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Visual Spatial and Executive Functions Disorders Among Palestinian Children Living Under Chronic Stress in Gaza

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Abstract:

Background: Demonstrating particular neurocognitive impairments due to stressful circumstances among children have been detected. In physical conflict areas around the world, children face various traumatic stressful events and this cause many neurocognitive disorders as memory, attention, concentration, but less attention has been devoted to study the effects of stress on specific neurocognitive abilities as visual spatial and executive functions on conflict areas as Gaza strip.

Objective: This study aims to determine the visual spatial and executive disorders among Palestinian children living under chronic stress in Gaza.

Method: A survey design was used to achieve the research objectives. Cross-sectional study was conducted with a sample (N = 90), (M = 47, F = 37) of children from Gaza. Validated Clock drawing test was used to evaluate visual-spatial, executive functions.

Results: Means and Standard Deviation were calculated in Clock Drawing tests. The results showed Clock Face Construction score is (11.47), Time Drawn to the Clock Hour, Half-hour and Minute scores are (4.71-4.89). All mean scores are in range of normative scores.

T-test for two independent groups was used. The finding also pointed out that there are no significant differences between male and female, citizens and refugees in Clock Face Constructional mean and the total mean of the Time Drawn to the Clock Hour, and Time Drawn to the Clock Half-hour.

Conclusion: Although, prevailing stress in Gaza, no visual spatial and executive disorders were recorded among Palestinian children.

Key words: Visual spatial, Executive functions, Stress

ملخص: بعض الاضطرابات المعرفية العصبية المحددة الناتجة عن التعرض للضغط النفسي تـم رصدها، وفي المناطق التي تشهد صراعات وحروب يواجه الأطفال جملة من الحوادث الـصادمة وصنوف مختلفة من الضغوط النفسية والتي تؤثر سلبا على بعض القدرات المعرفية العصبية مـن قبيل الذاكرة والانتباه والتركيز، مع ذلك لم توجه جهود كافية لدراسة تأثير الضغوط النفسية علـى الوظائف المعرفية التنفيذية وعلى والتصور المكاني البصري للأطفال الذين يواجهون تلك الضغوط في مناطق الصراعات. هدفت الدراسة الحالية إلى تحديد الاضطرابات للوظائف التنفيذية والتصور المكاني البصري لدي أطفال غزة الذين يعانون من الضغط النفسي المزمن نتيجة لحالة الحـصار والأعمال العسكرية المتواصلة منذ عدة سنوات، ولتحقيق أهداف الدراسة تـم اسـتخدام المـنهج الوصفي على عينة عنقودية عشوائية مكونة من 90 طفل، وللكشف عن اضـطرابات الوظـائف التنفيذية والتصور المكاني البصري تم تطبيق اختبار رسم الساعة، وللحصول على النتـائج تـم حساب المتوسطات والانحرافات المعيارية، وقد بلـغ متوسـط "Clock Face Construction" (11.47)،أما متوسطات "Time Drawn to the Clock Hour" و"Half-hour " و " Minute scores" تراوحت بين (4.71-4.89)، وجميع المتوسطات تقع ضمن البيانات المعياريـة التـي وضعت من قبل. وتخلص الدراسة إلى أنه ورغم الضغوط النفسية التي يتعرض لها أطفال غزة إلا أنهم لم يظهر عليهم اضطرابات في التصور المكاني البصري أو في الوظائف التنفيذية المعرفية.

Introduction

Neurocognition is a field of neurosciences that is related to the scientific study of biological concerns of cognition with a specific focus on brain physical and processes. It explains how many biological agents affect on the mental processes and how the behavior can alter structure and function of the brain. In addition, it examines where cognitive operations occur in the brain. Some psychologists call this discipline of neuroscience a cognitive perspective; they may study intelligences, memory, perception, and other mental processes. Another term is used term which called cognitive neurosciences, and indicated that it studies cognitive abilities and mental processes as, language, perception, attention, memory (long and short memory), and it may be useful for an understanding of brain-behavior relationship and the brain activity underlying appropriate social behavior (Davis and Buskist, 2008).

Visual Spatial is one of the basic components of the human cognitive abilities. And it indicates to the ability to form mental representations of the appearance of objects and to manipulate these representations in the mind (Wolbers *et al.*, 2004).

