without ADHD (50,6 %), of these, 62 (69,66 %) correspond to the male sex and 27 (30,33 %) are female, using statistical analyzes Levene for equality of variances, test for equality of means and Pearson's correlation coefficient (p). The results are not shown. The results are differentiated between the Work Memory Index (IMT), Perceptual Reasoning (IRP), Verbal Comprehension (ICV) and the Total Intellectual Coefficient (CIT). However, if it occurred (0,036 T <0,05). This result is significant to characterize the ADHD group with a cognitive level with a higher IVP score, unlike the group without ADHD. However, a significant index of the same index (IVP) was also identified in the correlation in the increase in age (closer to 11 years of the 6-11 range) in subjects with ADHD (0,006 p <0,01), which is an important finding to identify a cognitive profile of the disorder in the region.

Keywords: Infant ADHD; Cognitive Profile; Iq; Cognitive Indexes.

RESUMEN

El déficit de atención con hiperactividad (TDAH) es un trastorno del neurodesarrollo que afecta entre el 5 y 8 % de la población infantil. Se caracteriza clínicamente por la presencia de déficit atencional, hiperactividad e impulsividad. Investigaciones recientes señalaron la presencia e incremento del trastorno en escolares de la región de los Altos de Jalisco, lo que apunta a la necesidad de obtener un perfil cognoscitivo preciso al respecto. Con el objetivo previo, se describen los resultados de la Escala de Inteligencia Wechsler para Niños, Cuarta Edición (WISC-IV), aplicada a niños con TDAH y niños sin el trastorno, comprendiendo el rango de 6-11 años de edad, en una población total de 89 niños, 44 con TDAH (49,4 %) y 45 sin TDAH (50,6 %), de los mismos, 62 (69,66 %) corresponden al sexo masculino y 27 (30,33 %) son del sexo femenino, utilizando los análisis estadísticos de Levene para la igualdad de varianzas, prueba T para la igualdad de medias y el Coeficiente de correlación de Pearson (p). Los resultados obtenidos no muestran resultados con diferencias significativas entre los índices de Memoria de Trabajo (IMT), Razonamiento Perceptual (IRP), Comprensión Verbal (ICV) y el Coeficiente Intelectual Total (CIT). Sin embargo, respecto a la distancia entre el Índice Velocidad de Procesamiento (IVP) si se presentó (0,036 T < 0,05). Este resultado es significativo para caracterizar al grupo de TDAH con un nivel cognitivo con una mayor puntuación en IVP a diferencia del

grupo sin TDAH. No obstante, a pesar de este resultado, también se identificó un atraso significativo del mismo índice (IVP) en correlación al incremento de la edad (más cercano a los 11 años del rango 6-11) en los sujetos con TDAH ($0,006 p < 0,01$), lo que es un hallazgo importante para identificar un perfil cognitivo del trastorno en la región.

Palabras clave: TDAH Infantil; Perfil Cognitivo; C.I.; Índices Cognoscitivos.

INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) is a neuropsychiatric condition that affects childhood and can persist into adolescence and adulthood. Difficulties in attention, impulsivity, and, in some cases, hyperactivity characterize it. Its impact on children's cognitive and academic development has been widely studied, leading to the implementation of various methodologies to understand its effects on intellectual performance better. In this context, the present study focuses on the evaluation of the cognitive profiles of children diagnosed with ADHD in comparison with those without the disorder, using the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV).

The research aims to describe and analyze the significant differences in the cognitive profiles between the two groups using a quantitative approach based on the application of standardized tests. The WISC-IV, a widely validated tool for the assessment of child intelligence, allows the measurement of different aspects of cognitive functioning, including Verbal Comprehension (VCI), Perceptual Reasoning (PRI), Working Memory (WMI), and Processing Speed (PSI), in addition to the Total Intelligence Quotient (TIQ). These indexes offer a comprehensive view of children's cognitive capacities, which facilitates the identification of distinctive patterns in those with ADHD.

The study was carried out with a sample of 89 children aged between 6 and 11, selected from a general database of children evaluated and diagnosed within the framework of the research project on Risk Factors of ADHD in children from Tepatitlán de Morelos, Jalisco. Two groups were formed: 44 children diagnosed with ADHD and 45 children without the disorder. The methodology used was descriptive and comparative, with a cross-sectional design identifying significant differences between the groups in the various cognitive indices.

This study is distinguished by its focus on the Mexican child population, thus contributing to understanding ADHD in a specific context and providing valuable information for educational and clinical intervention. The standardization of the WISC-IV in Mexico supports the validity and reliability of the results obtained. Likewise, it is recognized that, although the analyzed sample is relatively small, the findings can provide relevant knowledge about the impact of ADHD on cognitive development and facilitate support strategies for children with this diagnosis.

Objective

The main objective of the research is to describe any significant differences (0,05) in the WISC-IV test, comparing the evaluations of children diagnosed with attention deficit hyperactivity disorder and children without the disorder, both primary school groups from the city of Tepatitlán de Morelos, Jalisco, obtaining a more precise cognitive profile of ADHD in the region.

