

Assessment of executive functions (inhibition, planning, flexibility) in a child with autism spectrum disorder

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Abstract ;

The current study aims to attempt to evaluate the executive functions represented by (cessation, planning, cognitive flexibility) in an autism spectrum child. A group of studies have confirmed the presence of clear weakness and deficiency at the level of these functions, which in turn causes unusual and similar behaviors in this group in the autism spectrum child. Such as stereotypical and repetitive behaviors, poor interaction and social communication, and introversion. In this study, three cases suffering from the autism spectrum were selected intentionally and with the aim of evaluating the executive functions mentioned above and knowing their level. The tests were applied, namely the Stroop test to measure palm function, the complex image ray shape test to measure planning function, and the TMT ring conduction test to measure flexibility function. The results of this study revealed weakness at the level of these executive functions, which indicates a clear deficiency in this group.

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1. Introduction

Executive functions are higher cognitive functions controlled by the frontal lobes, and they are a relatively new concept in neuropsychology. Some researchers point out that the concept of executive functions is a very complex concept because it includes a number of processes that have not been well defined. However, the role of these functions is very important because they interfere in simple and complex daily behaviors. Its disorder may hinder the individual's daily life and limit his adaptation to the external environment, which requires the skill of social interaction and communication, whether verbal or non-verbal. It clearly appears to us that the autism spectrum category's problem lies in the behavioral aspect, as we can almost see the clear difference between this category and ordinary individuals at the level of the method of behavior. And how to deal with the external environment. Most members of the autism spectrum suffer from an inability to adapt socially, isolation, and isolation around oneself. Can this abnormality in behavior be explained by a deficiency in the cognitive aspect? Therefore, in this study, we wanted to search for an answer to this question by trying to evaluate part of the cognitive aspect of this category, represented by executive functions (inhibition, planning, flexibility) since research into the cognitive aspect as a whole is rather broad and complex.

Problematic:

Among the most prominent categories of people with special needs, we find autism, or what is currently called the autism spectrum, as it is viewed as a developmental disability that is defined by three basic manifestations: communication difficulties, behavioral problems, and social difficulties (elsayed. Amara, 2008, 14).

The Diagnostic Statistical Manual of Mental and Mental Diseases IV (DSM-4) classified autism as a comprehensive developmental disorder, while the Diagnostic Statistical Manual of Mental and Mental Diseases V (DSM-5) classified it within the second axis of the category of neurodevelopmental disorders (DSM-5, 2013, 33).

The autism spectrum is a complex developmental and neurological disorder that a child is exposed to before the age of three and accompanies him throughout his life. It can be viewed as a general or widespread developmental disorder that negatively affects many aspects of the child's development. It appears in the form of deficient and often negative behavioral responses that push the child to withdraw into himself. It is also viewed as a social disability characterized by deficiencies in social behaviors, communication, and symbolic play, as well as stereotypical, repetitive, and restricted behaviors and interests. It is also pathologically associated with attention deficit disorder (Adel Abdallah, 2014).

Individuals with autism spectrum disorder suffer from many cognitive problems that can be considered cognitive characteristics of them, examples of which include lack of memory and metacognitive abilities, knowledge of others, knowledge of emotions, self-knowledge, problem-solving skills, and abstract thinking (**Adel Abdallah, 2014**).

Deficiency in performing executive functions in general leads to failure in social communication with others through visual expressions and gestures, as well as the ability to complete and follow up on dialogue with others, a decrease in the ability to express emotionally, and a tendency toward long self-dialogues, which exposes the individual to failure in establishing a healthy social relationship with others. Also, any imbalance at the level of one of these functions makes a person unable to adapt to new situations.

