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Original article

A Study of Cortisol Level as a Biological Marker in Disruptive Aggressive Behavior in Adolescence

Victor S. Mikhael [a], Mohamed M. Elhamady [a], Shewikar T. Elbakry [a], Ola S. Elshimi [b], Amira Z. Abd-ElAziz [a]

[a] Department of Psychiatry, Faculty of Medicine Benha University, Egypt. [b] Department of Clinical and Chemical Pathology, Faculty of Medicine Benha University, Egypt.

Corresponding to: Amira Z. Abd-ElAziz, Department of Psychiatry, Faculty of Medicine Benha University, Egypt

Email: dramirazaky.82.az@gmail.com

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Abstract

Background: Adolescence is usually associated with the teenage years, but its physical, psychological or cultural expressions may begin earlier and end later**.** Aggression is a behavior whose primary or sole purpose or function is to injure physically or psychologically. **Aim and objectives**: To demonstrate that high cortisol level in relation with the comorbidity of substance abuse and the duration of abuse in the conduct group. **Patients and methods:** This study was conducted on 50 aggressive patients with disruptive aggressive behaviors, attending the adolescent outpatient clinic at Alabbassia Mental hospital, who in turn divided into two groups one of conduct disorder and the other of Oppositional Defiant disorder and 25 resembling the control group during the period from March 2019 to February 2020. **Results:** Patients with conduct disorder showed statistically significant difference between the cortisol level and the comorbidity of substance abuse and the duration of abuse (by years) ($P<0.05$). While in the ODD group, there was statistically significant difference between the cortisol level and the gender and the age of the adolescent ($P<0.05$). **Conclusion:** Cortisol level is higher in the disruptive aggressive adolescents than that of the control group participating in the current study, moreover it was higher in those with conduct than ODD groups. It was demonstrated that high cortisol level in relation with the comorbidity of substance abuse and the duration of abuse in the conduct group.

Keywords: Adolescence, Aggression, Cortisol

Introduction

Adolescence can be defined as the period of transition from childhood to adulthood and all physical, mental, social and cultural changes that mark it including the maturation of the sexual organs and the secondary sexual characteristics [(1, 2)].

The major landmark of puberty for males is spermarche, the first ejaculation, which occurs, on average, at age 13. For females, it is menarche, the onset of menstruation, which occurs, on average, between ages 12 and 13 .The age of menarche is influenced by heredity, but a girl's diet and lifestyle contribute as well. Regardless of genes, a girl must have a certain proportion of body fat to attain menarche [(3)].

The brain reaches 90% of its adult size by the time a person is six years of age thus, the brain does not grow in size much during adolescence. However, the folding in the brain continues to become more complex until the late teens. The biggest changes in the folds during this time occur in the parts of the cortex that process cognitive and emotional information [(4)].

Adolescence is also a time for rapid cognitive development [5].

Piaget describes adolescence as the stage of life in which the individual's thoughts start taking more of an abstract form and the egocentric thoughts decrease. This allows the individual to think and reason in a wider perspective [6].

Aggression is an act that intended to cause harm to another person, Or as a behavior whose primary or sole purpose or function is to injure physically or psychologically" [7].

It can be classified as: Physical Aggression: is hostile form of aggression. Its aim is to cause bodily damage. It includes kicking, molesting, harassing, biting, pushing, torturing, fighting, bullying, vandalism, destruction and gangsterism, shoving, hair pulling, stabbing, shooting and Nonphysical aggression is aggression that does not involve physical harm. Nonphysical aggression includes verbal aggression (yelling, screaming, swearing, and name calling) and relational or social aggression [8, 9].

Disruptive behaviors in adolescent are clinically significant behavior that interrupts the interpersonal context of the adolescent. The extent to which ODD and conduct disorder should be considered as separate or as a single disorder is the subject of some debate. This is reflected in existing classification systems: in DSM-5 the diagnosis of conduct disorder can include all of the features of ODD and it is treated as a precursor to conduct disorder [10].

However, while ODD and conduct disorder have been found to have high levels of comorbidity, most children diagnosed with ODD do not go on to develop conduct disorder, and the two disorders are distinguishable by a range of different correlates [11].

The HPA axis is the main physiological system which mediates the body's stress response. The Para ventricular nucleus of the hypothalamus releases corticotrophin-releasing hormone in response to threat signals from brain regions such as the amygdala [12].

Cortisol has widespread effects throughout the body and brain, and passes through the blood-brain barrier to down regulate HPA axis activity by triggering negative feedback mechanisms, thereby inhibiting its own production, and it also acts at glucocorticoid and mineralocorticoid receptors in limbic brain regions such as the amygdala and hippocampus to modulate learning and memory [13].