What differences are there in the IQ and cognitive indices between children diagnosed with ADHD and those without the disorder in Tepatitlán de Morelos, Jalisco?

METHOD

The present study describes the significant differences determined through a quantitative approach, which consisted of analyzing reliable data on the cognitive profiles of both contrast groups, due to the WISC-IV, which is a validated and standardized measurement instrument for the Mexican population.

The Research Ethics Committee of the University Center of Los Altos University of Guadalajara approved the study. Before diagnosis, parents or legal guardians signed an informed consent (Annex 1) by analyzing Risk Factors for Attention Deficit Hyperactivity Disorder in children in Tepatitlán de Morelos, Jalisco. The study was explained to them, and they agreed to participate while maintaining complete anonymity and using results for publication for academic purposes.

Type of research: This is a descriptive and comparative study. A cross-sectional study was used between two diagnostic groups of primary school students from the city of Tepatitlán de Morelos, Jalisco: one group diagnosed with attention deficit disorder (ADHD) and a second group without the Disorder.

The comparative description will be of the results obtained in the intelligence test that was applied to them.

The IQ of the subjects of the analysis was measured using the Wechsler Intelligence Scale for Children Fourth Edition (WISC-IV). The different indexes on the scale were analyzed to obtain the following composite scores:

Total Intelligence Quotient (TIQ), Verbal Comprehension (VCI), Perceptual Reasoning (PRI), Working Memory (WMI), and Processing Speed (PSI).

Population: From the general database of children evaluated and diagnosed for the research project on Risk Factors for Attention Deficit and Hyperactivity Disorder in children in the city of Tepatitlán de Morelos, Jalisco, led by Dr. Leonardo Eleazar Cruz Alcalá, out of a total population of 180 children, 89 boys and girls who met the criteria for the study were selected.

SAMPLE: The Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV) was applied to 180 children between 6 and 11 years of age enrolled in public and private educational institutions in the city of Tepatitlán de Morelos, Jalisco. Only 44 previously diagnosed with Attention Deficit Disorder and 45 who did not present the Disorder participated in this study.

Selection Criteria

Approximately 50 % of the subjects had to present a diagnosis of ADHD as established in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Revised (DSM-IV-TR); the other 50 % did not present it, this being endorsed by a medical and psychological diagnostic protocol.

Both groups belonged to an age range between 6 and 11 years old, as well as studying in educational institutions and, those who were given the WISC-IV presented informed consent approved and signed by the father, mother, or legal guardian for statistical and research use.

Exclusion Criteria

The subject's Total Intelligence Quotient (TIQ) must not be evaluated below 70, which is interpreted as a very low IQ; based on the average, it can be associated with an Intellectual Disability or an Intellectual Developmental Disorder (American Psychiatric Association, 2013), or above 130, which indicates a result well above the average range. A CIT greater than or equal to 2 SDs above the standardized normative mean of cognitive ability is usually associated with identifying gifted children (The Psychological Corporation, 2003; Winner, 1997, 2000 cited in Flanagan & Kaufman, 2012). Failure to present informed consent approved and signed by the parent or legal guardian for statistical use in research.

Scope and Design

A descriptive-comparative design was carried out between two groups (ADHD and subjects without ADHD) for the analysis of the information (significant differences [0,05]) existing in the results obtained in the WISC-IV test applied to children with ADHD and to children without the Disorder, where their Intelligence Quotient and indices of Verbal Comprehension, Perceptual Reasoning, Working Memory and Processing Speed were evaluated, according to sex and in the range of 6-11 years of age. The cognitive profiles, derived from the research on Risk Factors for Attention Deficit and Hyperactivity Disorder in children in the city of Tepatitlán de Morelos, Jalisco, were analyzed with IBM SPSS Statistics Standard, version 24.0.0.0, according to the hypothetical construct of the study.

It is recognized that such a small study group generates a limitation in terms of population representativeness; however, for the purposes of this comparison work, it is not considered inadequate.

Instrument

The interpretation of the results contained in this report is based on the method proposed by Flanagan and Kaufman (2012) in the book *Keys to Assessment with the WISC-IV 2nd Edition*.

The WISC-IV was developed to provide a general measure of cognitive ability. It consists of a battery of individually administered cognitive tests that measure the intellectual ability of children aged 6 to 16. Although the full version of the WISC-IV has 15 subtests, only 10 are considered core and are used more often. These are combined to obtain four composite scores representing intellectual functioning in specific cognitive domains, called cognitive functioning indices, in addition to a measure of general intelligence: Verbal Comprehension (VCI), Perceptual Reasoning (PRI), Working Memory (WMI), Processing Speed (PSI) and Full-Scale IQ (FSIQ) (Wechsler, WISC-IV Wechsler Intelligence Scale for Children-IV. Technical Manual, 2007). The current Wechsler Scales are based on the following hypotheses (Wechsler, 2007):

1. Using the tests, it is possible to quantify a complex phenomenon such as intelligence, considering its various component factors.
2. Intelligence must be defined as the potential that allows the individual to confront and resolve particular situations.
3. Intelligence is necessarily related to the biological compounds of the organism.