The results of studies on executive functions indicate that executive dysfunction is one of the manifestations of the deficit that characterizes individuals with autism spectrum disorder. The executive system is a cognitive system in psychology that controls, manages, and organizes cognitive processes. It can be referred to as executive functions, the higher system that regulates the processes of attention functions, or the system that regulates cognitive processes to describe and define a group of cognitive processes responsible for planning, cognitive flexibility, abstract thinking, acquiring rules, choosing to

perform appropriate actions and actions, refraining from performing inappropriate actions, and selecting what is associated with those processes. Of sensory information (**Housin, 2004**).

Deficiencies in executive functions in children with autism spectrum disorder make them face great difficulties in planning, organizing, working memory, and other functions. These deficiencies are among the basic characteristics of autism spectrum disorder. A number of studies have found difficulties in planning skills, mental flexibility, self-monitoring, and verbal fluency. (**Hill et Bird, 2006, Russell, Jarrold, Hood, 1999**)

The study of Enda Tan and all confirmed that the poor cognitive performance of children on the autism spectrum is due to the poor performance of these children in reasoning and logical thinking tasks due to deficits in cognitive performance and efficiency of executive functions. Analyzes related to eye movement and attention also revealed that these children show less attention. In perceiving relationships between stimuli.

Among the most prominent of these executive functions, which constitute the subject of this study, we find the function of the palm, which includes the ability to initiate and take actions or stop them, monitor behavior and change it when necessary, and plan, by which we mean the ability to identify and organize the steps required to achieve a goal, in addition to mental flexibility, which is the ability to

shift from one idea to another. Another idea in response to a change in situation.

Based on what was presented in previous studies, this study came to reveal the level of executive functions in children on the autism spectrum by assessing palm skill, planning, and flexibility. Therefore, the question was as follows:

Basic question:

Does a child on the autism spectrum suffer from weakness in executive functions?

Partial questions:

- 1- Does a child on the autism spectrum suffer from weak palm skills?
- 2- Does a child on the autism spectrum suffer from a weakness in planning skills?
- 3- Does a child on the autism spectrum suffer from a weakness in the level of flexibility skills?

Study hypotheses:

General hypothesis:

A child on the autism spectrum suffers from weakness in executive functions.

Partial hypotheses:

- 1- A child on the autism spectrum suffers from a weakness in palm skill.
- 2- A child on the autism spectrum suffers from a weakness in planning skills.
- 3- A child on the autism spectrum suffers from a weakness in the level of flexibility skills.

The importance of the study:

The importance of the current study lies in trying to evaluate the executive functions represented in palm, planning, and flexibility by applying appropriate tests for these functions and knowing their level,

thus being able to build appropriate treatment programs and apply them to the autism spectrum group and prove their benefit.

Likewise, studying this category (the autism spectrum) from the cognitive aspect, which most studies have proven to be closely linked to the behavioral aspect of the individual.

Theoretical framework of the study:

1- Autism spectrum:

The autism spectrum is one of the most common disorders, as it is characterized by a severe delay in various areas of development, such as: social interaction, communication skills, and language difficulties, in addition to a weakness in interests and activities, with the presence of some behavioral disorders such as stereotypical movements, aggression, and self-harm. Many researchers have explained that Delay in development and poor social adjustment are the biggest problem facing an autistic child (Al-Sharkaoui, 2018, 18-19).

The World Health Organization (WHO) (1982) defined the autism spectrum as one of the developmental disorders that appears before the first three years of a child's life and leads to a disability in the use of language, play, communication, and social interaction (Souhil, 2015, 28).

The Diagnostic Statistical Manual of Mental Disorders (DSM5) also considers that autism spectrum disorder includes two basic symptoms: the presence of stereotypical and repetitive behaviors and a

deficiency in communication, both verbal and non-verbal (Kharroubi, 2021, 223).

