

## Improvement of attention deficit hyper active disorder for deaf female children by intake pumpkin seeds

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### ABSTRACT

The study aims to investigate the effect of intake pumpkin seeds as sources of magnesium and iron on improvement of the nutritional status and attention deficit of deaf female children with hyper active disorder (ADHD) symptoms. The range of sample age was 10-12 years for 40 female children who born deaf, suffering from ADHD and their hearing loss was 91 decibel or more. The investigated ADHD deaf female children were selected from El Amal school for the deaf and hard of hearing, Elsayeda Zenab. They were divided into two groups; the control group and the experimental one (20 female for each). The study used the data for each child; the personal and socio-economic, the food habits, the diet history, 24 recall and the clinical signs. In addition to the Attention Deficit Disorder Connected with Hyperactivity for Deaf Children test (ADDCHDC). The nutritional intervention was 50g from pumpkin seeds that contained an approximately 100% of Recommended Dietary intake (RNI) from magnesium (Mg) and iron (Fe). Pumpkin seeds were used for three months with experimental group. The results indicated that deficiency in the average intake pre dietary intervention in experimental and control group for Mg comparing with RNI was 12.5 and 13%, respectively, and in Fe was (38.5) in both groups. However, Mg levels were higher in the experimental group post dietary intervention than control group (138 and 14.5%, respectively). Also, Fe level was 149% in experimental group and 36.8% compared with RNI. On the other hand, the improvement in degree of ADDCHDC test for experimental group (post dietary intervention) was better than that in control group (65 and 95, respectively). There were statistically significant differences between pre and post dietary intervention to experimental group on Mg level and ADDCHDC test degree at ( $P < 0.01$ ) and at ( $P < 0.05$ ) in Fe. In conclusion, increments for intake of pumpkin seeds 50g /day, which give 100% RNI for magnesium and iron, improved attention deficit hyper active status for deaf children with ADHD.

**Keywords:** Bumpkin Seeds, deaf, female children, dietary intervention, ADHD, magnesium, iron.

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### INTRODUCTION

Deafness is defined as a degree of loss such that a person is unable to understand speech even in the presence of amplification, there hearing loss are (91) decibel or more (Abdelaziz, 2012). There are different causes of deafness for children, genetic conditions where there may be a history of deafness in the family, injury of a pregnant woman with German Measles or lack of oxygen during childbirth, certain diseases may cause deafness, drugs may cause changes to hearing including deafness, being in a noisy environment for a long time may damage the ear and also, certain chemicals can damage the ear (Kral and Donoghue, 2010; Seyyed *et al.*, 2020).

The percentages of prevalence deaf in Arab counters are 0.7% from children in primary school (Habib, 2016). Diagnoses of deafness depends on a physical examination, general screening test, routine screening of children and testing newborns (Drolsbauh, 2011). The child deaf suffers from some Psychological problems such as emotional imbalance, frustration and anxiety (Connor, 2006).

Deaf children may issue some undesirable behaviors such as aggressive behavior or attention deficit hyper active disorder (ADHD) (Ali, 2007). ADHD is

one of the most important and serious behavioral disorders facing children in general and with deaf children in particular. It is defined as an activity in the body, kinesthetic sharp where the child cannot control the movements of his body and spends most of the time in constant motion (Bener, 2015; Wolraich *et al.*, 2019). This disorder affects children more than adults, it affects more than (6.2%) of the Egyptian children in primary school, it occurs due to hereditary factors, environmental, imbalance in the functions of the brain or malnutrition (Soliman, 2011). It affects the developmental capacities of the child, either mental, psychological or health (Greenhill *et al.*, 2008; Bálint *et al.*, 2008).

Treatment of hyperactivity depends on several ways, the most important of these methods is the medical treatment, where some scientists and physicians turned to control the movement of the child and reduce his activity, but studies have proved ineffectiveness of this type (Millichap, 2012). In addition, behavioral therapy is based on methods that aim to increase the rate of exercise, which reducing the rate of undesirable behaviors without attention to other methods of treatment such as nutritional therapy (Jain and Katic, 2016).

