The Effectiveness of Training on Switching Attention and Inhibition Processes on Cognitive Performance in Adults with Attention Deficit Hyperactivity Disorder

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Abstract

The aim of the current study is to determine the effectiveness of training on (attention switching and response inhibition) in the performance of some cognitive tasks in a sample of university students with Attention Deficit Hyperactivity Disorder, the total number of students with Attention Deficit Hyperactivity Disorder (60 students) was randomly assigned to two groups: experimental group (n = 30) withe mean age (19,67 ±0.82) and control group (n = 30) with mean age (19.55 ±0.75) . The study used three sets of tools: diagnostic tools, which include self-report for adults with ADHD. Training tools, which include one training task for the inhibition process (Stop Signal task) and one training task for switching process (switching attention task). The third group of instruments are the cognitive functions characteristic of the activity of the frontal lobes of the cerebral cortex. These include the London Tower test, the interference function, The results of the study showed that The presence of a statistically significant effect of cognitive training (on shifting attention and response inhibition) in increasing the level of cognitive performance on tasks (London tower, interference) which is one of the tasks characteristic of the activity of the frontal lobes , and these results support the validity of the main hypothesis of the study regarding   performance on tasks (London tower, interference).

Key words: switching attention, inhibition process, attention deficit hyperactivity disorder, university students.

Introduction

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most famous psychological and behavioral – developmental disorders suffered by school-age children, as well as many adult individuals also suffer from. (Biederman et al., 2000; Goldstein, 20 02; Woods et al., 2002).

ADHD characterized by a combination of interrelated symptoms that include: inability to concentrate and maintain attention, a high level of activity in a socially unacceptable way, which is reflected in the form of excessive muscle activity and impulsivity. (Barkley,2006).

The majority of psychologists have turned their attention to the study of this disorder only in childhood, as it was believed that this disorder affects only this age stage and does not extend to the following age stages. There are many evidences that have confirmed the possibility of this disorder continuing into adulthood and beyond (Weiss,2003).

The fourth diagnostic manual of the American Psychiatric Association DSM4 indicates the presence of secondary disorders in adults who suffer from this disorder since childhood, due to the years spent by these individuals suffering from this disorder without diagnosis or treatment, and these secondary problems appear especially in social, professional and educational skills. (APA,1994).

The available information on this disorder in the adult, especially among university students, isn't enough, which requires a more in-depth understanding of the nature of the psychological, neurooncological and academic functions of university students with this disorder(weyand & DuPul, 2006,9).

Therefore, this disorder is a real problem for university students, as its effect extends beyond academic, professional and social aspects. Which makes the call for more studies on this disorder among (university students) more urgent, especially since in our Arab environment.

The views that explain this disorder have differed: from considering hyperactivity as the basis of this disorder, to considering the inability to pay attention (attention deficit) as the essence of this disorder, or attributing this disorder to impaired ability to inhibit. While the clinical views confirmed the existence of two main disorders that represent the basis of this disorder are: inability to pay attention, and Hyperactivity. (Barkely,1997; Mirskey et al.,2001) .

There has been a shift in the explanatory views of this disorder to focus on the dysfunction of cognitive control mechanisms responsible for attention and executive functions, in particular the two processes: attention switching and response inhibition (Kaplan&Stevens,2002, 355). The imbalance in the processes of executive control is the basis that underlies the cognitive problems suffered by children and adults with this disorder, such as: dysfunction in working memory, inhibition control, selective attention, switching attention, these processes are related to the executive control system. (White & Shah, 2006, 44).

Barkley (Barkley,1997,72) hypothesizes that the symptoms associated with Attention Deficit Hyperactivity Disorder are caused by an deficit in the ability to inhibit respond, and that this deficit leads to secondary disorders in four executive functions that depend on inhibition, these functions contribute to putting behavior under control and these functions are (working memory, self-directed speech, self-regulation of emotions, and reconstruction). The ability to inhibit responding is related to the ability to organize and self-control. Self-regulation or cognitive control means the ability to inhibition inappropriate responses and actions (Casey ,et al.,2006,958).