The Verbal Comprehension Index (VCI) expresses abilities in the formation of verbal concepts, relationships between concepts, richness, and precision in word definitions, social understanding, practical judgment, acquired knowledge, agility, and verbal intuition. The Perceptual Reasoning Index (PRI) expresses constructive

praxis abilities, formation and classification of nonverbal concepts, visual analysis, and simultaneous processing.

The Working Memory Index (WMI) analyzes the capacity to retain and store information, mentally operate with it, transform it, and generate new information.

The Processing Speed Index (PSI) measures the ability to focus attention and explore, order, and/or discriminate visual information quickly and efficiently.

Finally, the Total Intelligence Quotient (TIQ) includes the scores for the four indices and provides a relative measure of the cognitive functioning or general ability of the person being evaluated with respect to the subjects in the normative group (that is, a group of children of the same age).

The examiner only has to report the percentile rank associated with the scalar scores obtained from the child. Quick reference 4-1 presents a practical guide to locating the tables in the WISC-IV Administration Manual (Wechsler, 2007) and the WISC-IV Technical Manual (Wechsler, 2007), which the examiner will need in order to convert raw scores to scaled scores and standard scores, to convert the sums of the scaled scores to the CIT and the Indices, and to obtain the confidence intervals and percentile ranks. Examiners should always report standard scores with their associated confidence intervals. The WISC-IV system, found in figure 1, is the most traditional of the three and recommended by the test's editor (Flanagan & Kaufman, 2012).

<i>Rango de puntuaciones estándar</i>	<i>Descripción del desempeño</i>
130 y más	Muy superior
120 a 129	Superior
110 a 119	Promedio alto
90 a 109	Promedio
80 a 89	Promedio bajo
70 a 79	Límite
69 y menos	Extremadamente bajo

Figure 1. Traditional descriptive system for the WISC-IV (Taken from Wechsler, WISC-IV Wechsler Intelligence Scale for Children-IV. Technical manual, 2007)

The normative, descriptive system, which appears in figure 2, is the one most used by neuropsychologists and will become the most used by clinical and educational psychologists (Flanagan, Ortiz & Alfonso, 2007; Flanagan et al., 2002, 2006; Kaufman & Kaufman, 2004 cited in Flanagan & Kaufman, 2012).

Finally, it should be noted that the WISC-IV was standardized in the United States with a sample of 2200 subjects and in Spain with a sample of 1485 subjects, in all cases aged between 6 and 16 years. Both the original American version and the Spanish adaptation offer results with special groups.

<i>Rango de puntuaciones estándar</i>	<i>Clasificación descriptiva</i>	<i>Descripción del desempeño</i>
131+ 116 a 130	Extremo superior Arriba del promedio	Fortaleza normativa > +1 DE ≤ 116
85 a 115	Rango promedio	Rango promedio ± 1 DE, incluso 115
70 a 84 ≤ 69	Abajo del Promedio Extremo inferior	Debilidad normativa < - DE ≤ 84

Figure 2. Normative descriptive system for the WISC-IV (Taken from Flanagan & Kaufman, 2012 p. 118)

Categorization and Operationalization of Variables

<i>Variables de intervalo</i>	<i>Variables de razón</i>	<i>Variables nominales</i>
CIT	Edad (6 a 11 años)	Diagnostico TDAH
ICV		Sexo (hombre-mujer)
IRP		
IMT		
IVP		

Figure 3. Categorization of study variables

<i>Variable</i>	<i>Dimensión</i>	<i>Definición conceptual</i>	<i>Indicador</i>
Edad		Edad del sujeto	Años cumplidos
Sexo		Sexo del sujeto	Hombre o mujer
Diagnóstico de TDAH	Patología clínica	Trastorno del neurodesarrollo	Presencia de déficit atencional, hiperactividad e impulsividad inapropiados.
CIT	Cognición	Nivel de valoración de inteligencia general del sujeto evaluado.	Incluye el puntaje de los cuatro índices y proporciona una medida relativa del funcionamiento o habilidad cognitiva general del evaluado.
ICV	Cognición	Decodificación de la palabra y la comprensión e interpretación de los mensajes, que leen o escuchan.	Expresa habilidades de formación de conceptos verbales, relaciones entre conceptos, riqueza y precisión en la definición de vocablos, comprensión social, juicio práctico, conocimientos adquiridos, agilidad e intuición verbal.
IRP	Cognición	Organización de información que se presenta perceptualmente al individuo, por medio del razonamiento abstracto.	Expresa habilidades prácticas constructivas, formación y clasificación de conceptos no-verbales, análisis visual y procesamiento simultáneo.
IMT	Cognición	Capacidad de retener la información operaria y usarla con precisión en la resolución de problemas.	Analiza la capacidad de retención y almacenamiento de información, la capacidad de operar mentalmente con esta información, transformarla y generar nueva información.
IVP	Cognición	Tiempo de procesamiento información de diferentes tipos y grados de complejidad.	Mide la capacidad para focalizar la atención y explorar, ordenar y/o discriminar información visual con rapidez y eficacia.