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Pumpkin *Cucurbita moschata* seed is one of the edible parts of a pumpkin. The seeds are typically rather flat and asymmetrically oval, and light green in color and may have a white outer hull (Song *et al.*, 2011). The seeds are nutrient-rich, with especially high content of protein, dietary fiber and numerous micronutrients such as magnesium and iron (Fürnkranz *et al.*, 2012).

Magnesium is an extremely important mineral (Berdanir *et al.*, 2016) and it is used to make neurotransmitters involved in attention and concentration, and it has a calming effect on the brain. The Recommended Dietary intake, RDI, for children (9-13years) from magnesium is 207mg/day but Upper Intake Levels (ULs) 600 mg/day was given by Institute of Medicine (2001).

Iron is an essential nutrient that plays an important role in many body functions (Harris *et al.*, 2016). It is necessary for attention, and ferritin levels (a measure of iron stores) was low in 84 percent of children with ADHD compared to 18 percent of the control group (Millichap and Yee, 2012). Low iron levels correlate with cognitive deficits and severe ADHD (Lidy *et al.*, 2017). The Recommended Dietary intakes for children (9-13years) from iron are

5.7mg/day and the Upper Intake Levels (ULs) 40 mg/day (Institute of Medicine, 2004).

The present study aimed to investigate the effect of intake pumpkin seeds as sources of magnesium and iron on improvement of ADHD symptoms and nutritional status for deaf children with ADHD.

### **MATERIALS AND METHODS**

#### **Subjects:**

The present study was carried out on female children from El Amal School for the Deaf and Hard of Hearing, Elsayeda Zenab Administration, Cairo, Egypt. The investigated sample of children includes forty children (females) with Attention Deficit Hyper Active (ADHD) and Hearing Impairment (deaf), their age (10-12yrs.), their hearing loss are (91) decibel or more. They were divided into two groups, experimental group and control group, each group include 20 children. The following were collected for each child:

**a. Personal and Socio-economic data:** these include; name, sex, age, address, causes of disease and history of disease, Parent education, occupation and number of their children.

**b. Nutritional status:** It includes;  
**-Food Habits:** the required information was taken from children themselves such as Pumpkin Seeds/day.

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**-24 hr. Dietary Recall:** it was applied for 3 days pre and post dietary Intervention for deaf children with ADHD. Food quantities were calculated and analyzed using food composition tables of the national nutrition institute and compared with Recommended Nutrients Intake (USDA, 2020).

**-Dietary Intervention:** it was constructed and applied for 90 days, three non-consecutive days in week to improve nutritional and behavioral status for deaf children with ADHD. Dietary interventions in the present study include (50 g from Pumpkin seeds /day). Experimental group take in school break 50 g from Pumpkin seeds /day beside normal breakfast, while control group take only normal breakfast.

**-Anthropometric Measurements:** these body weight (WT) nearest 0.1kg, height (HT) nearest 0.5cm. Measure Upper Arm Circumference (MUAC) and skin fold by caliper were measured from three different places Triceps, Lower back and Sub scapular (TLS) (WHO, 2020).

**- Clinical signs: (It was applied twice pre and post Dietary Intervention):** Clinical signs include the appearance of Face, teeth, gum, nails and skin (Jelliffe, 1966).

### c. Behavioral status:

It includes applying the test of Attention Deficit Disorder Connected with Hyperactivity for deaf children (ADDCHDC) (Ali., 2005). This includes three parts:

**Part (1):** Attention Deficit Disorder accompanied with Hyperactivity (Copy of child photo) includes 9 pictures.

**Part (2):** Attention Deficit Disorder accompanied with Hyperactivity (Copy of child photo) includes 18 pictures.

**Part (3):** Attention Deficit Disorder accompanied with Hyperactivity (Family copy, it consists of 24 paragraphs, which contain wrong and right behaviors, the mother choose the right answer which belong to her child).

-Grade number were calculated from parts of the test and interpreted according to the test author as follow:

- Degree from 1-63 means: children do not suffer from attention deficit and hyperactivity.

- Degree from 64 -107 means: children suffer from attention deficit and hyperactivity.