Switching attention and response inhibition are considered to be critical processes in executive control because they are related to knowledge control processes , which include: selection, initiation, execution, and finish cognitive activities. The process of switching attention stands side by side with executive control, where performance on attention switching tasks is related to performance on complex cognitive tasks, it is also related to executive processes and inhibition control. (Friedman & Miyake, 2004; Miyake et al., 2000). As a result of the presence of a Notable defect in inhibition control in people with this disorder (ADHD), it is expected that this category will suffer from a defect in the ability to switch attention, which requires inhibition attention to one stimulus and switching it to another stimulus. (Minear, & Shah, 2008).

Adults with this (ADHD) suffer from deficit in the ability to switch attention, as these individuals have been observed to be slow in switching between stimuli or between a group of stimuli to control behavior appropriate to changing situations. (Oades & Christensen, 2008) the results of a study (White & Shah, 2006,) also confirmed that adults with attention deficit hyperactivity disorder suffer from deficit in the ability to switch attention, and this deficit can be improved through targeted short-term training.

Numerous evidences and results of neuropsychological studies (Elipek et al.1997; Mostofsky et al.1998) pointed out that the presence of structural and functional dysfunction in some areas of the cerebral cortex, especially in the frontal and prefrontal cortex, is considered one of the causes of the symptoms of this disorder. due to the main role played by the frontal lobe s in regulating the processes of cognitive mental activity, thinking processes, activation processes responsible for reflex attention, cognitive mnemonic actions, motor activity, control and guidance of behavior-dysfunction in these lobes leads to a disorder in the organization and control of these functions, the occurrence of impulsive behavior, inability

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to stop behavior, organize and implement search strategies, strengthen working memory functions and the speed of information processing (Kamel, 1997).

From the above, it is clear the close relationship between the processes of switching attention and inhibition on the one hand and their role in procedural control on the other hand, this control is necessary for the individual to successfully complete cognitive tasks and activities, especially those cognitive tasks characteristic of the activity of the frontal areas of the cerebral cortex, which suffer from a functional disorder in people with ADHD (Oades & Christinsen, 2008, 21).

Cognitive training is a new intervention designed to train an individual with attention deficit hyperactivity disorder (ADHD) to perform their functions like normal people , which results in effectively reducing the symptoms associated with this disorder and is reflected in improving behaviors in social and professional aspects as well as at home (Sandford, 2007). According to (Minear & Shah, 2008) that attention skills training is one of the main pillars of cognitive training, and the basis on which this technique is built is based on the fact that individuals with a cognitively impulsive response style (the opposite of leisurely) use an ineffective visual search method and inaccurate examination behaviors that cause less systemic vision. The goal of attention skills training is to help an individual remember the main parameters of the form of the stimulus.

The results of studies (Minear & Shah , 2008 (White & Shah , 2006) confirm that the practice of attention switching tasks leads to a significant increase in the ability to switch attention in general for normal individuals with Attention Deficit Hyperactivity Disorder and those with a clear defect in it. The results of the study (Houde et al. 2000,728) that training in inhibition control skills in individuals with ADHD resulted in an increase in the level of performance of that group on tasks that measure the ability to inhibit, that is, training has an effective role in improving that ability.