2- Behavioral characteristics of the autism spectrum group:

The behaviors of children with autism spectrum disorder are characterized by a severe deficiency and inability to influence the environment, in addition to the prevalence of some strange behavioral movements, such as repetitive movements of the hand and fingers, or biting themselves or others for no apparent reason. Examples of their simple, limited behaviors include rotating a pen between the fingers, loosening and tying shoelaces, and despite the simplicity of These behaviors are repeated until those who notice them imagine that they are oppressed. They may emit intense outbursts of anger without clear reasons, but they do not respond emotionally and do not express real emotions (Olaa Abdel Baki Ibrahim, 2011, 48).

Another characteristic frequently seen in autism and related disorders is preoccupation with limited, narrow-range objects. Autistic children ritually play with objects for a long time and show excessive interest in objects of a certain type, and they become disturbed by any

A change that occurs in the environment or a change in routine as they maintain symmetry and have resistance

Severe to change or transfer (Ibrahim Abdallah Farah Al-Zuraikat, 2004, 37).

According to the classification of the Diagnostic Manual of Mental Disorders-5 (DSM-5), the basic criteria for this disorder

are: persistent inability to communicate and social interaction.

Deficits in social and emotional exchange or treatment.

Deficits in nonverbal communication behaviors used in social interaction.

Deficits in understanding, developing and maintaining the relationship.

Limited and repetitive patterns of behaviours, interests and activities through:

- Stereotypical, repetitive movements and use of objects or speech.
- Insistence on monotony, rigidity, and inflexibility in adhering to a specific routine.

Apathy and focus on abnormal interests.

Excessive or decreased reactivity to sensory input or sensory input, such as: lack of sensation of pain or heat.

3-Causes of autism spectrum disorder:

There are many studies and theories that have explained the causes of the autism spectrum, but we cannot mention all of these studies, but the most important of them can be summarized as follows:

Imaging examinations and tests of the brain in autistic people showed the appearance of unusual differences in the formation of the brain and clear differences in the cerebellum, especially in periodic differences (7-6). The EEG showed the appearance of some changes in electrical waves in about (20-65%) of autism cases, as well as an increase in seizures. Epilepsy, especially as the child gets older. Some have attributed the reason to a defect in the individual's biological system, which

results in the disorder, as there was a similarity in symptoms between the psychological and behavioral imbalance resulting from damage or damage to the left part of the brain and the linguistic, cognitive, and behavioral behaviors of these children (Mohamed Ahmed Khattab, 2009, 42)

4- Executive functions:

Under thinking falls a group of cognitive functions such as: calculation, reasoning, judgment, concept formation, abstraction, generalization, discrimination, planning, and organization. Such processes are close to the concept of executive functions, which consist of a set of abilities that enable the individual to engage in effective and purposeful behavior that successfully serves the self. Executive functions refer to A set of cognitive abilities that regulate and control other abilities and behavior These are necessary and important functions in any behavior directed towards a specific goal and include the ability to initiate or stop actions, monitor behavior and interpret it when necessary, and plan future behavior when faced with new tasks or situations. Such functions help us anticipate the results of our behavior and adapt to changing situations (Sami Abdel elkaoui, 276).

Jorado and Rosselli, 2007, argue that executive functions are: advanced tuning and control processes necessary to direct behavior in a constantly changing environment. It is known as the diagnostic manual

The statistician (DSM-5) defines executive functions as a person's ability to carry out the planning process and initiate

Tasks, monitoring and maintaining their sequence or stopping complex behaviors (el-Baz, 2022)

5- The importance of executive functions:

The importance of executive functions is due to their role in the higher mental processing of information that does not exist in the individual's external environment, as these functions consist of specific rules, generalizations, and concepts that enable the individual to respond in an innovative way to new situations and stimuli that are not directly imposed by the environment (Baddeley, 1986).

Barkley (1997) believes that interest in executive processes has increased because research has shown that executive processes are involved in many developmental disorders and mental illnesses.

Blair (2002) believes that the sound development of executive processes is considered the key to the growth of children's social competence and academic and social readiness to enter school (Blair, 2002)

As for the information processing approach, executive processes are considered an important control process for successful learning, academic achievement, and achieving future goals. Therefore, this approach views

executive processes as a link between cognitive and metacognitive processes (Jing, 2003).

