MARTINIA

ISSN: 0297-0902

VOL.5 NO.2 Page: 566-571

http://martinia.com

Investigate the Effects of Omega-3 on Attention-deficit Hyperactivity Disorder in Hyperactive Children

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Abstract

The present study aims to investigate the effects of omega-3 on attention-deficit hyperactivity disorder in hyperactive children. The study is of experiment nature with pretest - posttest and control group. The population consists of children suffering from attention-deficit hyperactivity disorder in health centers of Tehran. In a Semi- pilot study with a control group, 30 children suffering from ADHD were randomly put in an experiment group and a control group and a Conners questionnaire was carried out on them. After measuring attention-deficit in the first step, the subjects of the experiment group entered into the intervention; as for the subjects of the control group, nothing was done. The first experiment group was treated for 8 weeks with fixed doses of omega-3 added to their diet in terms of age. Data were analyzed using multi-variable covariance analysis. The results of covariance analysis showed that after testing the symptoms of attention-deficit hyperactivity disorder decreased in the experiment group treated with omega-3 compared to the control group. According to the results of this study, it can be concluded that omega-3 can be effective in reducing the symptoms of attention-deficit hyperactivity disorder.

Keywords: attention-deficit hyperactivity disorder, omega 3, Conners Questionnaire

INTRODUCTION

The criticality of childhood problems, especially attention-deficit hyperactivity disorder, for the individual, the family, and the society has made it a matter of concern for the psychologists. The line of research done so far the disorder, which still continues, itself suggests that it is of great importance (Casper & Alderson & Hudecc, 2012). Due to the effects of chemical medication and families and specialists' interest in non-pharmacologic treatments have led to the introduction of the so called diet therapies as an approach for treatment of attention-deficit hyperactivity disorder. There is a consistent theory based on the fact that specific behavioral problems in patients suffering from attention-deficit hyperactivity disorder are due to a lack of fatty acids, especially omega-3, in diets and in brain cells. According to this theory, children who like adults suffer from this disorder may be facing a genetic problem in metabolizing fats that are needed for the brain. Hence, for normal brain function, they need these fats more than others do (Kraus, 2004). Receiving a balanced amount of essential fatty acids such as omega-3 and omega-6 are important factors in improving the nutritional status (Kraus, 2004)

Also, Omega 3 fatty acids are particularly abundant in the brain and have an active role in linking cells together. Even studies have shown that omega 3 changes levels of serotonin and dopamine in the brain – two neurotransmitters that play a major role in many mental illnesses (Glenn and Ross, 2004). Also, there is evidence suggesting that omega-3 fats can impact brain processes that control behavior and anxiety (Carlezon et al., 2005).

In this regard, an important hypothesis can be brought in consideration to explain the effects of omega-3 on attention-deficit hyperactivity disorder.
In the central nervous system, the strengthening mechanisms are converted through dopamine synapses in different brain regions including the anterior and ventral parts of the nucleus, circuit and putamen (Willcutt & Pennington & Defries, 2007).
Here, the excitatory Glutamate inputs are released from the cortex and the thalamus and end mainly efferent GABA cells. In this section, serotonin and dopamine synapses are widely distributed and facilitate the effects of glutamate on GABA receptors. Therefore it is determined that how much the information of efferent GABA cells would be transmitted outside the basal nucleus. GABA is an important neurotransmitter in the central nervous system which generally plays an inhibitory role and inhibits the neurons' stimulations or weakens them. Accordingly, it can be argued that serotonin and dopamine increase inhibitory effects in the brain by facilitating the messages transmitted to GABA. With the release of GABA in the synapse, they reduce cell excitability and slow down brain activity. In this respect, if this course can be controlled, it can positively impact attention-deficit hyperactivity disorder which is the result of brains hyperactivity. All of the above reactions can be facilitated by increasing omega-3 in the diet. In fact, studies have shown that omega-3 increases dopamine and serotonin in the brain. (Odes et al., 2008)
In fact, with the increase of vesicles containing neurotransmitters, Omega-3 increases neuronal firing rate and thus plays a key role in increasing dopamine and serotonin as well as GABA transmitters.

