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Autism spectrum problems, attention deficit, anxiety symptoms and IQ in children from 2 to 5 years

Problemas del espectro autista, déficit de atención, sintomatología ansiosa y coeficiente intelectual en niños de 2 a 5 años

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SUMMARY

The aim of the study was to establish the relationship between autism spectrum problems, attention deficit, anxiety symptoms, and IQ in children aged 2 to 5 years, through a quantitative correlational methodology. The sample consisted of 189 children and their parents and/or caregivers belonging to child development centers and children's homes in the city of Sincelejo, Colombia. The Wechsler Intelligence Scale for Preschool and elementary school children - WPPSI IV and the Child Behavior Check List - CBCL were applied. The main result was that in the Pearson correlation coefficient, anxious symptomatology and attention deficit were not related to any IQ index, while autism spectrum problems were related to the processing speed index (-0.282).*
Keywords: *IQ, autism, anxiety, childhood, attention deficit.*

RESUMEN

El objetivo del estudio consistió en establecer la relación entre problemas del espectro autista, déficit de atención, sintomatología ansiosa y coeficiente intelectual en niños de 2 a 5 años, a través de una metodología cuantitativa de tipo correlacional. La muestra fue de 189 niños y sus padres de familia y/o cuidadores pertenecientes a centros de desarrollo infantil y hogares infantiles de la ciudad de Sincelejo, Colombia. Se aplicó la Escala de Inteligencia Wechsler para preescolares y primarios – WPPSI IV y el Child Behavior Check List – CBCL. Como resultado principal sé obtuvo que en el coeficiente de correlación de Pearson la sintomatología ansiosa y el déficit de atención no se relacionaron con ningún índice del coeficiente intelectual, mientras que, los problemas del espectro autista se relacionaron con el índice de velocidad de procesamiento (-0,282).*
Palabras clave: *Coeficiente intelectual, autismo, ansiedad, infancia, déficit de atención.*

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INTRODUCTION

Neurodevelopment in the individual begins in intrauterine life and continues throughout life as a multidimensional and evolutionary process, where the person progressively acquires skills that often become more complex, which serve to consolidate a way of interacting with the world and transform it (1). Similarly, Wechsler (2) defines intelligence as the aggregate or global capacity of a subject to act with purpose, to think rationally, and to develop effectively with his environment and context.

In Colombia, early childhood is considered the stage that includes the development of children from gestation to 6 years of age. This stage is considered decisive for the development of children at the biological, mental, social, and cultural levels because it plays a crucial role in the structuring of personality, social behavior, and intelligence (3). Meza et al. (4) point out that in early childhood there is physical growth and remarkable development at sensory and perceptive levels. Also in early childhood, there is a significant awakening in the intellectual, emotional, and social components, being a period of great influence on the well-being of the person because it is a stage of significant brain development and growth.

It is precisely at this stage of development that the neurophysiological and psychological structures are in the process of maturing, a situation that increases the degree of vulnerability of this population due to the quality and quantity of influences that they receive from different factors and that they cannot control. A example of this, is the increase to a greater extent of the vulnerability levels of this population that occurs in the Department of Sucre, one of the poorest area of Colombia (5) and has been immersed for many years in an environment of violence and armed conflict.

Virues-Ortega et al. (6) consider that this stage is the most significant moment of growth in development, therefore, they suggest that the development quotient (DC) and the intelligence quotient (IQ) can function as a useful factors for the identification of children who need early intervention, since low IQ in childhood can affect in the short and long term the teaching and learning processes, besides causing an increase in school dropout. In the future, it can significantly affect the subject's work performance and therefore be a limiting factor for his or her social and economic development (7,8).

Some representative research on psychopathology in preschoolers has estimated a prevalence of disorders in preschoolers between 7 % and 25 % (9,10). Also, research conducted in twenty-three countries including South American countries found that, despite differences in child rearing and social class, the symptom patterns for the presence of childhood disorders were similar.

