

## Impact of Caffeine on Attention Deficit Hyperactivity Disorder

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### Abstract

**Background:** Consideration shortage hyperactivity issue (ADHD) is presently one of the most well-known kids' psychological well-being conditions. It includes indications of mindlessness or impulsivity and hyperactivity that lead to conduct impedances. Caffeine is viewed as a stimulant. It animates the body's focal sensory system, and lifts the mind's generation of dopamine, which controls the capacity to center and look after focus. This incitement can make an individual vibe invigorated and not to feel the impacts of weariness as unequivocally.

**Aim of the study:** To assess the correlation between the combining effect of caffeine and stimulant drugs and effect of stimulant drugs alone.

**Methods:** Prospective Intervention study with clinical trial, 50 ADHD children on stimulant drugs aged from 6 to 11 years, were subjected to battery of assessment that includes IQ assessment, Conner's evaluating scales for parent and instructor for appraisal of youngster conduct and El Behairy's scales for ADHD. Then enrollment of children in caffeine regimen schedule, Reassessment after 6months for the entire study group by the same scales used before.

**Results:** By combining effect of caffeine and stimulant drugs there was higher mean level of IQ with 0.4% increase in males and 0.1% increase in females and 0.3% increase according to teacher score in males and 1.3% in females and also a higher mean level of parent score with 5.1% increase in males and 0.9% in females.

**Conclusion:** Caffeine is effective as an adjuvant treatment and improving ADHD symptoms when combined with stimulant drugs.

**Keywords:** ADHD, Caffeine, Elbehairy's rating scales, Conner)

### تأثير الكافيين على اضطراب فرط النشاط ونقص الانتباه

**الخلفية:** يعد هذا الاضطراب واحد من اكثر الاضطرابات العقلية بين الاطفال حيث يضم اعراض نقص الانتباه والاندفاعية وزيادة النشاط الحركي مما يؤدي الى حدوث اضطرابات في السلوك. ويعد الكافيين من محفزات ومثيرات المخ حيث يثير الجهاز العصبي المركزي ويضعاف انتاج المخ من ماده الدوبامين مما يؤدي الى زياده قدره على التركيز وخاصة لدى الاطفال الذين يعانون من هذا الاضطراب.

**الهدف:** تقييم تأثير الكافيين على اعراض اضطراب فرط الحركة ونقص الانتباه، وتقييم اثر اقتران الكافيين مع الأدوية المنبهة المعتاد استخدامها على اعراض اضطراب فرط الحركة ونقص الانتباه مقارنة باستخدام الأدوية المنبهة فقط.

**المنهجية:** تم اجراء دراسته استطلاعيه مع تجريبه اكلينيكيه على 50 طفل من الذين ترددوا الى العيادة النفسية للأطفال في كلية الطب جامعة الزقازيق في الفترة الزمنية المحددة وأثبت أنهم يعانون من اضطراب فرط الحركة ونقص الانتباه وعلى نظام علاجي بالأدوية المنبه لهذا الاضطراب سوف يتناولون الكافيين يوميًا ومقارنه معدل الذكاء ومقياس البحيري للمعلم والوالدين قبل وبعد استخدام الكافيين للذكور والاناث.

**النتائج:** بعد تطبيق نظام تناول الكافيين ارتفع متوسط معدل الذكاء بنسبة 0.48% بالنسبة للذكور وبالنسبة للاثاث 0.1% وانخفض متوسط الدرجة الخام لمقياس الوالدين بنسبة 0.1% للذكور و 0.9% للاثاث وانخفض متوسط الدرجة الخام لمقياس المعلم بنسبة 1.3% للاثاث و 0.3% للذكور جميع النتائج كانت ذات دلالات احصائية عالية.

**الخلاصة:** للكافيين تأثير قوي لضبط اعراض نقص الانتباه وفرط الحركة وخاصة عندما يقرون بالأدوية المثيرة والمحفزة للجهاز العصبي.