Methodology
The present study is of semi-experiment nature with control group. In this study, we have two groups: a group treated with omega-3 diet and the control group on whom no intervention is performed. Subjects, who are school age children based on DSM.IV, are randomly selected and put in the two groups. The questionnaire was administered to both groups in the pre-test and post-test.
The diet length was 8 weeks and the children were weekly visited by dietitians. All the parents were given dietary instructions. The mothers were asked to check the diet according to the dietitians' instructions. After the end of the course, the questionnaire was performed on both groups again and the results were analyzed. At the end of 8 weeks, a four-week break was made and then the test was redone.
The population and sample: The study population consisted of children suffering from attention-deficit hyperactivity disorder who had visited clinics or health centers. They were randomly selected. 15 patients were suggested as sample for a pilot study (Khalatbary, 2010). It should be noted that the subject were homogenized regarding the intensity of their attention-deficit hyperactivity disorder as well as their gender and intelligence.
The manner of data-collection: in this study, data were collected through a structured questionnaire "48-question Conners Parent Rating Scale."
Data collection tools
48-question Conners Parent Rating Scale (CPRS-48): This questionnaire is accepted as a suitable screening tool and a measure of the symptom intensity in the patients sufferings from ADHD (Conner et al., 1998). This questionnaire is the most commonly used screening tool in many parts of the world (Scheffer et al., 2005). It is generally used also in Iran (Najafi et al.,

2004). The scale includes 5 main factors for conduct problems, attention and concentration problems (learning), psychosomatic, impulsivity, and anxiety. In addition, another factors called hyperactivity index can be derived from this scale. The scale is of good reliability and validity so much so that Conners (1973) has estimated Test-retest reliability at 0.7 to 0.9. In Iran, using Cronbach's alpha, 0.93 has been reported for its reliability (Khushabi and Pouretemad, 2002) and between 0.76 to 0.90 for its validity (Shahaiyan et al., 2007).

Implementation of the program: all the people in this group were invited to the center and the program was explained to them.

The Manner of adding omega-3: In this group, from the very first, Conners questionnaire was performed on pre-test children. Then according to the test, the subjects, who were children between 6 and 12 years of age, omega-3 supplementation was prescribed by a dietitian, and to ensure its in-take and also to determine potential problems such as likely digestive problems, weekly phone calls were made and bi-weekly visits were paid, and after a 1-month break the test was followed up.

Methods and tools for data-analysis: In this study, after collecting the required data through questionnaires, using descriptive and inferential statistical techniques from SPSS 21, the diagrams were drawn and the required indices were calculated. In this way, the descriptive statistics including the mean, standard deviation, frequency and percentage were used to give a descriptive expression of findings and ANOVA was used to compare the results of the pre-test in Conners questionnaire in both groups. Also, covariance analysis was used to compare the results of the pre-test and post-test in each group. The SPSS 21 was used for data analysis.

The reliability coefficients of questionnaire in the present study

Split method. To determine the reliability of the questionnaire, the questions were divided into two odd and even parts, the subjects' scores in each part were calculated, and the correlation coefficient between the two parts was calculated based on Brown's corrected correlation coefficient.

Internal consistency. Cronbach's alpha was used to measure the internal consistency of the questionnaire.

Table 1. Cronbach's alpha of the questionnaire

Scales	Hyperactivity	Attention deficit
Split	0.75	0.74
Cronbach's alpha	0.79	0.77

Results

Implementing a multi-variable analysis of covariance test (Mancova).

Table 2. Mancova test results on Attention Deficit Hyperactivity post-test scores in experiment groups (with omega-3supplementation) and a control by controlling the pretest.

	Value	F	hypothesis df	Error df	Level of significance
Pillai's trace	0.666	24.872	2	25	0.000
Lambada Wilks	0.334	24.872	2	25	0.000
Contributive effect	1.990	24.872	2	25	0.000
Largest error root	1.990	24.872	2	25	0.000

As is shown in the table, the significance level of all tests indicates that there is a significant difference between the experiment and control groups in at least one dependent variable. To

specify the variable at which there is difference between the two groups, two uni-variable covariance analyses were performed in the Mancova whose results are reported in the table below:

Table 3. Uni-variable covariance analysis in the Mancova on Attention Deficit Hyperactivity in the two experiment and control groups after adjusting the pretest scores

	Dependent variable	SS	df	MS	F	Sig.	Amount of effect
Group	Hyperactivity	46.729	1	46.729	13.631	0.001	0.344
	Attention deficit	275.316	1	275.316	51.682	0.000	0.665

As seen in the table above, there is a significant difference between hyperactivity and attention deficit in control and experiment groups. This table shows that after excluding the effect of pretest scores, there would be a significant difference between the adjusted mean of hyperactivity and attention deficit in posttest regarding the group. In general, based on these findings, it can be said that the addition of omega-3 in the post-test reduced the hyperactivity and attention deficit scores. To specify whether or not the effect of the intervention over time (from posttest to follow-up) was consistent, a multi-variable covariance analysis was performed with repeated measurements on the post-test and follow-up total scores by controlling the pretest dependent variables.