On the other hand, it is important to mention that among the most frequent disorders in early childhood are: attention deficit hyperactivity disorder, autism spectrum disorders, separation anxiety, developmental delay disorders, mutism, reactive attachment disorder, specific learning disorders, motor disorders, oppositional defiant disorder and depressive disorder (11).

Autism Spectrum Disorders and IQ

The autism spectrum implies a delay in the development of language and stereotyped behaviors, restricted interests, and difficulties in establishing social relationships (12). From this perspective, Carter et al. (13) stated that is important in this type of study to consider that the acquisition of significant learning is achieved in the interaction between the individual and the society. The Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSMV) specifies that the symptoms of autism spectrum disorder (ASD) should not be explained by intellectual disability. However, it should be considered that a comorbid diagnosis of ASD in a subject with an intellectual disability may be appropriate, even more so in situations where communication and social interaction are significantly altered in relation to what is expected from the developmental level (14).

Previous research shows that, even for autism, a high IQ can be a protective factor that decreases risk factors, unlike a low IQ (13,15,16). One of the first studies investigating IQ and autistic symptoms was that of Bartak and Rutter (17) who reported that of 17 children with autism and nonverbal IQ < 70 had more stereotypies,

self-injurious behavior, resistance to change, attachment to foreign objects, and lack of emotional expression, whereas in 19 children with autism and nonverbal IQ ≥ 70 the occurrence of this symptomatology decreased. In contrast, children with high-functioning autism had greater sensitivity to noise and more rituals than children with low-functioning autism. The two groups did not differ in language delay or deficits in peer relationships, although high-functioning children had less difficulty interacting with adults than low-functioning children.

Another study by Mayes and Calhoun (18) found that children with autism and mental retardation had more severe self-injurious behavior than higher-functioning children, which increased the level of vulnerability and psychosocial risk. Likewise, Matson and Shoemaker (19) mentioned that the lower the IQ, the greater the severity of the presence of autistic traits. Also, they found that lower IQ was related to the severity of ASD symptoms than any other factor, even age.

Bishop et al. (20) found that in a large sample of 1- to 11-year-old children with autism and a wide range of IQ, repetitive object uses and stereotyped hand movements increased as nonverbal IQ decreased (particularly in older children), but circumscribed interests (obsession with fact acquisition and curiosities) increased with increasing nonverbal IQ.

Although in young children, brain plasticity may indicate less stability in IQ scores. Follow-up cohort-based research shows progressive gains in IQ throughout the first years of life, mainly at 2 and 3 years of age (21). In this sense, Solomon et al. (22) studied the evolution of IQ in the early stages of autism development, finding the existence of a correlation between IQ and developmental trajectories. Children with ASD or autistic traits usually require more care and attention from family members or caregivers (23,24), so early diagnosis and intervention of these children is necessary to minimize the impact and delays they may experience in later functioning.

Due to this high incidence, some studies consider low IQ as comorbid with autism, that is, as a condition with an origin and cause independent of autism. Due to the concurrence of both: low IQ and autism, some research has attempted to define the characteristics of autism by controlling the dominance that intellectual capacity can have on it (25). On the other hand, there is another approach from which both disorders are conceived as two alterations that have an etiological relationship. To try to explain the interdependence between both constructs, these approaches are based on two types of data: on the one hand, from the perspective that there is a greater risk of intellectual disability in children who during the first years of life showed marked ASD symptoms, and on the other hand, on the importance of experiences at a social level at an early age in later development at a cognitive level (26).

Attention deficit and IQ

Attention is a multidimensional construct, which generates a large number of alterations in this process that can be observed in childhood (27). Attention deficit is evidenced by the impossibility of maintaining sustained attention in specific tasks or activities, remembering rules, following instructions, selecting important stimuli, and avoiding distractions (14,28).

Low IQ can frequently appear in conjunction with attention deficit disorder, as this is one of the most prevalent disorders in childhood today, in addition to emotional disorders, sensory disorders, and cognitive deficits. Similarly, low IQ, to some extent, may or may not be associated with the appearance of disciplinary and coexistence problems in the school setting (29).