From the previous presentation, it is clear that this category suffers from a clear deficit in cognitive

performance, especially the performance associated with the functions of the frontal lobes, so the researcher assumes that cognitive training for adults with this disorder, especially on the processes of switching attention and inhibition, would improve performance on some of the disturbed cognitive functions (functions of the frontal lobes) in this category, as these two processes are considered central that control complex cognitive performance

Definition of hyperactive attention disorder and its types :

The term attention disorder with hyperactivity is called the set of symptoms included in hyperactivity, short attention span, low resistance to frustration, impulsivity, low formability (disobedience), quick excitability and poor self-concept .from a social point of view, an individual with attention disorder with hyperactivity suffers from a high level of activity in a socially unacceptable way, inability to maintain attention, extreme impulsivity and inability to establish good social relationships with peers and parents (Sayed Ahmed; Mohammed, Badr, and 1999)

According to the fourth diagnostic manual of the American Psychological Association, this disorder is classified into three subtypes :

Type I- Inattentive (ADHD –IA)

It refers to the inability of an individual to concentrate and maintain his attention for a long period of time while performing tasks, he does not control the fixation of his attention towards the target or desired stimuli and is attracted to the target or desired stimuli, he also suffers from absent-mindedness and difficulty concentrating and retaining his mental activity.

Type II: Impulsivity (ADHD-H / I)

It also is characterized by the inability to inhibit response, which is reflected in the deficit in three processes, namely :(inhibit response to a particular event / stimulus, the continuity of the response stops in a certain direction, the ability to self-control, as individuals with this disorder are characterized by impulsiveness, they respond very quickly and less accurately than normal who do not suffer from this disorder(Wodushek &Neuman ,2003) to determine the inhabitation amplitude in adults with Attention Deficit Hyperactivity Disorder, which was applied to two groups of people with the disorder The first group consists of (23) individuals with high degrees of severity of this disorder, and the second group consists of (22) individuals with lower severity of the disorder from the first group. the results showed that the first group with higher severity of the symptoms of the disorder was more slow in the process of cessation, reflecting the imbalance in the cessation of behavior and its association with many difficulties in executive function.

Type III: the two previous types include together any attention deficit with the presence of excessive activity and impulsivity.

The three types are distinguished based on the dominant and controlling behavior of the individual, whether it is motor activity, impulsive behavior, attention deficit, or all of them together. (APA IV, 1994, 62-65).

the factors causing this disorder:

It was found that this disorder can be due to several causes or multiple factors, which include physiological factors, genetic factors, environmental factors

1. physiological factors: they can be classified into neurological factors and biochemical factors 2-genetic factors

3-environmental factors

Explanatory models and theories of the disorder: There are many models and theories explaining attention disorder accompanied by hyperactivity as a result of the multiple entrances and aspects adopted by these models, and the most important of these theories can be considered models in light of their classification into two main entrances: functional and neuropsychological   models   and   theories,   and   attention models.   1-**functional and neuropsychological models and theories explaining the disorder**These models and theories assume in their explanation of the source of this disorder that it is due to a functional disorder in certain areas of the cerebral cortex, especially the frontal and frontal areas, and the most important of these theories and model:

A-**The Theory of the right frontal and parietal lobes**

This theory assumes the existence of two areas of the cerebral cortex responsible for the appearance of symptoms of this disorder, namely: (frontal lobes, right parietal lobes). The frontal lobes, especially the Gare frontal lobes, play an important and fundamental role in the performance of executive functions such as planning, implementing goal-oriented strategies, controlling impulsivity, as well as the usual responses to a particular situation. As for the right parietal lobes, many evidences have been found that there is a behavioral similarity between attention disorders and hyperactivity over-activation observed in individuals with attention disorder accompanied by hyperactivity and the symptoms experienced by individuals with damage to the right parietal lobes based on this evidence, this theory assumed that this disorder is associated with dysfunction in these two areas together. (Aman et al. 1998) .