Figure 4. Operationalization of the study variables

The evaluation obtained on the WISC-IV Scale: Intelligence Quotient (IQ), indices of Verbal Comprehension (VCI), Perceptual Reasoning (PRI), Working Memory (WMI), and Processing Speed (PSI) are all numerical and interval variables, due to their properties, since their values allow comparisons to be made.

The variable sex (male-female) corresponds to the nominal dichotomous level of measurement, as it corresponds to the quality of the subjects. The variable Age (6 to 11 years) is a ratio variable due to its numerical quality. Finally, the variable Group with ADHD diagnosis, Group without ADHD, is a nominal variable.

RESULTS

For the analysis of results, IBM SPSS Statistics Standard, version 24.0.0.0, was used, based on the hypothetical construct of cognitive evaluation, that is, to obtain the differences in the results of each cognitive index and total intellectual coefficient (from WISC-IV) of each subject. Measures of central tendency and dispersion were calculated.

The parametric Student's T-test for the PVI obtained significant differences ($T=0,036$ two-tailed sig.), so the equality and means hypothesis is rejected. Therefore, it is concluded that the exposed index (PVI) for the group diagnosed with ADHD and the group diagnosed without ADHD is not the same ($PVI_{ADHD} > PVI_{without\ ADHD}$).

Contrary to previous results, in Pearson's correlation coefficient, the group with ADHD presented in the same IVP a delay, demonstrated with a moderate and negative significance, in correlation with the increase of the age of the subject with 0,006 ($p < 0,01$ bilateral).

Statistics by Diagnostic Group

As shown below, the overall averages obtained from the different indexes indicate, in the group with ADHD (N- 44 subjects), an average obtained corresponding to TCI of 87,591 and for the group without ADHD (N- 45 subjects) of 86,511; both corresponding to a total intellectual coefficient in the Average Range according to the normative, descriptive system, with an IQ score between 85 and 115, it is noted that the group diagnosed with ADHD scores 1,08 points above the average of the group without ADHD, which does not represent a significant disparity in the Intelligence Quotient (figure 5).

	<i>Diagnóstico</i>	<i>N</i>	<i>Media</i>	<i>Desviación típ.</i>
<i>ICV</i>	Con TDAH	44	82.386	14.9312
	Sin TDAH	45	83.089	15.3265
<i>IRP</i>	Con TDAH	44	92.000	16.4614
	Sin TDAH	45	93.822	15.3790
<i>IMT</i>	Con TDAH	44	87.773	13.2259
	Sin TDAH	45	87.289	12.2133
<i>IVP</i>	Con TDAH	44	101.818	15.1922
	Sin TDAH	45	95.467	12.9186
<i>CIT</i>	Con TDAH	44	87.591	14.7874
	Sin TDAH	45	86.511	13.8820

Figure 5. Overall averages obtained by both groups, in the different indexes and total IQ (Author's own creation)

The index with the most significant average disparity between the diagnostic groups is the PVI (Illustration 4), with an average of 101,818 for the ADHD group and 95,467 for the group without ADHD (6351 ADHD>no ADHD).

Subsequently, in Levene's contrast (F) on homogeneity or equality of variance. The result of this contrast in the first four indices, according to the established confidence level (95 %) and considering that the F value is more significant than 0,05, is assumed to be equal to the population variances.

Taking the t-values from the columns that assume equal variances, the significant result is as follows: in the case of the IVP, the obtained Student's t-value (two-tailed sig.) is 0,036, thus rejecting the hypothesis of equality, there are significant differences since it is less than 0,05. 05, the equality of means is rejected, and it is concluded that the index exposed (IVP) for the group diagnosed with ADHD and the group diagnosed without ADHD is not the same (ADHD>no ADHD) according to the parametric analysis of the T-test for equality of means (figura 7).

