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Study the Association of Serotonin and Serotonin Transporter Concentration with Attention Deficit Hyperactivity Disorder in Sample of Iraqi Primary School Children

Shatha Q. Jawad, Shaimaa S. Mutlak* and Sumaiah I. Hussein

Department of Basic Science, College of Dentistry, University of Baghdad, Baghdad, Iraq

**Corresponding e-mail: dr.alkarkhi@gmail.com*

ABSTRACT

Objective: *The current research focuses on neurotransmitter serotonin levels and the work was planned to study the comparison between children (female and male) as well as the special need children (with abnormal behaviors ADHD).* ***Materials and methods:*** *Total 86 children from certain primary school were selected, 56 of them were with ADHD (27 boys and 29 girls were present) and 30 healthy individuals (16 boy and 14 girls). ADHD was diagnosed by certain questionnaire form prepared for this study, blood samples were gathered, and were send for serotonin examination which was achieved with a certain enzyme linked immune sorbent assay (ELISA). Results were analyzed using special statistic program (SPSS version 18).* ***Results:*** *The collected data indicate that serotonin level was high (121.70 ± 4.05 ng/ml) in ADHD children compared with normal children (85.64 ± 2.43 ng/ml), and highly significant decrease in level of serotonin transporter in ADHD than in control samples (9.87 ± 0.29; 13.17 ± 0.50 ng/ml correspondingly).* ***Conclusion:*** *The increase and decrease in the level of serotonin serum and serotonin transporters could be related to the environmental issues that contribute to the disruption of behavior particularly rise in poor security and hot regions.*

Keywords: ADHD, Neurotransmitter, Serotonin, SERT (serotonin transporter), Dopamine, Primary school children

INTRODUCTION

Recently, researchers concentrate on serotonin and its effect on neurotransmitter and eventually their roles on the brain and it's reflection on the behaviors of ADHD children. The attention deficit hyperactivity disorder (ADHD) is a problem of overactive, not being able to focus, unable control behavior, or a combination of these, despite being one of the most common childhood psychiatric disorder of neurodevelopment type, by which children with abnormal behaviors ADHD are affected from home, school and there weakness as well [1,2].

The exact cause of ADHD has not been determined and the scientists are not sure what causes ADHD, it is believed to involve interaction between genetic and environment factors [3,4]. Blum, et al., stated that the cause or basis of ADHD is an impulse disorder with genetic components that results from an imbalance of neurotransmitters [5]. So it is a complex disorder having multiple causes including genetics as impacted by environment, which might contribute to ADHD in addition to brain injuries, nutrition, which is often blamed on bad parenting or bad attitude.

Neurotransmitters are considered to be one of the main keys to evaluating compound behaviors as well as the disorder in there behaviors. The dopamine of neurotransmitter could play a most important part in the metabolism of glucose as well as the flow of the blood which eventually affects the brain precisely, the memory and the cognitive parts of it [6,7]. A brain region that is responsible for dopamine activity, like striatum, mid brain, and anterior brain cortex, those parts are concerned with child disorder, as well as dopamine genes and subcortical networks that could be caused by hormones or genes [8-11].

To a large scope, the irregularity may reflect the evaluation of a clinically significant functional weakness. For those with the childhood defect, this remains in about two from three cases into adolescence. In about one in three conditions the childhood cases persist on into adulthood, where it is usually overshadowed by co-morbid disorder [12]. ADHD presents more often in male than female children but the ratio tends to even out among adults [13].

PATIENTS AND METHODS

Total 86 children were selected for this study, 56 having ADHD with the mean age being 11.85 ± 0.19 years, and 30 control group with the mean age being 11.82 ± 0.22 years. The children were selected from primary schools especially from class 3, 4, 5 and 6 in Baqubah, Diyala province, Iraq.

The certain questionnaire form was completed and filled by their teachers and their families to determine and specify as well as to confirm the disorder diagnosis, precisely (ADHD) these entire steps were achieved according to Rutter, et al., [14].

All the questionnaire forms were filled according to Ronser [15], by which the form that must be filled by the child families include the family history and genetic diagnosis, while the one that was filled by the children teachers include their behaviors in the class in addition to their relationships with their classmates as well as their understanding and reaction with the lessons.

After filling the forms, blood samples were taken from the study groups (both groups, control and diagnosis children). Centrifugation was applied to extract serums from blood samples, and then ELISA assay was applied to find the serotonin as well as serotonin transporter [15].

All tests were carried out in the hormones unit of the special Center of Endocrinology and Diabetes (Baghdad Russafa Health Directorate) in Baghdad. SPSS version 18 (statistical package for social sciences) was used for statistical analysis [16].

RESULTS

Table 1 data indicates the significant increase in serotonin level along with ADHD behavior children (121.70 ± 4.05 ng/ml) than in normal behavior group (85.64 ± 2.43 ng/ml), and highly significant decrease between ADHD group for serotonin transporter than in control group (9.87 ± 0.29; 13.17 ± 0.50 ng/ml respectively) (Tables 1 and 2).