B- Hybrid Neuropsychological Model of Executive (self-regulation) Functions

This model assumes that the main cause of the symptoms of this disorder is the defect   in the inhibition of the response, and this defect leads to secondary disorders in four abilities or neuropsychological

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functions that depend on the inhibition for the effective performance of these abilities, and this defect also leads to a decrease in the ability of motor control. Those functions or procedural abilities are determined according to this model in: working memory, self-talk, self-regulation of emotions-motivation-activation, reconstruction. These functions affect the motor system and are aimed at achieving goal-directed behavior and are called in the model motor control-fluency-constructiveness (Barkley, 1997) . This is supported by a study conducted by Epstein et al. (2001) in order to verify that the neuropsychological defect is related to this disorder. The study sample consisted of (25) individuals with ADHD .the results of the study showed that the errors caused by impulsivity of the group of individuals with ADHD were significantly higher compared to normal. these results support the assumption that the imbalance in the ability to stop responding is associated with the category of attention disorder accompanied by hyperactivity, and then the deficit in the ability to inhibit is mainly responsible for the behavioral symptoms characteristic of this disorder .

C – upper-lower model

This model emphasizes the role of the frontal cortex, which the model called the top of the system and called the role of the subcortical formations and the brain stem end (bottom) of the system, and has relied in its explanation of this disorder on the following functions :(executive functions, working memory, attention, ability to inhibition) with the observation of the existence of internal links between these functions. The model attributed all the manifestations associated with this disorder to the failure to control the inhibition, as the inhibition is responsible for other secondary disorders that occur in executive functions, so it puts the inhibition as the main reason behind the appearance of symptoms of this disorder and pointed out that the ability to cognitive inhibition is a necessary and important process in protecting working memory .

2- Models of attention for ADHD

Two attention models have emerged, both of which provide micro-level analysis of attention functions consistent with the results of neuropsychological tests :

A-the Mirsky model Mirsky Model

This model divided the attention structure into five components

The first component: focus / execution Focus / execute refers to the ability to pay attention and respond to certain stimuli and ignore the rest of the stimuli as distractions. The second component: shift displacement refers to the ability to distinguish and then focus on one focus among many different stimuli or among the different parameters of complex stimuli. The third component: Encode means the ability to keep information in the mind in order to perform some mental operations on it. The fourth component: continuity and alertness Sustain / Vigilance refers to the ability to retain focus and maintain alertness for a long time. The fifth component: stability stabilizes and this component is the one that enables the individual to respond in an appropriate way to the situation. This model assumes that an imbalance in more than one of these five attentional components causes an attentional imbalance, which is one of the characteristic core symptoms of attention disorder accompanied by hyperactivity, individuals with this disorder suffer from an imbalance in at least three of the previous attentional components. (Mirskey et al. 1999, Mirskey & Duncon, 2001) .

B-alternative model

This model focused on three basic components of attention, namely Selective attention, sustained attention, information processing capacity.

Selective attention refers to the ability to focus on certain stimuli or certain features for complex stimuli that include a large number of stimuli and ignore the rest of the stimuli, which enables the individual to focus on consistent and appropriate stimuli and ignore those that are not appropriate to the situation . Attention retention: it is also called attention alertness and is defined as the ability to maintain selective attention and mental control for a long period of time. While information processing capacity refers to the

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mental control of information and the amount of information, the efficiency of controlling that information as it has been processed at the emotional level, that is, the speed of information processing. (Tombaugh , 2006).

The most important cognitive and emotional functional disorders and the resulting behavioral manifestations can be summarized as follows:

1-a defect in cognitive functions, including: lack of attention, and a defect in: working memory, response efficiency, self-organization, motor control ability, planning ability, and this was supported by a study. Young et al, (2006) aimed to reveal whether the dysfunction in the performance on the interference task is due to the deficit in the processing of verbal information and the adequacy of the response in adults with ADHD disorder. The study sample consisted (26) adult individuals (20 males, 2 females) all suffering from ADHD disorder, in addition to (27) ordinary individuals, all of them university students . The results for people with ADHD showed that they have a significant impairment in the ability to stop compared to normal people.

 2-Dysfunction of emotional functions, including: hyperactivity, impulsivity, dysfunction in the self-regulation of emotions, dysfunction in social skills.