6- Types of executive jobs:

Weyandt (2005) believes that executive processes are a complex component that can be broadly defined as higher-order cognitive abilities that allow for strategy planning, cognitive flexibility, self-regulation, and directed behavior. Gioia et al (2001) divide executive processes into: initiation, Inhibition, and conversion, planning, organization, self-monitoring, emotional control, working memory (Al-Baz, 2022)

In this study, we were satisfied with three executive functions:

A/Inhibition:

Jing (2003) defines Inhibition as a process that includes a dominant response, resisting interference by competitive events, and Wolf defines that Inhibition is often defined as preventing the dominant response and that palm failure or palm weakness in children may produce behaviors such as responding before the task is performed, answering before there is sufficient information available, Distraction by internal stimuli or failure to correct an inappropriate previous response (ibid.).

B/planning:

It means the ability to identify the things and elements required to achieve the goal that was formulated in the previous component, and the manifestations of the disorder of this dimension appear in the patient's inability to develop a system of plans to achieve the desired goal, the

inability to think abstractly or think in concepts, the lack of intellectual flexibility, the lack of planning for the future, and the disorder of social behavior (Sami Abdel kaoui, D-S).

Scholnick et Friedman (1993) stated that planning includes five processes:

- Problem identification.
- Goal-setting.
- Building strategies.

Implementing the plan, namely monitoring and reconfiguration.

These steps are considered necessary to complete the planning task (Hilal, Shahdan, 2012)

C/flexibility:

It is defined as the ability to solve the problem facing an individual in one way and then move on to solving a similar problem in a different way by realizing the similarities and differences between them. Cognitive flexibility helps increase individuals' ability and willingness to try different strategies when achieving a specific goal. Cognitive flexibility matures in early childhood and improves. As the individual grows older (Ibrahim and Attia, 2016).

The applied aspect of the study

1/Study curriculum:

The descriptive approach, which aims to collect information for the purpose of analyzing and interpreting it, was based on the case study method because the sample consists of three cases.

2/Study sample:

The study was carried out in three cases with ASD undergoing arthroponic follow-up.

The following table shows the characteristics of the research sample:

	Name	age	intelligence level	severity of autism
first case	Y - M	years and 5 months 9	above-normal	medium
second case	Q - A	years and 8 months 10	normal	medium
third case	B - S	ten years	normal	medium

3/Study tools:

This study relied on three tests known in the academic and even clinical circles, which have proven useful in measuring executive functions by several studies. These tests are:

A/Stroop test to measure Inhibition function: The Stroop test

Stroop presented this test in 1935, using three cards with 10 rows of items, and used it to illustrate the response that occurs in frontal lobe injury. There are many developments that have been made to this test, and it has been published more than once in more than one version, all of which contain 4 tests. Sub:

- 1- Read the color name printed in black
- 2- Read the color name printed on the card in a different color
- 3- Naming the color of the rectangles
- 4- Naming the color in which the word was printed (in which the word is written ((Sami Abdel kaoui, D.S)

The test is corrected by calculating the number of correct answers, the number of incorrect answers, the number of frequencies, then the degree of error (2 kh

+ d) for each card alone. The duration of the test for each position does not exceed 45 seconds. The degree of interference is calculated by subtracting the interference result from the label result.

B/Complex shape test Rey to measure the plotting function: Character of rey (A)

This test was prepared by the scientist Andrei Rey.A (1942) with the aim of measuring visual perception and visual memory. It consists of two parts, the simple form (B) for ages 4-8 years and the complex form (A) for ages over 8 years.

The test consists of a geometric shape that the subject redraws, and then the completed shape is analyzed through 18 test items.

The score for each item is calculated by (Attendance + Accuracy) × Location. Then you collect the item marks, the maximum mark is 36 points.