Although the most frequent symptoms may correspond to Attention deficit hyperactivity disorder (ADHD), conduct disorders, learning disorders, anxiety, or depressive disorders, among others, the diagnosis of one of these pathologies is not exclusive to having a low normal IQ, which is congruent with the fact that, in child psychopathology, comorbidity is considerably high. Such comorbidity may correspond to pathologies independent or secondary to the appearance of low normal IQ, such as behavioral problems, emotional problems, anxious or depressive disorders, and/or learning disorders (30).

Anxious symptoms and IQ

Anxiety is very frequent in childhood (31) and specifically within the preschool stage, where it causes strong repercussions in the present and later periods of development, affecting the individual, family, social and educational functioning of children (32), since this is a period in which multiple developmental changes occur both neurologically and environmentally (33).

Both anxious symptoms and fear are present in children in early childhood, in many situations as part of the normative development of children, as they may appear as a fragment of survival and adaptation mechanisms (34). These manifestations appear as a response to specific stimuli from the child's developmental stage and can be transient and adaptive (35). Normally thanks to the accompaniment of parents, caregivers, and cognitive and affective capacities, children learn to manage them without having received a specific treatment (36).

Anxiety disorders are very common in people with low IQ, although it is very common for them to go undiagnosed and untreated. Sometimes they come from childhood, which makes it difficult to record exactly when they appear. Some researchers such as Franco (37) point out that people with low IQ have more frequent difficulties in coping with problems, proposing solutions, and confronting them. They also have unrealistic expectations of the family and greater problems with adaptive behavior, which facilitate the appearance of anxious symptoms (38).

According to Franco (37) in people with intellectual disabilities, the presence of anxious symptoms is common and they usually present with behavioral problems, which are aimed at avoiding a situation that may be difficult, complicated, or that they cannot cope with and that obviously constitutes the focus of anxiety. Also, according to Einfeld and Tongel (39), anxiety is closely related to low IQ, and it is a pathology that, according to different studies, appears frequently in this population.

Therefore, anxiety with the intense suffering it can cause in the sufferer can go unnoticed in many situations, and even more so in people with low IQ. Shyness, avoidance, fear, stuttering, as well as other manifestations, in various circumstances, will be misinterpreted as normal conditions of a person, because he/she has a diagnosis of low IQ. But it is necessary to mention that excessive fears are not related to any specific personality type, so their manifestation should alert them about the presence of anxious symptoms (40).

In general, the occurrence of certain disorders in children can affect cognitive functioning. In terms of anxiety disorders, studies of anxious children have shown detrimental effects on neuropsychological performance, such as executive function, memory, attention, and learning. Studies specifically addressing working memory have shown that anxiety negatively affects this cognitive function in children (41).

Based on the above, the present study aims to establish the relationship between autism spectrum problems, attention deficit, anxiety symptoms, and IQ in children aged 2 to 5 years in the city of Sincelejo, Colombia. It is also expected to find a relationship between low IQ scores and the presence of children with autism spectrum symptoms, attention deficit symptoms, and anxiety symptoms.

METHOD

Participants

The sample of this study was intentional, with the participation of children who met the inclusion criteria of the database constructed: being a boy or girl enrolled in one of the Child Development Centers (CDI) in the city of Sincelejo, between 2 and 5 years of age, signed voluntary informed consent by a parent or caregiver with parental authority, and having completed the protocol applied to meet the objective of this publication. These criteria were met by 189 children between 2 and 5 years of age linked to the CDI in Sincelejo-Colombia together with their parents and/or caregivers. We worked with 102 children equivalent to 54 % of the population who were between 2.6 and 3.11 years old, while the remaining 87 children correspond to 46 % with ages between 4 and 5.11 years old (Table 1).

Table 1. Characterization of children

	Ages		Sex	
	2.6 – 3.11 years	4 – 5.11 years	Female	Male
Percentages	54 %	46 %	56 %	44 %

Likewise, we worked with 189 parents and/or caregivers, 97.4 % female and 2.6 % male, who ranged in age from 28 to 68 years. 59.3 % were between 28 and 48 years of age, while 40.7 % were between 48 and 68 years of age. The mean age of the participants was 45 years.