Methods and techniques of diagnosing the disorder:

There are many techniques and methods used in the diagnosis of this disorder, and these methods can be classified in light of two inputs: behavioral assessment input, neuropsychological assessment input.

1-**the entrance to the behavioral assessment**: it depends on the monitoring of the characteristic behavioral manifestations and indicators of individuals

People with this disorder through the use of lists of behavioral observations, self-reports, standard behavioral measures. Which depends on the eighteen indicators provided by the DSM IV list. .(Weiss & Murray, 2004,19) one of the most common measures in the diagnosis of this disorder

Adult ADHD self – Report scale symptom checklist (ASRS-V1.1) .

2- **Entrance to the neuropsychological assessment**: this entrance is based on the monitoring of the imbalance in the cognitive and emotional brain functions characteristic of individuals with this disorder. Hence, the starting point in the process of neuropsychological diagnosis is to assess the efficiency of cognitive and emotional functions in that category to identify the functions that suffer from dysfunction in this category. (Wood et al. 2002; Weiss & Wiess, 2004), where these performance-based experimental methods (tests and neuropsychological tasks) are considered more accurate and powerful than previous methods in the identification and monitoring of individuals with this disorder (Nichols & Waschbusch, 2004 ,311). This was supported by the (Bernhard et al.,2007) study. which carried out the neuropsychological diagnosis of adults with attention disorder accompanied by hyperactivity. The study sample consisted of: (30) individuals with attention disorder accompanied by hyperactivity, in addition to (27) individuals who do not suffer from any disorder between the ages of (20 – 40) years. The study found the presence of cognitive dysfunction in the category of attention disorder accompanied by hyperactivity. The presence of statistically significant differences in performance between individuals with this disorder and the control group in many tasks .

Methods of intervention used with this category:

The intervention methods used varied with the category of adults with this disorder to modify the aspects of dysfunction and the disorder in this category-with different entries explaining the causes and sources of this disorder as follows:

1-drug intervention:

In light of the focus on the chemical and neurological factors and changes causing this disorder, the method of drug intervention was used on the basis that this disorder arises as a result of an imbalance in the chemical bases present in the neurotransmitters in the brain, or in the reticular activation system of

brain functions, so medical drugs are used to restore the chemical balance of these bases, which leads to raising attentional efficiency, increasing the ability to concentrate, reducing the level of impulsivity and excessive motor activity.   Among the most important drugs used are Methylphenidate , Ritalin, Amphetamine and Atomoxetine (Wadsworth & Harper, 2007,103).

2-Cognitive training

The cognitive training method was used considering that the core of this disorder is the dysfunction of the cognitive brain (such as the processes of cessation and attention) and then this method was used to raise the efficiency of the brain in performing these functions.. Cognitive training includes training on a variety of tasks, which are designed so that training and practice on these tasks leads to an increase in the ability to: visual and auditory attention, memory, impulse control, inhibition skills, which are functions in which the defect is clearly manifested in a group with attention disorder accompanied by hyperactivity (Sandford, 2007) the White & Shah (2006) study was conducted to verify the presence of a defect in the ability to divert attention in people with ADHD, the effectiveness of training on attention diversion tasks to raise the level of the ability to switch attention in this group, in addition to verifying the possibility of transferring the effect of training to new tasks to measure the ability to switch attention. The sample of the study consisted of (16) individuals suffering from ADHD disorder , (18) ordinary individuals and the results of the study concluded: there is a clear defect in the ability to divert attention in this category compared to ordinary, there was also a decrease in the time of switching attention after training in this category when comparing the results before and after training, there was also a transition to the effect of training .

3- Psychophysiological control of behavior using biofeedback exercises:

The technique of biofeedback training is based on " providing immediate information to the individual in an audible or visual form about the state of the physiological processes of electrical muscle activity in order for the individual to learn how to control them consciously, and this is done only by an act of Will as an invaluable psychological energy (Full, 1991).   It is used to assess the ability to pay attention, control impulsivity and reduce the symptoms associated with attention deficit hyperactivity disorder for adults suffering from this disorder (emotional, behavioral)

(Tinius&Tinius,2003; Thompson & Thompson, 2005).