**الكلمات المفتاحية:** اضطراب نقص الانتباه وفرط الحركة، مقياس البحيري، ومقياس كونرز.

**Introduction:**

Attention deficit hyperactivity disorder (ADHD) is now one of the most common children's mental health conditions. It involves symptoms of inattention or impulsivity and hyperactivity that lead to behavioral impairments. Approximately 50 percent of children diagnosed with ADHD continue to show clinically significant symptoms and impairment as adult.<sup>(1)</sup>

A great deal of research has investigated the possible role of caffeine in ADHD. Caffeine is a psychoactive stimulant drug, which can increase alertness and reduce drowsiness. Coffee, tea, soft drinks and chocolate all contain caffeine and are consumed around the world. Approximately 90 percent of adults in North America consume caffeine daily.<sup>(2)</sup>

Effect of caffeine on body system, Caffeine, or more properly, 1,3,7-trimethylxanthine, has central nervous system effects, mainly thought to be due to blocking adenosine receptors in the brain.

Caffeine is quickly absorbed once consumed and it immediately gets to work stimulating neurotransmitter release. Besides psychiatric effects, it has effects on alertness (positive), headache (also effective, except in withdrawal situations), athletic performance (another win), the cardiovascular system (my fingers are crossed), and the endocrine system, where it may improve diabetic control. It's also being studied for effects on the gastrointestinal system, as well as its impact on cancer risk. In adults, caffeine consumption is associated with a negative relationship with all-cause mortality, largely due to a reduction of cardiovascular effects. Causation hasn't been established though. Most of you are very familiar with the side effects of caffeine: agitation, tremors, insomnia, headache. Overall, despite documented cases of dependence and withdrawal, caffeine consumption has a generally attractive safety profile with a wide therapeutic range.<sup>(3)</sup>

Sometimes the effect can be negative, however. For example, people who have trouble sleeping can experience further sleep disturbances or insomnia due to caffeine.

**Objective:**

1. To assess the impact of caffeine of ADHD symptoms.
2. To assess the Combining effect of caffeine plus stimulant drugs versus stimulant drugs alone on ADHD symptoms.

**Methodology:**

- ✧ Study Design: prospective intervention with clinical trial study.
- ✧ Subjects: This study is prospective intervention study to assess the correlation between the combining effect of caffeine and stimulant drugs and effect of stimulant drugs alone, It was conducted on ADHD children attending "Child psychiatry clinic" in Zagazig university hospital, in the periods between first on January 2016 till the end of June of 2017 with age range between (6- 11) years, children were attending regularly weekly to clinic to receive caffeine and milk and their parents were cooperative returning signed (follow up chart) of administrating caffeine in regular dose and in regular time daily.

**✧ Inclusion Criteria:**

1. Age (6- 11) years.
2. Males And Females.
3. Iq More Than 90.
4. ADHD children diagnosed according to DSM V criteria.
5. Children on ADHD stimulant drug.

**✧ Methods:** The study was carried out on three phases:

1. Phase (1): Both two groups passed through pre assessment by:
  - a. Full medical history taking focusing on: symptoms and signs and stressing on nutritional history.
  - b. Thorough Clinical Examination Assessment.
  - c. Confirming diagnosis of ADHD according to DSM V criteria and they were already on regular same stimulating drugs.
  - d. Battery Of Assessment: Assessment of both groups by IQ (Intelligence Quotient assessment by Stanford Binet fifth edition).<sup>(4)</sup> Conners' parent rating scale (CPRS- 48) for assessment of child behavior which consist of 48 items, each item has 4 options according presence of severity of the problem, it is given score (0- 3).<sup>(5)</sup> Conners' teacher rating scales (CTRS- 28) which consist of 28 items, each item has 4 options according presence of severity of the problem, it is given score (0- 3).<sup>(5)</sup>
2. Phase(2): Application of caffeine regimen on the test group as follow:
  - a. The children of the test group were encouraged to take 1.8 gm of classic black Nescafe with 180cc milk twice daily at 7 am and 4 pm every day for continues six months (sweetening of caffeine was standardized to all children). Children were advised to drink plenty of water during the day at least four glasses of water per day to overcome the diuretic effect of caffeine.
  - b. Monitoring the amount of caffeine which were given per week by (follow up chart) given to mother weekly noting everyday as received caffeine or not and exclude children who were not on regular caffeine intake schedule and dropping two days of caffeine.
  - c. Given written instruction about diet and restricted food containing caffeine and restricted sugar intake, food additives and junk foods.
3. Phase (3): Post assessment to both groups after six months to evaluate the combining effect of caffeine and stimulant drugs on ADHD symptoms by IQ, Conners for parent and teacher rating scales (Elbehairy's scales) for ADHD compared to the effect of stimulant drugs alone on control group.