Instruments

The Wechsler Preschool and Primary Scale of Intelligence WPPSI IV (2) is an individually administered clinical test. It is designed to assess intellectual aptitudes and general IQ in children between 2 years and 6 months and 7 years and 7 months. The structure of the test is organized into three levels of interpretation: primary scales, secondary scales, and total scales. Each of these levels in turn is made up of subscales of verbal comprehension, visuospatial index, working memory (primary scales) and vocabulary acquisition, nonverbal index, and general ability (secondary scales) for both age groups, in addition to the evaluation of fluid reasoning, processing speed and cognitive competence for children between 4 years and 7 years and 7 months.

Regarding the psychometric properties, the manual states at a general level that the reliability of the W/PPSI-IV tests preserves or improves that of the WPPSI-III tests. Specifically, reliability coefficients are adequate for the subscales Figure Key, Comprehension, and Cancellation, there are good coefficients for Similarities, Vocabulary, Information, Drawings, Names, Cubes, Puzzles, Concepts, and Location, and excellent coefficients for Recognition, Matrices, and Animal Search. That is, the average reliability coefficients of the WPPSI-IV composite scores are between 0.85 and 0.93.

The Child Behaviour Checklist (CBCL 1½-5) is a standardized instrument that allows the recording of behavioral problems and functioning of preschoolers in different situations. This test has been frequently used in cross-cultural research and applied to Colombian children. The questionnaire applies to parents, caregivers, and/or tutors who live with the child in their family context. In this process, the individual is instructed to read a list of 99 child problems and to indicate the most appropriate option for each situation: not so true for the child (0), sometimes or somewhat true (1), very true, or occurs very often (2).

Regarding the psychometric properties, the authors of this instrument obtained test-retest correlations of 0.80 and 0.90 for the Internalizing and Externalizing syndromic scales, and 0.90 for the Total Problems scale (Achenbach and Edelbrock, 2000; Rescorla, 2005). In addition, they found high levels of internal consistency reliability for Total Problems (r = 0.95), Internalizing (r = 0.89), and Externalizing (r = 0.92) (42).

Procedure

This study was of positivist paradigm, quantitative approach which, according to Hernandez et al. (43), "uses the collection of information and data analysis to answer research questions and get to test the hypothesis through numerical measurement, counting and the use of statistical analysis" (p. 95). Likewise, it was of a correlational type, whose "objective is to identify the degree of relationship or association that may exist between one or more variables within a specific context" (Hernández et al., 2014, p. 85). It was of non-experimental design, since "there was no deliberate manipulation of the study variables" (43).

Child development centers in the city of Sincelejo were contacted, to which the project

was presented and consent was requested to talk with the parents of the children participating in their homes. After their approval, the parents and/or caregivers were summoned to socialize the research project and request their participation by signing the voluntary informed consent form designed for the research entitled: "Development of a Predictor Model of Determinants of IQ in Children aged Three to Five years in Sincelejo", this informed consent was prepared by the researchers and socialized with the different participants in the research, being approved by all of them, guaranteeing the privacy of the data, respect for the participation and the guarantee of the good treatment of the data and exclusive use only for scientific publications and scientific reports, without mention of personal names of those evaluated. Once parental consent was obtained, the entire protocol of the different scales and instruments designed for the same was applied, including the Wechsler Intelligence Scale for Preschool and Primary School WPPSI IV to the children and the Child Behaviour Checklist instrument to parents and/or caregivers, which was conducted by telephone due to the availability of the participants and the beginning of the COVID-19 pandemic in the year 2020.

Statistical analysis

Data analysis was carried out using the Statistical Package for Social Science (SPSS) V. 20 statistical software. Initially, descriptive and frequency statistics were used for each of the variables studied, and later, to determine the relationship between IQ, autism spectrum problems, attention deficit, and anxiety symptoms, a correlational analysis was carried out using Pearson's correlation coefficient.