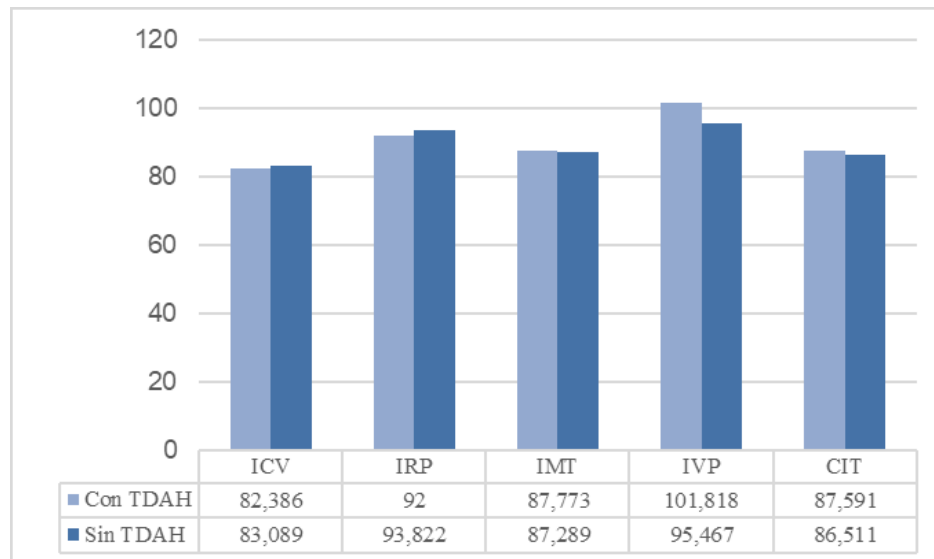


Figure 6. Of the general averages obtained by both diagnostic groups in cognitive indexes and total IQ (Author's own creation)

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias		
		F	Sig.	t	gl	Sig. (bilateral)
ICV	Se han asumido varianzas iguales	.245	.622	-.219	87	.827
IRP	Se han asumido varianzas iguales	.207	.650	-.540	87	.591
IMT	Se han asumido varianzas iguales	.325	.570	.179	87	.858
IVP	Se han asumido varianzas iguales	.824	.366	2.126	87	.036
CIT	Se han asumido varianzas iguales	.000	.989	.355	87	.723

Figure 7. Results obtained in the T-Test for equality of means by diagnostic group (Author's own creation)

Statistics by Gender

Although the present study intends to describe differences according to the diagnostic group, it was decided to carry out the same parametric test for the nominal dichotomous variable of the subject's gender. This clarifies possible differences that are not expected in the results. The following figure 8 shows that of the total number of participants (N- 89), 62 evaluations (69,66 %) correspond to males and 27 evaluations (30,33 %) to females. The average scores obtained in the different indexes and the CIT are shown.

In the same way as in the previous contrast, shown below (figure 10), the first is Levene's test (F) for homogeneity or equality of variance. The result of this contrast in the first four indexes, according to the established level of significance (95 %) and considering that the F value is more significant than 0,05, is assumed to be equal to the population variances. Taking the t-values from the columns that assume equal variances, the significant result is as follows: there are no significant differences, and the inequality of significant differences by sex is rejected.

	<i>Sexo</i>	<i>N</i>	<i>Media</i>	<i>Desviación típ.</i>
<i>ICV</i>	Masculino	62	83.177	15.0709
	Femenino	27	81.741	15.2406
<i>IRP</i>	Masculino	62	93.097	15.1243
	Femenino	27	92.519	17.7295
<i>IMT</i>	Masculino	62	87.177	12.5261
	Femenino	27	88.333	13.1471
<i>IVP</i>	Masculino	62	99.758	14.4446
	Femenino	27	95.963	14.0971
<i>CIT</i>	Masculino	62	87.355	13.8683
	Femenino	27	86.333	15.3873

Figure 8. Overall averages obtained by sex, in the different indexes and total IQ (Author's own creation)

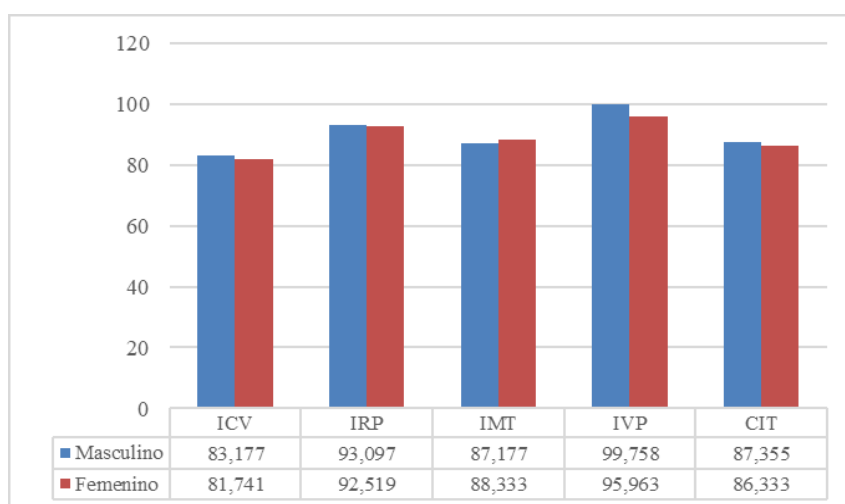


Figure 9. Graph of the general averages obtained by sex in cognitive indexes and total IQ (Author's own creation)

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias		
		F	Sig.	t	gl	Sig. (bilateral)
<i>ICV</i>	Se han asumido varianzas iguales	.577	.449	.412	87	.681
	No se han asumido varianzas iguales			.410	49.066	.683
<i>IRP</i>	Se han asumido varianzas iguales	.741	.392	.157	87	.875
	No se han asumido varianzas iguales			.148	43.239	.883
<i>IMT</i>	Se han asumido varianzas iguales	.002	.961	-.394	87	.694
	No se han asumido varianzas iguales			-.387	47.458	.701
<i>IVP</i>	Se han asumido varianzas iguales	.007	.931	1.148	87	.254
	No se han asumido varianzas iguales			1.159	50.693	.252
<i>CIT</i>	Se han asumido varianzas iguales	.819	.368	.309	87	.758
	No se han asumido varianzas iguales			.296	45.236	.768