Cortisol level variation in disruptive aggressive behaviors: Results concerning cortisol levels or cortisol response to stress in aggressive children are not without ambiguity, while the majority of studies have reported an association of low basal HPA axis activity with high aggressive and disruptive symptom levels [14]. Also there was a study that worked by examining whether cortisol hypo reactivity to stress was specific to childhood-onset CD, and compared male adolescents with childhood-onset and adolescence-onset forms of CD and a healthy control group. Both CD subgroups showed attenuated cortisol (and cardiovascular) responses to stress compared with control group [15].

The aim of the study was to demonstrate that high cortisol level in relation with the comorbidity of substance abuse and the duration of abuse in the conduct group.

Patients and methods:

This descriptive comparative research study was carried out during the period from March 2019 till the end of February 2020, on 50 participants from Alabbasia mental hospital in Cairo and 25 apparently healthy individuals.

Study group: Fifty participants with disruptive aggressive behavior in adolescence (presenting with aggression and diagnosed according to DSM 5) and divided into two groups:

Group I: 25 conduct disorders, **Group II: 25** oppositional defiant disorders and **Control group (group III): 25** healthy personnel.

An approval from Research Ethics Committee in Benha Faculty of Medicine was obtained.

An approval and authority of Research department in the General Secretariat of Mental Health and addiction treatment was obtained. A written informed consent was taken from the parents or care givers & oral consent from the participants, it included data about aim of the work, study design, site of the study, time of the study ,subjects involved in the work, tool used in it and confidentiality.

The patients were invited to participate in the study & received a complete description of the study. Going with the simplicity, the caregivers wanted the benefit to the others, they all agree to participate although it was explained that it was not beneficial in the current condition of the adolescent, Moreover, it was stressed explained that withdrawal from the study was possible at any time without any consequences

Inclusion criteria: Residency: Urban, Age: from 12 years to 18 years (not to be in different developmental eras which might affect the HPA axis and in turns could affect the cortisol level) and Schools: All from public and experimental governmental schools.

Exclusion criteria: Cases giving clinical or borderline range of the following: Gross medical or endocrinal disorders**,** Anxiety or depressive disorder**,** Intellectual disability and Neuro -Developmental disorder.

All patients were subjected to the following:

Semi-structured interview (including age, sex, residency, educational level, substance abuse, and family stressor), **Clinical psychiatric assessment including** history taking, mental state examination and Physical examination. At first to set in quite room greeting the parents and the adolescent then to introduce and to illustrate the aim of the current study and get the consent to be part of the research. And **Psychometric assessment including:** to illustrate the different psychometric tools to be used and how we can obtain the data as both the Child Behavior Check List and Baza aggressive scale were only to be fulfilled by the parents or caregivers so to illustrate that to the adolescent participants and in turn to add Magdy Eldesokky scale as it had already two versions one for the parents and one for the adolescent himself as to take their opinion in the presence and severity of the symptoms in comparison to their parents view.

A-Child behavior check list (CBCL): The school-age version of the CBCL (CBCL/6-18) instructed to be completed by the parent/caretaker who spent the most time with the child. The CBCL/6-18 provided ratings for 120 problem items.

The eight empirically based syndrome scales were: Aggressive Behavior**,** Anxious/Depressed**,** Attention Problems**,** Rule-Breaking Behavior**,** Somatic Complaints**,** Social Problem**,** Thought Problems and Withdrawn/Depressed

B- Aggressive behavior and hostility scale for adolescent and youth (Baza) [(16)]:

On the current version of the scale used in our study, we got the whole aspects of aggression as physical aggression, verbal aggression, hostility and anger. It is a self -administered 56 –point questionnaire. Each one had 14 questions covered different items throughout the adolescent and youth at home or school. So, the high number was referring to the worst or the severe form of aggression. In each subtype scores between 14-27indicated none to mild aggressions, scores between 28-41 indicated moderate aggression, scores between 42-55 indicated severe aggression whereas scores between 56-70 indicated profound aggression. And **C-Oppositional Defiant disorder scale by (Magdy Eldesokky) [(17)]**: The author had formulated 24 items or statements into Arabic depending on the

previous scales for the diagnosis of oppositional.

Tree forms were developed by the author: The teacher and the parents form which had the same items, and the adolescent form. All can be done in 10 minutes only.

Each had 5 ranges of the answers as: the high number was referring to the worst or the severe form of the symptoms.