Research question:

Q1 - Are there difference between post-performance and pre performance on cognitive tasks for the experimental group

Q2-Are there difference between the experimental group and **control group in** post-performance on cognitive tasks

Aime of Research

The current Research aimed to :

1- revealing some aspects of cognitive dysfunction characteristic of university students with attention disorder accompanied by hyperactivity

2- determining the effect of Cognitive training on the tasks of switching attention and response efficiency to improve performance on some cognitive tasks (characteristic of the activity of the frontal-frontal areas of the cerebral cortex) in university students with attention disorder accompanied by hyperactivity

3-determining the extent of transition of the impact of targeted short-term cognitive training (on the processes of switching attention and response cessation) to performance on some cognitive tasks in the category of attention disorder accompanied by hyperactivity of university students.

Research Hypothesis:

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1- There are statistically significant differences between the mean scores in the post-performance indicators on the tasks (Tower of London, overlap) and the pre performance of the experimental group.

2 - there are statistically significant differences between the experimental and control groups in the means of the scores in the post-performance indicators on the tasks (Tower of London, overlap).

Methods:

Participants:

To select the research sample, the researcher relied on two integrated tests to judge that the individual suffers Symptoms of attention disorder accompanied by hyperactivity are as follows :

The first test: the list of self-report for the examination of adults with attention disorder accompanied by hyperactivity.

The second Test: neuropsychological assessment using: continuous performance CPT task, individuals whose performance level is less than the 33 percentile value in the two indicators of the correct degree of palm, and the degree of continuity of attention were selected). The previous tests have been applied to students of the Department of Psychology Faculty of Education King Khalid University- Abha .Thus, the final sample (60 students) was randomly distributed into two groups: an experimental group (N = 30) whose mean age was (19.67) with a standard deviation (p = 0.82) and a control group (N= 30) with an mean age (19.55) and a standard deviation (0.75).

Measurers:

The researcher used three sets of tools:1-diagnostic tools 2-training tools   3-cognitive tasks

1-**diagnostic tools: the list includes self-report, continuous performance testing**

 A-self-report list for screening adults with attention deficit hyperactivity disorder: Preparation (Adler et al.,2002) and researcher localization.

It is taken from DSM VI. The list consists of eighteen phrases, the first six phrases of the first part A are more predictive of symptoms characteristic of adults with hyperactivity accompanied by attention disorder. The six phrases are the basis in the self-report list, and the Second Part(B) is made up of (12) phrases containing additional signs / indications of CES that predict and confirm the presence of this disorder

 -Constructive validity

The constructive honesty of the list was calculated by calculating the correlation coefficients between the score of each phrase of the list and the total score on the list (after deleting the phrase score) the values of the correlation coefficients ranged between (0,37 – 0,71) and were all a function of statistically

Reliability:

- The researcher calculated the reliability of the list by the method of reapplication (with an interval of two weeks) on the rationing sample, and the value of the correlation coefficient between the degrees of the first application and the degrees of the second application reached t= 0,89, which shows that the list is characterized by a high degree of stability.

- The stability of the list was also calculated by the alpha cronbach method, the value of the alpha cronbach stability coefficient was (0.86).

B-continuous performance test (CPT):

The continuous performance test developed by (Conner, 1994) is one of the most common neuropsychological tests for measuring the persistence and alertness of Attention (Attention continuum), as well as impulsivity and lack of consideration. This test is highly effective and sensitive in distinguishing between adults with this disorder and normal, as confirmed by the results of studies (Advokat, et al.,2007

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; Epstein et al. , , ,2001; Bernhard et al. 2007; Schweiger et al. 2007) a lower level of performance of individuals with ADHD on this test compared to the performance of normal individuals .