Figure 10. Results obtained in the T-Test for equality of means by sex (Author's own creation)

Correlations

Because the variables of the cognitive indexes, the total IQ, and the age of the subjects correspond to an interval-ratio type of measurement, Pearson's correlation coefficient (p) analysis was carried out as a statistical test. For the reader's correct interpretation, Pearson's values are presented with **: the correlation is significant at the 0,01 level (bilateral), and *: the correlation is significant at the 0,05 level (bilateral).

Low, positive, significant correlations were obtained in the analysis of subjects without ADHD (figure 12) of the VCI with 0,014 (bilateral sig.) and of the TMI with 0,036 (bilateral sig.) in correlation to the increase in the age of the subject, which does not represent an unexpected finding ($p < 0,05$ bilateral).

In contrast to the previous group, in the results obtained in the group with ADHD (figure 13), the PVI had a moderate and negative significance in correlation with the increase in the age of the subject with 0,006 ($P < 0,01$ two-tailed).

	ICV	IRP	IMT	IVP	CIT	Edad
Correlación de Pearson	1	.519**	.486**	.368**	.815**	.112
Sig. (bilateral)		.000	.000	.000	.000	.297
Correlación de Pearson	.519**	1	.467**	.415**	.815**	.009
Sig. (bilateral)	.000		.000	.000	.000	.933
Correlación de Pearson	.486**	.467**	1	.386**	.723**	.058
Sig. (bilateral)	.000	.000		.000	.000	.589
Correlación de Pearson	.368**	.415**	.386**	1	.659**	-.118
Sig. (bilateral)	.000	.000	.000		.000	.269
Correlación de Pearson	.815**	.815**	.723**	.659**	1	.041
Sig. (bilateral)	.000	.000	.000	.000		.702
Correlación de Pearson	.112	.009	.058	-.118	.041	1
Sig. (bilateral)	.297	.933	.589	.269	.702	

Figure 11. Pearson's Correlation Coefficient Results for the total study population (Author's own creation)

	ICV	IRP	IMT	IVP	CIT	Edad
Correlación de Pearson	1	.653**	.420**	.397**	.866**	.362*
Sig. (bilateral)		.000	.004	.007	.000	.014
Correlación de Pearson	.653**	1	.347*	.388**	.821**	.050
Sig. (bilateral)	.000		.019	.008	.000	.745
Correlación de Pearson	.420**	.347*	1	.335*	.656**	.313*
Sig. (bilateral)	.004	.019		.025	.000	.036
Correlación de Pearson	.397**	.388**	.335*	1	.639**	.164
Sig. (bilateral)	.007	.008	.025		.000	.281
Correlación de Pearson	.866**	.821**	.656**	.639**	1	.288
Sig. (bilateral)	.000	.000	.000	.000		.055
Correlación de Pearson	.362*	.050	.313*	.164	.288	1
Sig. (bilateral)	.014	.745	.036	.281	.055	

Figure 12. Pearson's Correlation Coefficient results for the group without ADHD (Author's own creation)

	ICV	IRP	IMT	IVP	CIT	Edad
Correlación de Pearson	1	.387**	.552**	.374*	.771**	-.190
Sig. (bilateral)		.009	.000	.012	.000	.217
Correlación de Pearson	.387**	1	.577**	.482**	.817**	-.035
Sig. (bilateral)	.009		.000	.001	.000	.820
Correlación de Pearson	.552**	.577**	1	.437**	.783**	-.218
Sig. (bilateral)	.000	.000		.003	.000	.156
Correlación de Pearson	.374*	.482**	.437**	1	.692**	-.411**
Sig. (bilateral)	.012	.001	.003		.000	.006
Correlación de Pearson	.771**	.817**	.783**	.692**	1	-.230
Sig. (bilateral)	.000	.000	.000	.000		.132
Correlación de Pearson	-.190	-.035	-.218	-.411**	-.230	1
Sig. (bilateral)	.217	.820	.156	.006	.132	

Figure 13. Pearson's Correlation Coefficient Results for the group with ADHD (Author's own creation)

Hypothesis Test

The results presented above provide empirical evidence for the hypothesis that significant differences exist in the Cognitive Indices of each clinical group.

The difference is significant and characterizes the ADHD group with a cognitive profile where the Processing Speed Index (PSI) is higher than in the group without ADHD; the latter acquired lower scores in processing speed. However, a higher score in TMT and VCT was obtained in correlation to the increase in age, which was not an unexpected result. However, contradicting the initial finding, the PVI of the group with ADHD showed a loss of score in correlation to the increase in age of the subjects. However, in the results of the PRI and TCI, no significant disparities exist in any clinical group.