C/Tracking or looping test to measure mental flexibility function: Trail Making Test(TMT)

The Tracking or Ring Connection Test (TMT) is one of the tests used in the field of determining brain injury through many of the functions it measures. It is also a good indicator of general mental ability. The basis of this test was Taylor's Number Series test

The test currently consists of two parts, the first (A), in which the subject is asked to connect a series of numbers inside random circles on a piece of paper, provided that the connection is in order As for part (B), it consists of circles, some of which contain serial numbers (from 1 to 13) and others

contain letters (from A to S). The subject is asked to connect the circles that contain numbers and the circles that contain letters in a logical sequence (connecting Number 1, letter A, then 2, letter B, and so on), taking into account recording time and calculating the number of errors (Sami Abdel kaoui, D.S)

4/Presenting and analyzing the results of the study hypotheses:

4-1-Presentation and analysis of the results of the first partial hypothesis:

View and analyze Stroop test results to measure palm function:

Table No.(02): Shows the results of the Stroop test

cases	Position-A-	Position-B-	Position-c-	Position-D-	Degree of overlap
01	37 %74	19 %38	31 %62	15 %30	16
02	29 %58	12 %24	28 %56	9 %18	19
03	30 %60	22 %44	30 %60	11 %22	19

Through Table No.(02), we note that the results of the three cases in the first position ranged between 58% and 74%, while in the second position they ranged between 24% and 44%, while the third card ranged between 56% and 62%, while the last card ranged between 18% and 30%, while the rate of interference was estimated. Between 16 and 19, So, these results showed that the cases were somewhat able to read the colors written in black, along with their ability to read the colors of rectangles in position –C- compared to positions B- and D-, whose results were low, as position B- requires reading the meaning of the word with a palm. The effect of color, while

position D requires reading the color with a palm of the effect of the meaning of the word. We also note that the degree of overlap is high. In addition, the response time was slow, which indicates the presence of significant difficulties at the level of Inhibition function, and this is what fulfills the first partial hypothesis that stated the presence of disorders at the level of the Inhibition in children on the autism spectrum. This is consistent with Adams and Jarrold (2012) study entitled Palmism in People with Autism Spectrum Disorder, where the study found that people with autism showed a clear deficiency in resistance to distracting responses to correct responses, which indicates that they suffer from a deficiency in the response Inhibition.

4-2-Presentation and analysis of the results of the second partial hypothesis:

Presentation and analysis of the results of a complex Ray shape test to measure the plotting function: Character of Ray.

Table No.(03): Shows the results of the complex Ray form.

N	unity	Case01	Case 02	Case 03
01	An outer cross next to the left corner of the large rectangle	1	2	1
02	The large rectangle, which is the center of the shape	1	0.5	1
03	Diagonal of the large rectangle	2	2	0.5
04	The horizontal line that divides the large rectangle into two parts	1	0.5	1
05	The vertical line that divides the large rectangle into two parts	0.5	0.5	0.5
06	Inner small rectangle	0.5	0.5	0.5
07	The horizontal line near the small rectangle above	2	2	0.5
08	Parallel horizontal lines	1	2	0.5
09	The upper triangle formed by half of the upper side of the large rectangle	2	1	1
10	The vertical line located in a triangle inside the large rectangle, specifically under element 9	2	0.5	1
11	Circle and three points	1	0.5	0.5
12	The five diagonal lines	1	0.5	0.5
13	The two equal sides of a large triangle are to the right of the rectangle	1	1	1
14	The small rhombus suspended at the vertex of the triangle (element)	2	0.5	1
15	Vertical line inside element 13	2	1	1
16	A horizontal line represents an extension of the horizontal line that divides the large rectangle	1	0.5	0.5
17	The bottom cross that connects to element 5 is made by a small vertical line	2	1	0.5
18	The small square in italics is inside it from the left side down from the large rectangle	1	0.5	0.5
19	total	24 %66	17 %47	13 %36

Through the results of Table No.(04), we notice that the results ranged between 24-17-13, equivalent to 66%-47%-36%, which are low percentages. This indicates a weakness in the planning skill that this test measures, and this proves the fulfillment of the second partial hypothesis Which stated the presence of weakness at the level of planning function, which is consistent with the study of Happe and al (2006), which concluded that there is weakness indicative of the level of executive function tasks as a whole in the group of children with autism disorder and problems in the ability to plan.