RESULTS

Presence of autism spectrum disorders, attention deficit, and anxiety symptoms in the sample

The mean score of each of the subscales of the Child Behaviour Checklist studied was not within the clinical range indicated by the instrument. This is detailed in Table 2.

The mean overall IQ for the participating children was 80.41. Table 3 describes the mean performance for each index evaluated.

Table 2 . Problems of anxiety, autism spectrum disorder, and attention deficit disorder in participants

	Minimum	Maximum	Mean	Standard deviation
Anxiety problems	0.00	11.00	3.01	2.29
Autism spectrum disorder problems	0.00	13.00	1.51	2.21
Attention deficit problems	0.00	10.00	2.80	2.09
IQs and indices in the sample				

Table 3. IQ and subscales

	Minimum	Maximum	Mean	Standard deviation
Verbal Comprehension	45	122	71.13	12.30
Spatial Viso Capacity	49	112	77.73	10.96
Fluid reasoning	60	106	75.12	9.05
Memory Work	46	131	84.65	14.81
Processing Speed	54	106	75.47	8.71
Vocabulary Acquisition	45	128	79.22	15.96
Non Verbal	49	116	79.95	10.56
General Capacity	56	111	76.13	10.55
Cognitive Competence	53	97	70.49	8.72
General IQ	61	116	80.41	11.06

Table 4 shows the results corresponding to the significant associations between variables. It should be noted that in the Pearson correlation coefficient, anxious symptomatology and attention deficit were not related to any IQ index. While autism spectrum problems were related to the processing speed index.

Table 4. Significant Pearson Correlation Results

CI	TEA
Verbal Comprehension	-0.062
Capacity Viso Especially	-0.021
Fluid reasoning	0.171
Work Memory	0.043
Processing Speed	-0.282*
Vocabulary Acquisition	-0.075
Non Verbal	0.006
General Capacity	-0.034
Cognitive Competence	-0.023
General IQ	-0.052

** The correlation is significant at the: 0.01; * the correlation is significant at the 0.05

DISCUSSION

This research proposed to establish the relationship between autism spectrum problems, attention deficit, anxious symptoms, and IQ in children from 2 to 5 years of age, for which a review of the literature on these variables was made, followed by the application of the instruments and data analysis.

From the results corresponding to the association between autism spectrum problems, attention deficit, anxious symptomatology, and IQ, it was obtained that, for IQ, the processing speed index was related to autism spectrum problems, while the rest of the variables were not related to IQ indexes.

The correlation found indicates that children with autistic symptomatology may present difficulty in inhibiting responses, requiring more time to process information and carry out certain tasks (44). These results are in line with previous studies, such as that of Mayes and Calhoun (18) and Wechsler (45) who demonstrated that autistic children may present difficulties in processing speed, which are often present throughout life. Similarly, Ogiwara and Takahashi (46) mention that approximately 25 % to 55 % of children with these difficulties have difficulty in certain axes that allow the evaluation of IQ.

In this sense, Oliveras-Rentas et al. (47) observed the profile of a group of children with autistic problems by means of the WISC-IV, where they found that there were difficulties in terms of processing speed and comprehension. Likewise, Travers et al. (31) evaluated processing speed, finding lower performance in people with autism spectrum disorders.

These findings could be because the same diagnostic typologies as the neurological alterations present in the autism spectrum have repercussions on neuropsychological performance. Thus evidencing difficulties in executive functions, memory, and processing speed (48).

Finally, this research allows health professionals and professionals from the Social and Human Sciences, feasibility to better understand intellectual diversity in early childhood, in addition to the analysis of multiple causes and factors, which could bring implications for the field of research, clinical psychology, neurology and education (49).

This study shows some limitations; on the one hand, the representativeness of the sample cannot be guaranteed due to the sampling technique used. In addition, the collection of information could not be carried out in person due to the situation of confinement by COVID-19 in 2020, which was a restriction as it was not possible to have more participants. However, it could be solved by carrying out the work by telephone according to the availability of the participants.

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