Spatial ability is generally refers to skill in representing, transforming, generating, and recalling symbolic, nonlinguistic information(Simmons, 2003), or it is the ability of an individual to manipulate or transform the image of spatial patterns into other arrangements. Otherwise, Hegarty and

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Kozhevnikov (1999) differentiated between spatial and visual abilities, they pointed out that visual ability indicates to a representation of the visual appearance of an object, such as its size, color, shape or brightness, but spatial ability indicates to a representation of the spatial relationships between parts of an object and the location of objects in space or their movement (Hegarty and Kozhevnikov, 1999).

Spatial ability consists of mental rotation, spatial perception, and spatial visualization.

Mental rotation is the ability to orient oneself in space relative to objects and events; and the awareness of self-location (Wolbers and Hegarty, 2010), it involves the ability to rapidly and accurately rotate a two- or three dimensional figure.

Its significance lies on the fields of architecture science, engineering, graphical studies (Samsudin and Ismail, 2004), physical education and educational therapies (Hegarty *et al.*, 2006).

Spatial perception is a person's ability to determine spatial relationships with respect to the orientation of his or her own body in spite of distracting information. In spatial

perception, the senses report things to have sizes, shapes, positions and motions (Simmons, 2003).

Spatial visualization is "the ability to mentally manipulate, rotate, twist, or invert pictorially presented stimulus objects"(Wolbers and Hegarty, 2010), it involves complicated, multi-step manipulations of spatially presented information.

Individuals with visual spatial abilities can do well on tasks as; visual transformation, mental rotation, counting three-dimensional arrays of blocks and duplicating block designs.

Visual Spatial Disorder is associated with many psychological, mental disorders, as autism, hyperlexia, constructional aphasia, and Non-Verbal Learning Disabilities (Kozhevnikov *et al.*, 2007).

They suffer from the troubled inability to recognize things that need to visualize, they are unable to perceive the distances between things accurately, or to imagine things after a promising arrangement, organization or change its place. In a practical sense, this problem would impair an individual's ability to write appropriately or print letters on paper or to place numbers in an appropriate space for accurate computation (Hegarty *et al.*, 2006).

The executive functions represent a broad, multifaceted class of functions consisting of mental planning and organization, cognitive flexibility, set-

shifting and development, reasoning, interference control and response inhibition (Pennington and Ozonoff, 1996; Joel *et al.*, 2010).

Executive functions are a vital component to regulate the human complex behavior, and any imbalance in these functions will inevitably lead to behavior disorders in neurobehavioral functions.

In the same context, Executive functions are considered to be significant prerequisite for successful adaptation and behavior in daily-life situations. They enable individuals to initiate and perform tasks and relentless pursuit in the face of challenges. As the environment can be changeable and unpredictable, executive functions are essential to recognize the significance of unexpected situations and to make alternative plans quickly when unusual events arise and interfere with normal routines (Morgan and Scott, 2000).

Many studies were performed to find out the relationship between executive functions and Alzheimer's disease(James *et al.*, 2004), (attention-deficit/hyperactivity disorder (ADHD) (Biederman *et al.*, 2004), schizophrenia (Defeyter *et al.*, 2009), obsessive-compulsive disorder ,depression and Autism (Joanna *et al.*, 2001). The outcomes explained that there is a wide range of executive function deficits.

Stress significantly influences on a wide range of cognitive functions, and the effects are dependent on the type, duration, and intensity of the stressor (Pirkola *et al.*, 2005; Lupien *et al.*, 2009).

Many studies have been showed the evidence of chronic stress on the brain and cognitive profile where stress can lead to deficits in memory, attention and concentration. Some cognitive disorders that have been reported among people experience chronic stress, mainly learning functions, attention deficit hyperactivity disorder (ADHD), dysphoria (unpleasant mood), major depression and anxiety disorders, Compulsive overeating, alcohol abuse, and chronic sleep deprivation. (Dodson, 2002).