**Limitation Of The Study:**

1. Some Caregivers were uncooperative.
2. much time was needed for evaluation of one child.

**Ethical Consideration:**

Approval of medical ethics committee of national research centre and ethical committee of the faculty for postgraduate childhood studies was obtained. A full explanation of the study was provided to the parents. oral consent was taken from the guardians.

**Statistical Analysis:**

Collected data were tabulated using the statistical package for the soul science (SPSS) on the computer (SPSS 17). Mean and standard deviation (SD) were estimates of quantitative data while frequency and percentage were estimates of qualitative data. Differences in clinical and biochemical characteristics were tested by paired student's T test for quantitative data. two sided P value >0.05 was considered statistically significant.

**Results:**

Table (1) Comparing males past history of both groups

Clinical Criteria	Intervention Group (50)		Control Group (48)		Chi Square	P-value	Sig	
	N.	%	N.	%				
Age±SD	8.8±1.6		8.5±1.69		*0.8	0.3	Ns	
Gestational Age	Full Term	28	56	26	54	0.03	0.8	Ns
	Preterm	22	44	22	46			
Post- Natal Incubation	Yes	13	26	5	10	3.9	0.04	S
	No	37	74	43	90			
Post- Natal Resuscitation	Yes	12	24	5	10	3.1	0.07	Ns
	No	38	76	43	90			
Baby Sitter	Yes	15	30	11	23	0.6	0.4	Ns
	No	35	70	37	77			
Day Care	Yes	15	30	17	35	0.3	0.5	Ns
	No	35	70	31	65			
Past History Of Head Trauma	Yes	6	12	5	10	0.06	0.8	Ns
	No	44	88	43	90			
Development Of Speech	Normal	44	88	36	75	2.7	0.09	Ns
	Delayed	6	12	12	25			
Long Period Of Watching Tv	Yes	24	48	20	42	0.3	0.5	Ns
	No	26	52	28	58			
Preceding Events	Yes	13	26	10	20	0.3	0.5	Ns
	No	37	74	38	80			

his table show that 56% of studied group were full term and 44% of studied group were preterm with 26%with history of postnatal incubation and 24%recieved post natal resuscitation no significance difference regarding age, Gestational age, Post- natal resuscitation, and 30% acquired babysitter or daycare and 88% were with normal development of speech and 48% exposed long period of watching TV.

Table (2) Paired t test for comparison between before and after treatment for males intervention group

Intervention Group Males (n= 50)	Before ±SD	After ±SD	MD	Paired T	P- Value	Sig
IQ	93±1.4	93.48 ±1.4	0.48	3.5	0.001	S
Parents Score	16.2±4.7	10.5±4.3	- 5.7	12.9	0.0	S
Parents Standard Score	104.5±15.7	96.4±3.2	- 8.1	4.7	0.0	S
Parents Percentile Rank	60.8±31.2	52.7±13	8.1	3.2	0.002	S
Teachers Score	16.4±3	14.1±2.9	2.3	11.2	0.0	S
Teacher Standard Score	99.8 ±9.4	89±8.9	10.8	10.8	0.0	S
Teachers Percentile Rank	59±19.9	55.5±21	- 13.5	7.6	0.0	S

X: Mean, SD: Standard deviation, MD: Mean difference, t value: student t, p value= Probability value, S= Significance

This table show results of male studied group and show a higher mean

IQ after combination of caffeine and stimulant drug compared to effect of stimulant drug alone and the difference is statistically significant with 0.48% increase. There is higher means increase in the mean parent score with- 5.7% increase and- 8.1% increase according to parent standard score and 8.1 increase% according parent percentile rank after application of caffeine regimen. There is higher means increase in teacher score with 2.3% increase and 10.8% increase according teacher standard score and 13.5% increase according teacher percentile rank, and these differences were statistically significant.