4-3-Presentation and analysis of the results of the third partial hypothesis: *Presentation and analysis of the results of the traceability test to measure resilience: TMT*

Table No.(04): Shows the results of the flexibility test.

Cases	Number of errors	time spent	percentage
Case 01	12	360 s	%48
Case 02	19	450 s	%76
Case03	15	382 s	%60

Through the results shown in Table No.(05), we notice that the number of errors ranged between 12 to 19 out of a total of 25 (13 numbers, 12 letters), and that the time taken exceeded the threshold estimated at 300 seconds, and the percentages are high, which indicates that there are significant difficulties in completing this task. It is also noted that there are errors in removing the pen from the paper before finishing and confusion in the arrangement of numbers and letters So, the cases suffer from a weakness in the flexibility function, which fulfills the third partial hypothesis, and this is also consistent with the study of Ozonoff and Strayer (1997), which found that people on the autism spectrum have a weakness in the ability to change their responses when needed after they are accustomed to specific responses, i.e. Difficulty in conversion (cognitive flexibility).

Discuss the general hypothesis:

Through the results obtained after applying tests on palm functions, planning, and flexibility to the three cases, we noticed

that they were low results, which indicates the presence of weakness at the level of executive functions in the study sample. This fulfills the general hypothesis that stated that a child on the autism spectrum suffers from weakness at the level of These functions are responsible for decision-making, social interaction, verbal and non-verbal communication, as well as moving from one task to another and ability To stop inappropriate responses, in addition to the ability to plan to achieve a specific goal by building a plan appropriate to the goal and building effective strategies to solve any type of problem to which the individual is exposed.

We also note that the results reached are consistent with the study of Robinson, Goddard, Drischel, Wesley, and Howlin (2009), which aimed to determine the nature of the executive functions of children with autism disorder and verify the assumption that the difference in the performance of individuals with autism disorder Autism on executive function tasks reflects the severity or degree of autism disorder, not IQ The results of the study concluded that children with autism disorder have a clear deficiency in executive functions more than the group of mentally retarded children. It was observed in children with autism disorder that they move a lot and violate rules more than the second group, and that there is a correlation between the number of errors and age in the mental retardation group.

As well as the Etemad study (2010), which aimed to examine the relationship between executive functions and adaptive behavior among a sample of pre-school children with autism disorder. The results indicated that these children have deficiencies in executive functions that appear in their daily behaviors. The results revealed a significant negative relationship between Executive function scales and autism symptoms.

Conclusion:

In light of the challenges imposed by various modern trends that dealt with autism spectrum disorder, this study came to highlight the importance of the cognitive aspect for this group, and considering that executive functions are an important and effective part of this aspect, these functions were evaluated by applying cognitive tests and being able to detect the level of deficiency. In these functions, which are palm, planning, Flexibility, based on previous studies and arriving at the conclusion that a child on the autism spectrum shows abnormal behaviors due to disorders at the level of the executive functions directly responsible for these behaviors. Accordingly, some suggestions and recommendations can be given regarding the topic:

- The need to detect and assess disorders of executive functions in children on the autism spectrum.
- Conducting similar studies.

-Construction or adaptation of modern and contemporary batteries for the diagnosis of disorders of executive functions.

-Building knowledge programs based on these executive functions.

-Reducing undesirable behaviors in children on the autism spectrum by rehabilitating the efficiency of their executive functions.

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