Statistical Testing Hypothesis

General Hypotheses

Hi is accepted: there are significant differences (with a level of 0,05) in the cognitive profile obtained from the WISC-IV test of two groups, one of children diagnosed with ADHD and the other of children without the disorder.

Ho is rejected: no significant differences (at the 0,05 level) in the cognitive profile obtained from the WISC-IV test of two groups, one of children diagnosed with ADHD and the other of children without the disorder.

Specific hypotheses

Hi1 is rejected: there are significant differences between the Verbal Comprehension Index (VCI) scores obtained in children diagnosed with ADHD and those without ADHD.

Ho1 is accepted: there is no significant difference between the Verbal Comprehension Index (VCI) scores obtained in children diagnosed with ADHD and those without ADHD.

Hi2 is rejected: there are significant differences between the scores obtained in the Perceptual Reasoning Index (PRI) in children diagnosed with ADHD and those without ADHD.

Ho2 is accepted: there is no significant difference between the scores obtained in the Perceptual Reasoning Index (PRI) in children diagnosed with ADHD and those without ADHD.

Hi3 is rejected: there are significant differences between the scores obtained in the Working Memory Index (WMI) in children diagnosed with ADHD and those without ADHD.

Ho3 is accepted: there is no significant difference between the scores obtained in the Working Memory Index (WMI) in children diagnosed with ADHD and those without ADHD.

Hi4 is accepted: there are significant differences between the scores obtained in the Processing Speed Index (PSI) in children diagnosed with ADHD and those who do not have ADHD.

Ho4 is rejected: there is no significant difference between the scores obtained in the Processing Speed Index (PSI) in children diagnosed with ADHD and those who do not have ADHD.

Hi5 is rejected: significant differences exist between the total IQ score obtained in children diagnosed with ADHD and those without ADHD.

Ho5 is accepted: no significant difference exists between the total IQ score obtained in children diagnosed with ADHD and those without ADHD.

DISCUSSION

The present investigation aims to describe and compare the cognitive processes that present differences in subjects with ADHD in the Altos region to promote research and understanding of this disorder. It is pointed out that the viability and structural validity of the use of the Wechsler Scale is found by Gómez, Vance, & Watson (2016), who, through the use of the WISC-IV intelligence scale, set themselves the objective of studying the application of WISC-IV in children with ADHD. The results obtained indicate the guidelines for its reproduction.

Using the complete application of WISC-IV to obtain the IQ as a tool for the analysis of the cognitive processes that present deficiencies in ADHD, the processes that are most relevant in this research are working memory, processing speed, attention, verbal comprehension, perceptual reasoning, and processing speed. Styck and Watkins (2017) observed that the application of WISC-IV provided more reliable information and, therefore, recommended its use to obtain the interpretation of the full-scale IQ used for this study. Although this is not the case, we will have to take into consideration the study carried out by Antshel et al. (2007), which concluded that children with a high IQ and ADHD showed a pattern of familiarity, as well as cognitive, psychiatric, and behavioral characteristics consistent with the diagnosis of ADHD in children with average IQ. These data suggest that the diagnosis of ADHD is valid in children with high IQs, so it should be considered that the CIT may or may not present variances in its score, and it will be necessary to precisely delimit the cognitive profile with the indices in contrast to the specific executive functions.

Focusing the discussion on the most relevant aspects extracted from the results, we can agree that there is a minimal difference between subjects with ADHD and subjects without ADHD. The most relevant finding in the CIT is that the group with ADHD scores 1.08 points above the group without ADHD, but despite the difference, both are within the average range according to the normative, descriptive system, with an IQ between 85 and 115 points. This infers that the intellectual capacity of both groups is preserved and is within the normal range (Jepsen, Fagerlund, & Mortensen, 2009). The same authors point out that the associations between IQ and attention deficits in ADHD are generally modest, with a medium influence on the IQ that probably amounts to 2 or 5 IQ points. (Jepsen, Fagerlund, & Mortensen, 2009). Therefore, it is in line with our result, where the variance in the processing speed in our subjects does not influence the total IQ.

The analysis of the results shows that the index with the most significant disparity is the PVI since the group with ADHD obtained a score of 101,818 and the group without ADHD only 95,467, which represents a difference of 6,351, which highlights the ability of the subjects to respond quickly to the solution. 818, and the group without ADHD only 95,467, which represents a difference of 6,351, which highlights that the ability of the subjects to respond promptly to conflict resolution is not affected in both groups, therefore contrasting with the above (Fenollar, Navarro, González, & García, 2015) where they pointed out similar findings in children with ADHD, specifically the ADHD-D (inattentive or distractible) and ADHD-C (combined) subgroups with an apparent deficit in the processing speed index.

The results obtained provide us with an important finding: the group with ADHD presents a higher speed index than the group without ADHD. However, the latter compensates for this lower score by presenting a higher verbal comprehension, comparing the results obtained by (Fenollar, Navarro, González, & García, 2015), in which processing speed presents deficiencies in the groups that present ADHD.