Table (3) Paired t test for comparison between before and after treatment for females intervention group

Intervention Group Females(n= 60)	Before ±SD	After ±SD	MD	T- Value	P- Value	Sig
IQ	92.9 ±1.56	93.2±1.5	0.3	3.4	0.001	S
Parents Score	16±5	13.6±1.2	- 2.4	10.3	0.00	S
Parents Standard Score	109±18	98±16	- 11	7	0.0	S
Parents Percentilerank	64.9±29	48±13	- 16.9	11.2	0.0	S
Teachers Score	15.43 ±3.3	13.6±3.2	- 1.83	11.6	0.0	S
Teacher Standard Score	98.3 ±11	90±9.9	- 8.3	10.3	0.0	S
Teachers Percentilerank	59±19.8	49±20.7	- 10	6	0.0	S

This table show results of female studied group and show a higher mean IQ after combination of caffeine and stimulant drug compared to effect of stimulant drug alone and the difference is statistically significant with 0.3% increase. There is higher means increase in the mean parent score with- 2.4% increase and- 11% increase according to parent standard score and- 16.9 increase% according parent percentile rank after application of caffeine regimen. There is higher means increase in teacher score with- 1.8% increase and- 8.3% increase according teacher standard score and- 10% increase according teacher percentile rank, and these differences were statistically significant.

**Discussion:**

Attention deficit hyperactivity disorder (ADHD) is a highly prevalent psychiatric disorder affecting between 5 and 10% of elementary- school children and it is characterized by the presence of three primary symptoms: hyperactivity, inattention, and impulsivity.<sup>(6)</sup>

In the current study we found that there is significance difference regarding males, both groups before and after intervention regard IQ but in female there was insignificant differences either before or after intervention.

In agreement with our result Quintero J. et.al.<sup>(7)</sup> hypothesized that ADHD patients would have lower Intelligence levels in adulthood than healthy patients, considering Intelligence as an ability that is developed during childhood and adolescence.

In the current study we found that there is no significance difference regarding Pre intervention parents score, Pre intervention parent's standard score and Pre intervention parents percentile rank but after intervention there was significant differences between two groups in both sex.

In the current study we found that there is no significance difference regarding Pre intervention teachers score, Pre intervention teachers

standard score and Pre intervention teachers percentile rank but after intervention there was significance difference regarding Post intervention teachers score, teachers standard score and post intervention teachers percentile rank in both sex between two groups.

In intervention group there was significant differences between after and post intervention as regard IQ, parents score, parents standard score, parents percentile rank, teachers score, teacher standard score and Teachers percentile rank in contrary in control groups there was insignificant differences as regard these score between before and after intervention in both sex

When caffeine's effect on stimulus recognition was compared between a small groups of normal children versus a small group of 'hyperkinetic' children, the result was numerically beneficial but statistically insignificant, possibly due to limited power.<sup>(8)</sup>

Conversely, some encouraging results were published, displaying caffeine's superiority versus placebo alone,<sup>(9)</sup> or as a combination treatment with other stimulants versus stimulants alone.<sup>(10)</sup>

Interestingly, Harvey and Marsh used 'whole coffee', trying to replicate Schnackenberg's study, as opposed to other studies that used 'pure caffeine' tablets. A curvilinear pattern of dose response for caffeine to alleviate the disorder's symptoms was suggested,<sup>(11)</sup> although a dose of 200 mg and above was thought to be the pharmacologically sound choice.<sup>(12)</sup>

In a meta- analysis of all previous studies on the potential utility of caffeine in ADHD treatment Leon MR. , 2000 caffeine, regardless of dose, was clearly found to be less efficacious to improve functioning, compared to MPH or amphetamines, on a number of cognitive, psychomotor and affective variables.

However, compared to no treatment, caffeine was found superior in reducing teachers' severity ratings of children's ADHD symptoms and lowering children's aggression, plus substantially more able to reduce parents' severity ratings and reducing children's impulsivity. In all, when compared to no treatment, it was found that caffeine can reduce impulsivity.

Finally, compared to placebo, caffeine was probably efficacious in reducing teacher's severity ratings of children's ADHD symptoms and children's levels of hyperactivity. In the meta- analysis paper of Leon (2000), only a subgroup of the 19 studies was included in the analysis, due to missing data and heterogeneity. No recommendations for adolescents and adults with ADHD were able to be given due to lack of data.

### Conclusion:

Caffeine is biphasic weapon affecting ADHD children if it used in précised dose in regular times with monitoring other nutritional caffeine sources to avoid side effects of it will offer more potent and synergitic combining effect with stimulant drugs in school age 6- 11 years.

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