### d. Statistical Analysis:

Statistically analyzed using Mean, Standard Deviation ( $\pm$ SD), T-test, Analysis of Variance (ANOVA) and Correlation Matrix by using package software SPSS windows (Vavdallen, 1997).

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### **RESULTS AND DISCUSSION**

#### **a. Socio Economical Data:**

About 47% of mothers and 40% of fathers of the investigated deaf children with ADHD finished their Secondary education level. Only 10% of both mothers and fathers of the total sample finished was university graduate. The percentage of illiterate was 43% and 50 among mothers and fathers of the total sample, respectively. About 80% of mother's sample was as house wife. Regarding occupation of fathers, 60% were government

employee, 35% working in private sector and 5% were retired. Most of family (66%) tended to have 4-5 children in the Current study samples.

#### **b. Nutritional Status Results:**

##### **- Food habits and 24hr. Dietary recall:**

Table (1) showed the eating pumpkin seeds/day among deaf children with ADHD. It showed that deaf children with ADHD had intake a small amount from pumpkin seeds/day, about 5g /day for the two groups pre dietary intervention.

**Table (1): Eating pumpkin seeds/day among deaf children with ADHD pre intervention.**

<b>Groups</b>	<b>Pumpkin Seeds g/day</b>
Experimental group (20 female)	<b>5.3</b>
Control group (20 female)	<b>5.2</b>

##### **- Diet History:**

The present study showed that, there was a low intake form pumpkin seeds for deaf children with ADHD.

##### **- Food Intake Evaluation and Dietary Intervention:**

According to the results of Food Habits, Diet History and 24hr Dietary Recall, the dietary intervention from pumpkin seeds

was measured as 50 g/day for intervention group for 90 days.

Table (2) illustrated the nutritional value analysis of pumpkin seeds. The result showed that 50g form pumpkin seeds contain high minerals specially magnesium and iron (276.5mg and 7.5mg, respectively) and it provides 133.6% and 131.5% respectively of RNI (USDA, 2020).

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**Table (2): Nutritional value analysis of 50g pumpkin seeds according to USDA (2020).**

Nutritional components	Energy (Kcal)	Protein (g)	Fat (g)	Cho (g)	Ca (mg)	Mg (mg)	Fe (mg)	Zn (mg)	Se (mg)	Vit. A IU	Vit. C (mg)	Thiamin (mg)
pumpkin seeds.	242	12	18	8	8.5	276.5	7.5	3.1	2.8	52	2	0.2
% RNI	34.5	30	40	17	0.7	133.6	131.5	40	8	20.5	5.1	28

It was observed from Table (3) that the deficiency in mean intakes of Mg was 13% and 12.5% for control group and experimental group, respectively pre dietary intervention, as compared with RNI (USDA, 2020). Regarding post dietary intervention there was an increase in Mg in experimental group than control group, it was 138% and 14.5%, respectively as compared with RNI (USDA, 2020). There were a statistically significant differences between pre and post dietary intervention for experimental group in Mg intake

at  $p < 0.01$ .

The result indicated that, deficiency in mean intakes in Iron (Fe) (38.5%) in both control and experimental groups pre dietary intervention, as compared with RNI (USDA, 2020). For post dietary intervention there was an increase in Fe for experimental group than control group, it was 149% and 36.8%, respectively as compared with RNI (USDA, 2020). There were a statistically significant differences between pre and post dietary intervention for experimental group in Fe at  $p < 0.05$ .

**Table (3): Mean intake and percentage of magnesium and iron/day pre and post dietary intervention for deaf children with ADHD.**

(Magnesium mg)	Control group (20 female)		Experimental group (20 female)	
	Pre	Post	Pre	Post
	27 mg	30 mg	26mg	286 mg
SD±	4	5	5	2
% of RNI	13%	14.5%	12.5%	138%
<b>Sig.</b>	<b>0.123</b>		<b>0.001*</b>	
Iron (mg)	2.2 mg	2.1 mg	2.2 mg	8.5 mg
	SD±	3	5	2
% of RNI	38.5	36.8	38.5	149
<b>Sig.</b>	<b>0.112</b>		<b>0.04**</b>	

\* $p < 0.01$  \*\* $p < 0.05$

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### - Anthropometric Measurements:

It could be seen that deaf children with ADHD had normal mean height 143cm ) and weight (37kg) compared with standard measurements given by WHO (2020).