The current researcher has programmed this test to be performed on a computer

Criteria validity :

was calculated by calculating the correlation coefficient between the correct inhibition score on the test and the errors on the write - off Test, where the correlation coefficient value reached (–0,66), and the correlation coefficient was calculated between the degree of attentiveness on the test and the mean errors on the number codes test, where the correlation coefficient value reached (- 0,625), which are acceptable honesty coefficients in such tasks .

2-Training tasks

These are tasks that have been programmed on the computer and include two tasks for inhibition Training (stop signal task) and two tasks for attention switching training (attention diversion task), where the examinee continues to train on each task separately until he reaches the stage of relative stability, which is determined by the learning curve for each examinee, and the computer program allows the examinee to train on the task to an infinite number of attempts until stability occurs These training tasks have been specifically selected according to the studies that have proven the correlation of performance on these tasks with the processes of inhibition and attention switching

A - the task of the stop signal SST:

This task is used in training on the hand control inhibitory control, in particular the hand motor response when hearing the Stop Signal and this task was programmed on the computer

(Nichols&Waschbusch,2004;Smith et al.,2006)

B - Motor Stroop task MST:

This task is used in training on the interference inhibition (Smith et al., 2006) and the task is programmed on the computer

C - shifting attention task (SAT)

This task aims to train attention switching based on changing the rule on the basis of which the examinee matches – on the basis of shape or on the basis of color – between the geometric shape displayed at the top of the computer screen and the two geometric shapes displayed below it .

In his current study, the researcher relied on the index of the number of correct attention switching responses.

D - Visual Spatial Switch Task(VSST):

This task is aimed at training in the transformation of visual-spatial attention (Smith et al.,2006)

3- Tasks characteristic of the activity of the frontal lobes of the cerebral cortex: including the tower of London test, the Stroop task

A-   the tower of London test
B-   The test measures the ability to think about a plan for the sequence of transfers (planning and organization) and the frontal lobes are involved in the process of Planning, Organization and control systems of a high executive level. (Christine temple, 2002, pp. 53-58).

Performance indicator: the mean time (in seconds) it takes to reach from the initial state to the target state of the attempts.

B - Stroop task

By comparing the speed at which colors can be named (reaction time) in both the cases of consistency and inconsistency, we measure the level of interference and dispersion measured by the names of competing colors. Here we find that patients with damage to the frontal lobe will show a high degree of dispersion in this test, a condition that is called the Exaggerated Stroop-effect (Boctig, & Marquard, 2001). The task was programmed on the computer

Validity the tasks for training and the activity of the frontal lobes:

The performance tasks that measure these functions were selected based on the use of these tasks in experimental scientific research to measure these functions, and this research has relied in proving the measurement of these tasks for these functions and their activation of certain areas in the brain on the use of modern techniques in identifying brain areas that are active during the performance of these tasks: Such as the technique of radioactive positron imaging (PET)

Search results:

Result of H1

To verify this hypothesis, the data were analyzed using the T- test to indicate the differences between the Associated means. Table (1) shows the results of the analysis

Table (1) T- test for differences between the mean scores of the pre-and post-performance indicators of the experimental group on the cognitive tasks of the experimental group (N = 30)

Tasks	Performance indicator	Measurement	mean	Stander deviation	T	D f	sig
Tower of London	Solution time per second	pre	24.3	4.99	8.4		
						28	0.01
		post	22.3	4.52			
Stroop	Interference Reaction time mms	pre	850.6	209	3.1		
						28	0.05
		post	775.9	189.6			

The results shown in Table (1) show that there are statistically significant differences between the mean scores of the post-performance indicators and the pre performance on the tasks (Tower of London, overlap) towards the post-performance.