Salivary cortisol sample: To get the salivary cortisol sample as to obtain it in the early morning between 9 to 10 am by using sterile swab and to put it in the mouth which had to be clean either by being already washed or at least to use sugar free gum before obtaining the sample, as a non-invasive method of collection of the sample from adolescence. It also reflected the plasma concentration of the non-protein bound active fraction. This process was conducted mostly in one session, but some cases were asked to come in second visit to finish the psychometry as for the time consumed through the steps.

RESULTS:

Male was more prominent in the three studied groups as 80% of the conduct group were males and 56% of the ODD and 65% of the control group. Also, the adolescent between 15 to 17 were more than those between 12 to 14 years as they were 76% of the conduct and 60% of the ODD and 96% of the control group. As shown in **(Table 1)**.

Those with conduct disorder showed statistically significant difference between the cortisol level and the comorbidity of substance abuse and the duration of abuse (by years) ($P<0.05$). While in the ODD group, there was statistically significant difference between the cortisol level and the gender and the age of the adolescent ($P<0.05$). As shown in **(Table 2)**.

(Figure 1) demonstrated the common life stressors that had an impact on the different groups participating in the current study so it was shown that 60% among the conduct group had no impact by any of the life stressors, 16% get the impact of divorced parents,8% get the stress of failure in one academic year, 8% get that of both divorce of parents with the failure of one academic year and the last 8% get the impact of both death of one of the parents with the failure in one academic year. Also, among the ODD group it was found that 72% had no stressors, 4% get the impact of divorced parents, 8% of death of one of the parents, 8% get the stressor of both divorce of the parents and the failure in one academic year and 8% were got both stress of death of one of the parents with the failure of one academic year. While in the control group there were also 72% had no stressors, 16% get the divorced parents and 12% with the death of one of the parents.

Table (1): Sociodemographic data of the studied adolescent with conduct, ODD and control groups participating in the study.

		Group						Total	
		Conduct		ODD		Control			
		NO	%	NO	%	NO	%		
Gender	Male	20	80%	14	56%	15	60%	49	65.3%
	Female	5	20%	11	44%	10	40%	26	34.7%
Age (years)	12-14	6	24%	7	28%	10	40%	23	30.7%
	15-17	19	76%	18	72%	15	60%	52	69.3%

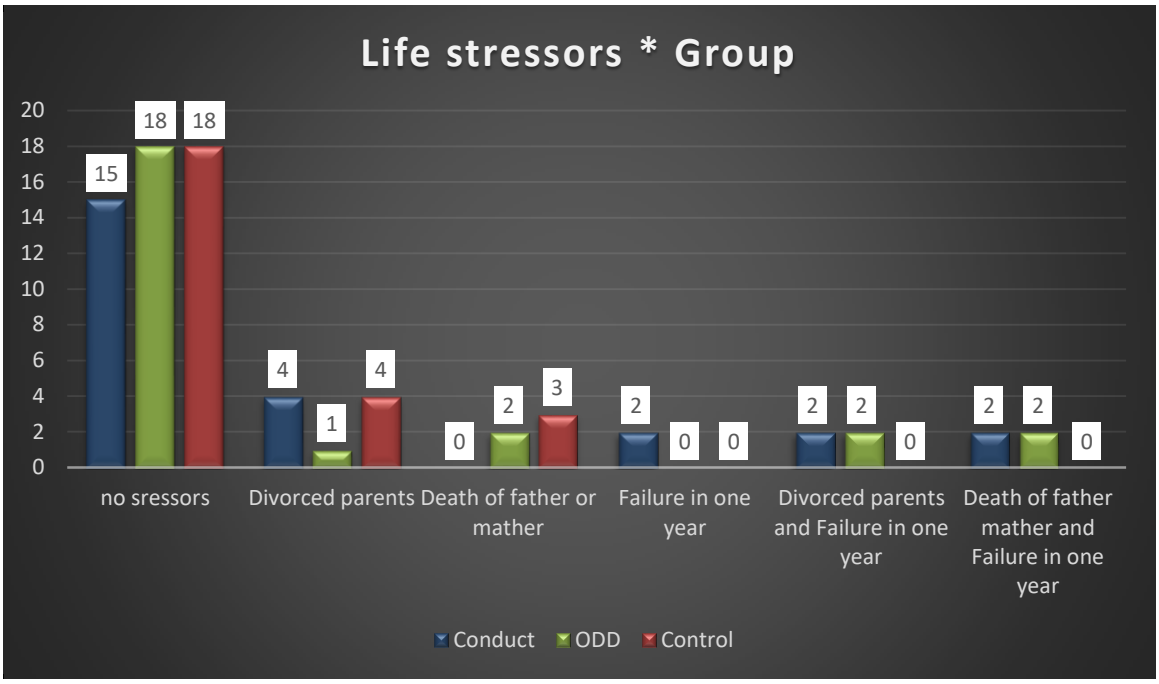

Fig. (1): The different life stressors affecting the conduct, ODD and control groups participating in the study.