Table 3. Multi-variable analysis of covariance performed with repeated measurements on the hyperactivity and attention deficit post-test and follow-up scores in the experiment group (omega 3) and control group by controlling the pretest dependent variables

	Value	F	hypothesis df	Error df	Level of significance
Pillai's trace	0.049	0.648	2	25	0.531
Lambada Wilks	0.951	0.648	2	25	0.531
Contributive effect	0.052	0.648	2	25	0.531
Largest error root	0.052	0.648	2	25	0.531

As is seen in the table above, the significance level of all tests indicates that there is no significant difference between the experiment and control groups at least in terms of the scores of the post-test and follow-up dependent variables. As follows, two uni-variable covariance analyses were performed in the MANCOVA whose results are reported in the table below:
Covariance analysis performed with repeated measurements in MANCOVA on the post-test and follow-up scores in the experiment group (adding omega 3) and control group by controlling the pretests

Table 4. MANCOVA whose results

	Dependent variable	SS	df	MS	F	Sig.
Subjects (time)	**Hyperactivity**	**1.471**		**1.471**	**1.322**	**0.261**
	Attention deficit	**0.150**		**0.150**	**0.164**	**0.689**
Time and group interaction	**Hyperactivity**	**2.799**		**2.799**	**3.070**	**0.092**
	Attention deficit	**0.513**		**0.513**	**0.461**	**0.503**

The result of the table above shows that the covariance analysis with repeated measurements related to the effect of time (from posttest to follow-up) is not significant in the variable of attention deficit and hyperactivity. This non-significance indicates that time has not had any impact on attention deficit post-test scores. Accordingly, we can say that the effect of adding omega-3 in reducing attention deficit has been consistent over time, because there is no significant difference between the follow-up and posttest of experiment group after excluding the effect of pretest.

Discussion and Conclusion

The results indicated that there is a significant difference between mean of attention deficit hyperactivity in the control and experiment groups so much so that following the exclusion of the

effects of pretest scores, there is a significant difference between the adjusted means of attention deficit and hyperactivity according to the group in the posttest. Overall, based on these findings, we can say that the addition of omega-3 in the posttest has reduced the scores of hyperactivity and attention deficit. The results of this study are consistent with those of Sorgi et al (2007), and Ziv et al (2010).

Sorgi et al (2007) studied the relationship between saturated fatty acids in omega-3 and impulsivity and inattention in children and concluded that there is a significant relationship between the amount of unsaturated fatty acids and hyperactivity. Ziv et al (2010) have shown that there is relationship between artificially colored food and intensity of attention deficit hyperactivity. In this study, they showed that hyperactive individuals lack essential nutritive elements such as unsaturated fats, zinc, Mg, and iron, and taking supplements gave new hope for reducing the intensity of attention deficit hyperactivity. These findings suggest that artificial dietary changes may help mitigate the intensity of attention deficit hyperactivity.

In general, many psychologists believe that the concentration of omega-3 and omega-6 fatty acids is much lower in patients suffering from attention deficit hyperactivity, and these children show the symptoms of lack of essential fatty acids such as excessive thirst. (King et al., 2012)

The researchers who have observed the behavior of rats and analyzed the biochemical processes of their brain revealed an improvement in behavior associated with hyperactivity through omega-3 fatty acid supplements and also faster circulation of dopamine, serotonin and glutamate signals in the nervous system. Currently, the diagnosis of attention-deficit hyperactivity disorder is based solely on behavioral criteria, while the genetic and molecular background of the disease is largely unknown (Dervola, 2012).

Limitations:

Despite the significant results, the present study faced limitations and weaknesses as mentioned below:

1. Since the study was conducted on a low volume of people, the generalization of the results is problematic.
2. The sample included children in Tehran and it is problematic to generalize it to other hyperactive children

Suggestions:

1. Since other therapeutic interventions such as psychotherapy and drug therapy have been conducted on children's symptoms, it is recommended that the effectiveness of diet be evaluated in comparison with other treatment approaches and consulting trainings.
2. It is recommended that further studies be conducted in other parts of the country.
3. It is recommended that the study be done on a larger sample size.

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