It could be seen from Table (4) that the average measurement of physical standards (pre and post dietary intervention) for deaf children with ADHD was relatively agree with that recorded by WHO (2020) for normal children. The

average MUAC was 19cm for pre and post dietary intervention, while it was (13: 23 cm) for normal nutritional status with 10-12years, and the average TLS was 17mm for pre and post dietary intervention, while (normal ranged between 16:22 mm for female 10-12years) (WHO, 2020).

No significant statistical in MUAC and TLS pre and post dietary intervention in the two group and this refer to children with ADHD not suffer from obesity and malnutrition.

**Table (4): Average measurement of Physical standards (pre & post dietary intervention) for deaf children with ADHD.**

Groups	*MUAC		** TLS	
	Pre	Post	pre	Post
Control group (20 female)	18.5 cm	19.2 cm	17.2 mm	17.2 mm
Experimental group (20 female)	19.2 cm	19.8 cm	17 mm	17 mm
Sig.	0.121		0.125	

\*MUAC=Measure Upper Arm Circumference.

\*\*TLS= Measure skin fold by average for triceps, Lower back and sub scapular

### - Clinical signs: (It was applied twice pre and post Dietary Intervention):

Clinical examination has always been, and remains, an important practical method for assessing the nutritional status of a community (Jelliffe, 1966). It was obvious from data illustrated in Table (5) for clinical sings (skin,

teeth, gums and nails) for pre and post dietary intervention in deaf children with ADHD that there was an improvement in experimental group than control one after dietary intervention by pumped seeds, with respect to pale skin, bleeding gums and white spots nails. This result was in agreement with Colin (2017) who

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reported that iron deficiency anemia is a global health issue in children and adults and show in white spots in nails, and in blood analysis, and there are some evidences that iron deficiency anemia in infants and children can lead to potentially irreversible

long-term neuro-developmental sequel. There is a strong association with administration of inappropriate amounts of food rich in iron and anemia in patients and Yung *et al.* (2020) reported that deaf children suffer from pall face.

**Table (5): Clinical sings (skin, teeth, gums and nails) between pre & post dietary intervention in Deaf children with ADHD.**

groups	Skin		Teeth				Gums		Nails	
	Pale		Loss		Caries		Bleeding		White spots	
	Pre	Post	pre	post	Pre	post	pre	Post	Pre	post
	Number of female									
Control group (20 female)	2	2	1	1	2	2	3	3	3	3
Experimental group (20 female)	2	1	1	1	2	2	3	2	3	2

#### c. Behavioral status:

Test of Attention Deficit Disorder Connected with Hyperactivity for Deaf Children (ADDCHDC) is an important step for assessment of the behavioral status. It is consisted of 3 parts and applied on groups (Ali, 2005). Data in Table (6) showed that the result of this test on experimental group was better than that on control group post dietary intervention (65 and 95) respectively. There was a statistically significant difference between degree test pre and post dietary intervention in experimental group at ( $P < 0.01$ ). This may be explained due to the increase of Mg and Fe levels in

Deaf Children with ADHD after intake 50g daily of pumpkin seeds. This result was in agreement with Bener (2015) who found correlation between iron deficiency and ADHD in children. He indicated that low serum iron, ferritin levels and vitamin D deficiency may be associated with ADHD. Also, Sarris *et al.* (2011) reported that 55 children with ADHD improved behavior after nutritional education by reduce the intakes of food that contain high sugars and preserved foods and increase with minerals. Similarly, Huss *et al.* (2010) found that children (5-10 years) with symptoms of attention deficit and hyperactivity/impulsivity after 12

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weeks of consumption of a combination of omega-3 and omega-6 fatty acids as well as magnesium and zinc, most subjects showed a considerable

reduction. Also, Harry *et al.* (2020) confirmed that ADHD symptoms are associated with deficit of magnesium, iron, zinc, copper and selenium.