The hypothesis proposed by us is that there is inequality between the two groups in the processing speed index, which, through data analysis, clearly denotes the difference between the two groups, highlighting the superiority of the group with ADHD, a characteristic of the non-representative sample of the population of Tepatitlán, supporting the findings of Thaler, Bello and Etcoff (2013), where they demonstrated that children with inattentive subtype ADHD had deficient scores on the Processing Speed index.

According to Thorsen et al. (2018), processing speed is one of the main tools available to school-age children, making it difficult to socialize with their peers.

Contrary to Thorsen (2018), the results obtained in our research show a high processing speed index in subjects with ADHD, but this does not show development, causing a lower level of this function at higher ages, which represents an unexpected finding in the research, which, in turn, agrees with the results of Thorsen (2018)

According to other authors (Wal, Hapfelmeier, El-Wahsch, & Prior, 2017) (Caspersen, Petersen, Vangkilde, Plessen, & Habekost, 2017) (Cook, Braaten, & Surman, 2018) (Adalio, Owens, McBurnett, Hinshaw, & Piffne, 2017), the PVI is one of the cognitive processes that is most closely related to the behavioral deficiencies presented by subjects with ADHD. In our results, this index is favored at early ages, but it deteriorates as the subject's age increases, causing very significant deficiency at an age closer to adolescence.

Contrary to what Thaler, Bello, and Etcoff (2013), children with inattentive subtype ADHD had deficient scores on the PVI and, similarly, this index, together with the TMI, was associated with impaired behavioral functioning in children with ADHD, it could not be considered as a reference for this study because the categorization of ADHD subtypes was not performed. However, it is also accepted that significant differences exist between the scores obtained in the Processing Speed Index (PSI), which measures the ability to focus attention and explore, order, and/or discriminate visual information quickly and efficiently. Nevertheless, it was demonstrated here that children diagnosed with ADHD have a higher evaluation than those not diagnosed with ADHD, and this result was not expected.

The latter generates the most relevant finding of the study: generating a cognitive profile of the subject with ADHD in the range of 6 to 11 years of age.

Based on the results obtained, it can be affirmed that, as expected, significant differences have been found, with the group with ADHD presenting the most significant variation in the expected results. Furthermore, the fact that there are no significant differences in IQ is consistent with the results previously described by Carlson (2000, cited in Carlson & Mann, 2000) and which are contrary to what is mentioned by Bridgett (2006) and The American Psychiatric Association (2013), which state that subjects with Attention Deficit Disorder have a lower intellectual level compared to the general population, or that they may achieve lower academic and intellectual development levels in contrast to those obtained by their peers, verified by individual tests, which seems to be somewhat lower than that of other children, because the IQ did not show significant differences.

It is accepted that there are significant differences between the scores obtained in the Verbal Comprehension Index (VCI), where children diagnosed with ADHD score lower than those diagnosed without ADHD, which expresses abilities in the formation of verbal concepts, relationships between concepts, richness, and precision in the definition of words, social understanding, practical judgment, acquired knowledge, agility, and verbal intuition. Finally, we are dealing with a condition of attention deficit, which was to be expected.

Finally, as a third specific objective, the aim was to generate a theoretical contribution to help understand ADHD and the application of intelligence scales for subjects who present it. It should be noted that the theoretical and methodological contrasts, rather than being opposed, showed an evolutionary process of adaptation of praxis to the problem. Hence, the only intention was to make a historical reference to both processes, which is considered complete for the stated objective.

CONCLUSIONS

Firstly, and of great importance, it should be mentioned that in both groups, there are no significant differences in IQ. Therefore, there is no inequality in the level of assessment of general intelligence. Therefore, a relative general cognitive functioning or ability difference should not be assumed.

Finally, the ADHD diagnostic group demonstrated a significantly higher PVI score compared to the group without ADHD. This indicates a superior characteristic in the processing time of information of different types and degrees of complexity, which translates into a greater capacity to focus attention and explore, organize, and/or discriminate visual information quickly and efficiently.

However, this same index (IVP) showed a loss of score with increasing age in subjects with the disorder, denoting a moderate and negative significance in correlation with age because the children in the clinical group with ADHD aged 6 years presented the maximum score and the children aged 11 years the lowest. This describes the existence of a reduction in the development of processing speed according to the age range in their growth. A delay in the ability to focus and discriminate visual information, which progressively deteriorates. This refers to diagnostic criteria of the disorder, such as being easily distracted by irrelevant stimuli. However, this was not initially the case.

Low and positive significant correlations were also obtained in the analysis of subjects without ADHD in the VCI: a slight improvement in the decoding of words and the comprehension and interpretation of messages that they read or listen to, and in the MTI, a significant but low improvement in the ability to retain operational information and use it with precision in problem-solving, which is not an unexpected finding.

From the above, it can be concluded that the study provides important findings for identifying the cognitive profile, which encourages a more fantastic approach to the study, treatment, and/or psychological or pedagogical intervention of children with ADHD in the region.

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FINANCING

None.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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