Impaired intellectual ability, worse academic performance, and a greater need for individualized education programs have been noted in children who experienced early life stress (Loman *et al.*, 2009; Van Den Dries *et al.*, 2010)

Significance of the study

The Gaza Strip population, especially children, live in exceptionally severe circumstances with unique situation around the world. Many previous and recent events related to the political conditions and complicated aspects from the regional countries have created as condition. Firstly, the Israeli occupation status since 1967; secondly, the Intifada, the last siege and the 4

years closure which is considered a major accumulated reason to the harsh state; thirdly, the military actions against Gaza from time to time.

In the last 2 years, the humanitarian condition of the entire Gaza Strip entered into a very serious stage in which most of the bakeries stopped working and cues of people were in front of the opened one. Electricity was coming for 8 hours daily, no house gas and people started to use woods and kerosene cookers. Besides, there was a shortage in most of food material and UNRWA stopped distribution of food for around one million persons in the Gaza Strip (Thabet and El Sarraj, 2009).

Consequently, these children are suffered from wide range of psychological and emotional harmful effects problems such as anxiety, depression, irritability, frustration, anger, worrying, uncertainty, and signs of post traumatic stress disorders.

Until now, no actual studies about the chronic stress and its effects on cognitive as visual spatial and executive functions have been carried out which is a neglected area in the assessment of these children, they living under constant stress in physical conflict areas.

Therefore, the purpose of the study is to determine the visual spatial and executive functions disorders among Palestinian children living under chronic stress.

Methods

Aim of the study is to determine the visual spatial and executive functions disorders among Palestinian children living under chronic stress.

Research hypothesis

Is there a relationship between exposure to chronic stress and visual spatial and executive functions disorders among Palestinian children in Gaza?

Technical design

A survey design was used to achieve the research objectives. Cross-sectional study was conducted with non-probability cluster random sample (N = 90) children from Gaza.

Settings

The study was conducted at Al Mostaqbal, Almagid and Azahraa Schools.

Sample

More than 80 (*N* = 90) children (*Age* = 12-13) from Gaza participated in the study, (*M* = 47, *F* = 37) , they selected from the population of the study.

Inclusion and exclusion criterion

i) Inclusion Criteria

All children aged between 12 to 15 years old in Gaza strip were included in this study .

ii) Exclusion Criteria

The inclusion criteria include:

.1 Children under 12 years old and those older than 15 years old.

.2 Children with physical deficits .

.3 Children with psychological problems.

4. Children unable to read and write.

Data collection Tool

The validated clock drawing assessment was adopted in this study. This test is a very interesting test and useful technique to evaluate visual-spatial, executive functions, dementia (Strauss *et al.*, 2006) and may detect deficits in attention (Suhr *et al.*, 1998). The test also valuable with other tools to measure of several domains of cognitive function (Kremer, 2002). It needs short time, about 5 minutes only, familiar and favorable for the children.

The test requires merely a sheet of paper and a pencil and can be given as part of a bedside examination or, in other instances, when lengthy neuropsychological testing is not possible (Esther *et al.*, 2006). According to Cohen and colleagues (2000), the child is provided with piece of paper and instructed to "draw the face of a clock and make the clock say 3:00." After this, the child is presented with two predrawn is asked to indicate the times of 9:30 and 10:20 (Cohen *et al.*, 1992; Cohen *et al.*, 2000).He recommended scoring clock construction and clock setting separately, clock construction has a maximum score of 13 , and clock setting is measured on a 5-point scale.

Procedures

At the first, permission from the competent authorities to apply the test was got. Then, define the purposive sample in, Al Mostaqbal, Almagid and Azahraa Schools

Before data collection, ten professional social workers were undergone for training for three hours and supplied with all information about the sample in five districts. Administration of the test was carried out through September 20 – November 2010, and data entry and analysis was done in December 2010.

All data were analyzed using Statistical Package for social Sciences (SPSS) version 15.

Statistical Analysis

SPSS version 15 was used for data entry and Analysis. Descriptive statistics was applied for analysis of the demographic data and Means, Standard Deviations were used to analyze the data. In addition, Means and standard Deviations were counted for each cognitive function. Independent t-test was used to compare means in gender variable.

P-value or significant value < .05 was considered as statistically significant and used for all comparisons, either between two or several groups.