Table (2): Cortisol level in relation to the sociodemographic variables, substance abuse and the presence of life stressors for the conduct, ODD and control groups participating in the study.

Variables		CORTISOL LEVEL													
		Conduct					ODD					Control			
		Normal		high		Chi-square (P-value*)	normal		high		Chi-square (P-value*)	normal		high		Chi-square (P-value*)
		NO	%	NO	%		NO	%	NO	%		NO	%	NO	%	
Age (years)	12-14	0	0%	6	100%	.686	0	0%	7	100%	8.974	10	100%	-		---
	15-17	2	10.5%	17	89.5%	(.407)	12	66.7%	6	33.3%	(.003)*	15	100%	-		
Gender	Male	2	10%	18	90%	.543 (.461)	10	71.4%	4	28.6%	6.997 (.008)	15	100%	-		---
	Female	0	0%	5	100%		2	18.2%	9	81.8%	*	10	100%	-		
Substance	No	0	0%	19	100%	6.884 (.009)	6	40%	9	60%	5.235 (.155)	25	100%	-		---
	Tobacco	-		-		*	2	100%	0	0%		-		-		
	Tobacco and cannabis	2	33.3%	4	66.7%		4	66.7%	2	33.3%		-		-		
	Tobacco & Tramadol	-		-			0	0%	2	100%		-		-		
Duration of abuse (years)	0	0	0%	19	100%	25.00 (.000) *	6	40%	9	60%	1.229 (.541)	25	100%	-		---
	2	0	0%	2	100%		-		-			-		-		
	4*	2	100%	0	0%		4	66.7%	2	33.3%		-		-		
	5	-		-			2	50%	2	50%		-		-		
	6	0	0%	2	100%		-		-			-		-		
Life stressors	no stressors	2	13.3%	13	86.7%	1.449 (.836)	12	66.7%	6	33.3%	8.974 (.062)	-		-		---
	Divorced parents	0	0%	4	100%		0	0%	1	100%				-		
	Death of father or mother	-		-			0	0%	2	100%		-		-		
	Failure in one school year	0	0%	2	100%		-		-			18	100%	-		
	Divorced parents and Failure in one schoolyear	0	0%	2	100%		0	0%	2	100%		4	100%	-		
	Death of father or mother and Failure in one academic year	0	0%	2	100%		0	0%	2	100%		3	100%	-		

*. Correlation is significant at 0.05.
**. Correlation is high significant at 0.01

Discussion

As for the Age of the adolescents participating in the current study with disruptive aggressive behaviours both conduct, ODD and in the control group, it was revealed that the age ranged between 15 to 17 years and they represented 76% of the conduct and 60% of the ODD and 96% of the control group, which is consistent with the study conducted by the study done in 2015 [(11)] about the age of onset of the adolescent CD to be between (14-17 years).

Regarding the presence of Life stressors on the studied conduct, ODD and control groups: it was demonstrated that 60% among the conduct group had no reported life stressors, 16% had divorced parents, 8% failed one academic year, 8% suffered from divorce of parents with failed one academic year and the last 8% went through the death of one parents with failed one academic year. Also, among the ODD group it was found that 72% had no stressors, 4% had divorced parents, 8% passed through the death of one of the parents, 8% had both divorce of the parents and the failure one academic year and 8% passed through death of one of the parents with the failure of one academic year. While in the control group there were 72% who had no stressors, 16% had divorced parents and 12% had one of the parents died.

Another study revealed that the social support had significantly positive correlation with self-esteem and negative correlation with aggression **(13)**.

In addition other researcher showed that marital conflict between parents was statistically significantly higher among cases with conduct disorder (36.5%) than among controls (22%) while those with single parent family had percentage of 16.5% higher in aggression behavior more than controls **(18)**.

Conclusion:

It was deducted that cortisol level is higher in the disruptive aggressive adolescents than that of the control group participating in the current study; moreover it was higher in those with conduct than ODD groups**.** It was demonstrated that high cortisol level in relation with the comorbidity of substance abuse and the duration of abuse in the conduct group.

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