Result of H2

To verify this hypothesis, the researcher used the T- test to indicate the differences between the experimental and control groups in the means of the scores of the post-performance indicators

and Table (2) shows the results of the analysis

Table (21) T-Test for the significance of the differences between the experimental and control groups in the means of the scores of the post-performance indicators

task	Performance indicator	Measurement	n	mean	Stander deviation	T	D f	sig
		experimental	30	20.9	4.78	3.4		

Tower of London	Solution time per second						28	0.01
		control	30	21.8	3.82			
		experimental	30	790.6	152.2	4.1		
Stroop	Interference Reaction time mms						28	0.01
		control	30	7895.9	169.6			

The results shown in Table (2) show that there are statistically significant differences between the experimental and control groups in the means of the scores of the post-performance indicators on the tasks (Tower of London, overlap,), towards the performance of the experimental group

Discussion

These results of Hypothesis (1):, taken as a whole, partially verification the first assumption. According to the meaning of the score on the London tower task (where a decrease in solution time indicates a high level of performance), and the Stroop task (where a decrease in interference return time indicates a high level of performance, this explains the differences in performance towards post-performance where lower values of the means indicate a high level of performance. The result of this hypothesis is partially supported by the existence of an effect of cognitive training in raising the level of post-performance of the experimental group on some tasks characteristic of frontal lobe activity (London tower, overlap) compared to the level of pre performance.

Results of Hypothesis(2) show: There are statistically significant differences between the experimental and control groups in the means of the scores of the post-performance indicators on the tasks (Tower of London, overlap), towards the performance of the experimental group. The result of this hypothesis is partially supported by the existence of effect of cognitive training in raising the level of post-performance of the experimental group on some tasks characteristic of frontal lobe activity (London tower,

overlap) compared to the level of post-performance of the control group.

With regard to the finding that there is a statistically significant effect of cognitive training (on switching attention and inhibition response) in raising the level of performance on tasks (London tower, Stroop), which are characteristic of the activity of the frontal lobes, this result is consistent with what was mentioned in the theoretical framework of the current study, and supported by the results of its previous studies, which indicated the effectiveness of cognitive training using a computer in raising the level of concentration of attention, problem solving, reducing the level of impulsivity and behavioral improvement in adults with ADHD, as well as the results of the (Stevenson et al.study.,2002), the results of which confirmed the existence of an effect of the cognitive rehabilitation program in improving brain function in Adults with ADHD, as also consistent with the study of(White &Shah,2006), the results of which proved the effectiveness of training on attention-shifting tasks in raising the level of ability to switch attention and the occurrence of a transition to the effect of training on attention-switching tasks to new tasks

This result is consistent with what has been confirmed by studies (Minear & Shah , 2008;Minear et al.2005; White & Shah, 2006) that the practice of attention switching tasks leads to a significant increase in the ability to switching attention in general – not only on tasks assigned to training – where the effect of training is transferred to other tasks that measure the same ability for normal individuals with Attention Deficit Hyperactivity Disorder and those with a clear defect in it

As well as what was emphasized by Houde et al. 2000,728) that training in the skills of control of the inhibition in individuals with attention disorder accompanied by hyperactivity caused a rise in the level of

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performance of that group on tasks that measure the ability to inhibit, which was not included in the steps of cognitive training, that is, training has an effective role in improving that ability.

This result can be explained in the light of the relationship between the two processes of cessation and switching attention and their role in executive functions and cognitive performance, and that the imbalance in these two processes, which is characteristic of people with attention disorder accompanied by hyperactivity, represents a malfunction in the cognitive control mechanisms responsible for attention and procedural functions, and that this deficit can be improved through targeted short-term training and then reflected on cognitive performance in general and executive functions in particular, which are associated with the functions of the frontal areas, which are evident in the performances on tasks(Tower of London, the overlap) .Which supports the scientific basis of this study that targeted qualitative cognitive training (Based on the core of the cognitive dysfunction in this category in the two processes: cessation and diversion of attention) can effectively affect the disturbed cognitive performance in this category, which is characteristic of the activity of the frontal lobes and whose activity is mainly related to executive functions .

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