The results

Sociodemographic characteristic of the study

The sample responded to the interview were 84 subject, it consisted of 47 male (56.0%) and 37 females (44.0%). The age ranged from 12 to 13 years with mean age was 12.23 *years* (SD =.427). According to place of residence 53 % were from Gaza area, 23.8 % from KhanYounis area. Due to citizenship, 70.2 % were citizens and 29.8 % were refugees, a according to family monthly income, 11.9 % had equal or less than 250-500 $ monthly. (Table 1)

Table 1: Sociodemographic characteristics of study population (n = 45)

	Frequency (N)	**Percent (%)**
1.Sex		
Male	47	56
Female	37	44
Missing value	-	-
Total	84	100
2. Age (12-15) *Mean = 12.23 (SD = .42)*		
3. Residency		
Gaza	45	53
KhanYounis	20	23.8
Missing value	19	22.6
Total	84	100
4. Citizenship		
Refugee	25	29.8
Citizen	59	70.2
5.Family monthly income		
More than 2000 (500 $)	24	28.6
1000 – 2000(250-500$)	26	31.0
5000 – 1000(125-250$)	4	4.8
Less than 500(125$)	10	11.9
Missing Value	20	23.8
Total	84	100

Table 2: Means and standard deviations **for Clock Drawing Tests**

Clock Drawing Tests	n	Mean	Std. Deviation	Minimum	Maximum
Clock Face Construction (maximum score =13)	82	11.47	2 .0	**1**	13
Time Drawn to the Clock :Hour (maximum score =5)	82	4.84	.45	**2**	5
Time Drawn to the Clock :Half-hour (maximum score =5)	82	4.89	.49	**2**	5
Time Drawn to the Clock : Minute (maximum score =5)	82	4.71	.71	**2**	5

Means and Standard Deviation in Clock Drawing Test (Table 2)

Means and Standard Deviation were calculated in Clock Drawing tests. The results showed Clock Face Construction score is (*M* = 11.47) (SD = 2.0), Time Drawn to the Clock Hour,*(* *M* = 4.84) (SD = .45), Time Drawn to the Clock Half-hour (*M* = 4.89) (SD = .849), Time Drawn to the Clock Minute (*M* = 4.71) (SD = .71).

The significant differences between male and female in Clock Drawing Test

T-test for two independent samples was used to determine differences between male and female groups in Clock Drawing Test (table 3). Its results showed no significant differences between male and female groups, in time Drawn to the Clock Hour (p-value=.13 > .05). On the other hand, the results showed significant differences between male and female groups in Clock Face Construction (p-value=.01 ≺ .05).

Table 3: P- Values of male and female experimental group in Cock Drawing Test

Cock Drawing Tests	Groups	n	Mean	P- Value
Clock Face Construction (maximum score =13)	**Male**	85	**11.85**	**.40**
	Female	24	**11.16**	
Time Drawn to the Clock :Hour (maximum score =15)	**Male**	85	14.55	**.31**
	Female	24	**14.20**	

Table 4: P- Values of citizens and refugees experimental group in clock drawing test

Cock Drawing Tests	Group	n	Mean	P- value
Clock Face Construction(maximum score =13)	**Male Group**	45	10.978	**.01**
	Female Group	37	12.05	
Time Drawn to the Clock :Hour (maximum score =15)	**Male**	45	14.74	**.13**
	Female	37	14.70	

The significant differences between citizens and refugees in cock drawing tests

T-test for two independent samples was used to determine differences between citizens and refugees in Clock Drawing Test (table 4). The results show no significant differences between citizens and refugees groups, in Clock Face Construction (p-value=.40 > .05), Time Drawn to the Clock (p-value=.31 > .05).

Discussion

To answer the main question of the current study which stated that "is there a relationship between exposure to chronic stress and visual spatial and executive functions disorders among Palestinian children in Gaza?" mean scores are compared with normative data. Mean score for Clock Face Construction is 11.47 (Table 2) and normative data is 11.62, (Table 5). Time drawn to the Clock Hour is 4.84 (Table 2) and normative data is 4.54 (Table 5). Time drawn to the Clock Half-hour is 4.89 (Table 2) and normative data is 4.69 (Table 5). Time drawn to the Clock Minute is 4.71 (Table 2) and normative data is 4.65(Table 5). As seen in Table (5), all means of Clock Face Construction, time drawn to the Clock Hour, time drawn to the Clock Minute are fall in normative scale (Strauss *et al.*, 2006). Consequently, children haven't suffered from visual-spatial disorders or executive dysfunction (Strauss *et al.*, 2006).