Table 1 Descriptive statistic for ADHD and control group

Variables	Number	Min	Max	Mean	SE
For ADHD					
Age	56	9.00	15.00	11.85	0.19
Serotonin	56	37.15	89.32	121.70	4.05
Serotonin transporter	56	4.65	16.36	9.87	0.29
For Control					
Age	30	9.00	14.00	11.82	0.21
Serotonin	30	60.18	110.40	85.64	2.43
Serotonin transporter	30	9.11	19.28	13.17	0.50

Table 2 Descriptive statistic for ADHD and control group according to gender

Variables	Number	Mean	SE
For ADHD (male)			
Age	27	11.61	0.33
Serotonin	27	202.62	9.30
Serotonin transporter	27	10.37	0.50
For ADHD (female)			
Age	29	12.07	0.21
Serotonin	29	46.50	1.34
Serotonin transporter	29	9.41	0.32
For control (male)			
Age	17	11.94	0.33
Serotonin	17	90.36	3.03
Serotonin transporter	17	13.86	0.74
For control (female)			
Age	13	11.66	0.21
Serotonin	13	79.46	3.35
Serotonin transporter	13	12.27	0.55

Table 3 revealed significant differences for serotonin transporter in males between ADHD and control group ($p<0.05$). Also, the same table showed significant differences for STR in females between ADHD and control group ($p<0.05$).

Table 3 T-test between ADHD and control group

Variables	Number	Mean	SE
ADHD and Control			
Age	0.686	0.490	NS
Serotonin	2.020	0.040	S
Serotonin transporter	4.862	0.000	HS
Male and female (ADHD)			
Age	-1.423	0.167	NS
Serotonin	1.045	0.306	NS
Serotonin transporter	1.467	0.154	NS
Male and female (control)			
Age	0.589	0.567	NS
Serotonin	2.381	0.035	S
Serotonin transporter	1.389	0.190	NS
Control and ADHD (male)			
Age	0.346	0.734	NS
Serotonin	-0.854	0.406	NS
Serotonin transporter	3.06	0.007	S
Control and ADHD (female)			
Age	-0.946	0.363	NS
Serotonin	9.173	0.000	HS
Serotonin transporter	3.921	0.002	S
$p>0.05$: Non significant; $p<0.05$: Significant			

Highly significant differences for serotonin was revealed between ADHD and control in females, and a positive correlation between age and serotonin transporter for ADHD groups ($p<0.05$) (Table 4 and Figure 1).

Table 4 Pearson correlation for ADHD variables

Variables	r	p-value
Age and Serotonin	0.23	0.869
Age and Serotonin Transporter	0.39	0.002
Serotonin and Serotonin Transporter	0.34	0.012

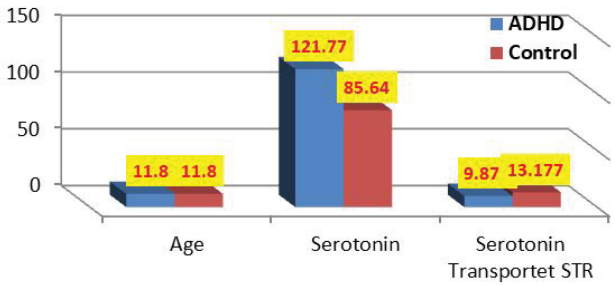

Figure 1 Bar chart for a mean of ADHD and control group

DISCUSSION

Children that participate in this study were 30 of normal in behaviors (considered as a control group) and a total of 56 of disorder in behavior (ADHD). This work was the first in the study of the serotonergic system in males and females pupils in Iraq.

As depicted from Tables 1-4 the concentration of serotonin serum is higher in ADHD children than the normal children which match the finding that was achieved by Coccaro, et al., and Hercigonja, et al., which revealed, the correlation between the violent behaviors of ADHD children with low serotonin in brain [17,18].

Results also indicate a major difference in the concentrations of the serum serotonin means among both groups (control and ADHD), this results match the study done in 2005 by Biedeman and in 2007 by Dunlop, et al., as well as the study that was made in 2008 by Fineberg, those researchers indicate the relationship between psychiatric and its effect on neurotransmitter in ADHD children [19].

Regarding the serotonin transporter, the statistics indicate the high considerable difference in the mean serum SERT while the mean serum SERT which decreases in the ADHD group compared with normal children (control group). This may be related to cerebral chemistry, precisely hormones which are the most important factor in brain activity.

CONCLUSION

Children with the disorder in their behaviors ADHD depict increases in serotonin concentration and a decrease in serotonin transporters comparing with normal children. Environment, education, poverty, and nutrition beside the family issues may play an important role in the behaviors of ADHD children.

DECLARATIONS

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Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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