The outcomes of variables showed no significant differences between groups except gender variable, these findings consistent with the prevailing

stressful circumstances in all area of Gaza and all sectors regardless of incomes or social site.

Table 5: Means and (SDs) for Clock Drawing in Children Cohen and colleagues (2000) collected data on a sample (N = 429) from public school children in USA, age (6-12).

Time Drawn to Clock					
Age (Years)	**n**	**Hour[a]**	**Half-hour[a]**	**Minute[a]**	**Construction[b]**
6	40	3.20(1.65)	3.20(1.45)	2.15(1.46)	8.65(2.14)
7	79	3.97(1.27)	3.86(1.267)	3.03(1.62)	9.46(1.73)
8	70	4.59(0.96)	4.35 (0.91)	4.305 (1.18)	10.84(1.14)
9	69	4.68(0.76)	4.55(0.80)	4.57(0.92)	10.81(1.13)
10	91	4.36(0.90)	4.35(0.99)	4.38(1.06)	11.34(0.98)
11	54	4.62(0.89)	4.51(0.84)	4.47(1.09)	11.39(1.09)
12	26	4.54(0.86)	4.64(0.68)	4.65(0.89)	11.62(0.98)

[a]Scale ranges from 1 to 5, with higher scores indicating better performance
[b]Scale ranges from 1 to 13, with higher scores indicating better performance
Source :(Cohen *et al.*, 2000)

But these results generally are not consistent with many studies have been done that explained negatively stress effects on cognitive functions and brain neurocognitive system. In spite of no studies have been performed highlighting the stress and cognitive abilities in Gaza as area of constant stress and prevalence of (PSTD).

It is worth mentioning that the main reason for the stress, children have been suffered in Gaza Strip from the occupation, the siege imposed on it since years; in addition, to the recent war in Gaza at the end of 2008 and the beginning of 2009 and the ongoing military operations in the border areas in Gaza Strip .

Gaza is the largest prison in the world, and it is completely sealed off ghetto. More than 1.5 million Palestinians are living in a piece of land not exceeding 360 km^2, and closed from either barbed wire or from the sea. There are only four gates, three with Israel, and one with Egypt, but it is rarely opened

The most important common feature that approximately 60 % live below the poverty line, about 50% of the population depends wholly or partially on food aid provided by the United Nations Relief and Work Agency for Palestinian refugees (UNRWA), which were established in 1948 (Gilbert and Fosse, 2009).

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During the past four years, the population in the Gaza Strip has faced of a wide range of stressful and traumatic events. The blockade caused of shortages in many of the basic requirements of life, intermittent military operations which including the bombing by aircraft, artillery, voices of shooting fire and the sounds of aircraft flying in the sky for long periods. So, many studies were explained that families in Gaza as conflict witnessing an increase psychological problems due to stressful and traumatic events (Thabet *et al.*, 2004).

The class of children in Gaza is considered to the most affected by stressful events. Thabet and colleagues (2010) indicated that the most traumatic events among the children were hearing the frightening sound of explosions resulting from bombardment with artilleries and air fighters, the sounds of tanks and sonic sounds of the jetfighters. Whereas the least events stressful impacts, hearing the news of the death or injury of a relative or friend as well as witnessing the effects of destruction and devastation caused by the bombing (Thabet and Vostanis, 2009).

The study of Thabet (2009) after the war against Gaza, revealed that there was no safe place for children and families and children were not able to feel safe or believe that someone can protect them which was accumulative stress beside the other traumatic events. This unsafe feelings lead to internal displacement of the families and this item was predicting the PTSD and traumatic grief in children. Loss of close relative, friend, or someone close to the children was one of the traumatic events for children and their families. Almost half of the children said that they lost someone they know and this loss increase the children grief and bereavement (Thabet *et al.*, 2009).

In study of Helminen and Punamäki (2008) of 345 Palestinian children and adolescents reported nocturnal dreams using a seven-night dream diary. The results showed that the dreams of children exposed to severe military trauma incorporated more intense and more negative emotional images. Children in the trauma group showed relatively fewer post-traumatic symptoms if their dreams incorporated intensive and positive emotional images. Similarly, personal exposure to military trauma was not associated with anxiety and aggressiveness among children whose dreams had low negative valence, or with lower anxiety when dreams had intensive emotional images (Helminen and Punamäki, 2008).

There are many wide ranges of negative consequences of stress (Curtis, 2000; Natvig *et al.*, 2003; Almeida, 2005; Westen *et al.*, 2006). And this basically due to the alteration the structure and function of the brain (Westen *et al.*, 2006).

The effects of the stress on cognitive abilities were studied by many researchers, particularly in the areas as military conflicts, sectarian, ethnic or areas where famine, poverty and lack of natural resources.

Many studies have performed and focused on the relationship of chronic stress with cognitive function, such as attention, perception, and memory, they have been done mostly in animals like rodents, rats and dogs, in which investigators have examined the influence of chronic stress on acquisition, consolidation, and retrieval of information.

One of the most profound aspects of prolonged stress is reduced performance in tasks that require attention, and thus causes disturbances in focusing and the ability to deal with information (Xiao-heng *et al.*, 2007).

Stress affects functions of new learning and memory that are mediated by the hippocampus (Bremner *et al.*, 1995; Lupien and Lepage, 2001). Stress can also impair subsequent learning and memory and can even lead to amnesia. Two important brain regions in regulating learning and memory are hippocampus and amygdala, which contain receptors for stress hormones. The effects of stress hormones on learning are mediated by these receptors in the hippocampus and am In physical conflict areas, the latest studies have indicated that victims of combat veterans experience alteration to the hippocampus (Jensen, 2000), which play very important rule in memory and learning. As well as it connects functionally with the prefrontal cortex, the center of emotional response to stress and fear. Also, impairments have been found in with who exposed to traumatic events one or both of these brain regions; these impairments can lead to problems with learning and academic achievement(Lindau *et al.*, 2007).

Many studies (Gilbertson *et al.*, 2001; Vasterling *et al.*, 2002) indicate a relationship between exposure to a traumatic stress and deficits in visual spatial skills and attention. Global deficits in executive functioning following effects of early life stress are frequently reported (Colvert *et al.*, 2008; Pollak *et al.*, 2010).

Deficits in complex, higher-order functions as executive functioning may take place due to brain prolonged exposure to stress in early life regions. These dysfunctions could contribute to the progression of mental illness; for example, executive dysfunction may impair emotion regulation and foster rumination as seen in depression (Pechtel and Pizzagalli, 2011).

The current study does not shows executive function and visual spatial disorders in spite of stressful circumstances prevalent since years in Gaza. These findings can be interpreted partially to coping strategies that children in Gaza developed.

The Palestinian family frequently acts as a buffer against stress and contributing in developing coping strategies (Garmezy and Rutter, 1985; Kimberly and William, 2006). Family cohesion is a predictor of good mental health in refugee children (Kimberly and William, 2006) Adaptability and cohesion within families appears to protect the emotional well-being of children following stress exposure .

Palestinian society is heavily rooted in traditional, Arab-Islamic, and preservative culture, Traditional Palestinian culture views children as personal and collective possessions.

Children are required by social values and norms to conform, obey, and honor their elders (Kathleen and James, 1994). It is argued here that this social attention reflected positively on the Palestinian child's ability to deal with stressors and developing coping strategies in their life. Furthermore, the occupation state changed the social perception of the child. Children began to be perceived as having individual needs and rights. In essence, the occupation state "humanized" the Palestinian perception of the child (Shalhoub-Kevorkian and Baker, 1999).

Conclusion

Visual spatial and executive functions disorders among Palestinian children living under chronic stress were not recorded in spite of stressful conditions prevailing in Gaza and the ongoing suffering of the children.

Recommendation

In the light of the current study findings it is recommended that; more cognitive studies might be conducted to determine the relationship between the stressful situations that children face and other cognitive disorders such as attention, memory, understanding and focus.

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