**Table (6): Result of applying ADDCHDC test in deaf children with ADHD.**

Status	Control group (20 female)		Experimental group (20 female)	
	Pre	Post	Pre	Post
Degree Test ADDCH	95	95	96	65
Sig.	0.143		0.00 (*)	

\*P < 0.01

It could be noticed from data in Table (7) that there was highly negative correlation between pumpkin seeds and ADHD at (-0.887), and moderate negative correlation between magnesium and ADHD at (-0.421), beside there was strong negative correlation between iron and ADHD at (-0.712). This result is in agreement with Eric *et*

*al.* (2007) who examined the effects of iron supplementation on ADHD in 23 children (5-8 years). Iron supplementation (80 mg/day) appeared to improve ADHD symptoms in sample children. Also, Elbaz *et al.* (2017) reported that magnesium and zinc deficiencies were found to be correlated with hyperactivity, inattention and impulsivity.

**Table (7): Correlation coefficient between pumpkin seeds and ADHD.**

Items	ADHD
pumpkin seeds	-0.887 (*)
Magnesium	-0.421(**)
Iron	-0.712 (*)

\* Highly negative Correlation = -0.7 >: -1

\*\* Moderately negative Correlation = - 0.4: - 0.7 <

**Conclusion:**

Intake of deaf children with ADHD pumpkin seeds 50 g /day as foods rich in magnesium and iron can provide 133% RNI for magnesium and 131% RNI for iron which can help in improving their hyper active status,

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### تحسين اضطراب نقص الانتباه المصحوب بالنشاط الزائد للأطفال من الإناث الصم من خلال تناول بذور اليقطين

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#### المستخلص

هدفت الدراسة إلي التحقق من تأثير تناول بذور اليقطين (اللب الابيض) علي الحالة الغذائية وكذلك تحسين أعراض النشاط الزائد للأطفال الصم. تتراوح اعمار عينة الدراسة البالغ عددهم 40 طفلة بين 10-12 سنة وقد تم اختيارهم من الاطفال الذين ولدوا صماً حيث يتراوح الفقد السمعي لديهم من 91 ديسيبل أو أكثر. قد أجريت الدراسة على الاطفال الصم ذو أعراض النشاط الزائد من مدرسه الأمل للصم وضعاف السمع بالسيدة زينب. وقد تم تقسيم العينة الي مجموعتين متساويتين (20 لكل مجموعة)، الأولى المجموعة الضابطة والأخرى المجموعة التجريبية. وقد استخدمت الدراسة الأدوات الآتية : إستماره البيانات الشخصية للطفل الأصم وإستماره العادات الغذائية وإستماره التاريخ الغذائي وإستماره المأخوذ اليومي لأربع وعشرون ساعه وإستماره العلامات الأكلينيكية ومقياس نقص الانتباه المصحوب بالنشاط الزائد للطفل الأصم. وتم التدخل الغذائي بتقديم 50 جرام من بذور اليقطين حيث توفر 100% من إحتياجات الطفل من الحديد والمغنسيوم لمدة ثلاثة شهور للمجموعة التجريبية. وأظهرت النتائج وجود نقص في المأخوذ من المغنسيوم قبل التدخل الغذائي للمجموعة التجريبية والضابطة (13,12.5 % ) علي التوالي بالمقارنة بالتوصيات الغذائية المسموح بها، بينما حدث تحسن بعد التدخل الغذائي للمأخوذ من المغنسيوم للمجموعة التجريبية عن الضابطة وأصبح (14.5,138 % ) علي التوالي، وكذلك بالنسبة للحديد أظهرت النتائج نقص في المأخوذ من الحديد قبل التدخل الغذائي للمجموعة التجريبية والضابطة (38.5 % ) لكلاهما بالمقارنة بالتوصيات الغذائية المسموح بها ، بينما حدث تحسن بعد التدخل الغذائي للمأخوذ من الحديد للمجموعة التجريبية عن الضابطة وأصبح (36.8,149 % ) علي التوالي. بالإضافة إلي تحسن ملحوظ في درجات مقياس نقص الانتباه المصحوب بالنشاط الزائد للمجموعة التجريبية عن الضابطة بعد التدخل الغذائي وكانت (95& 65 درجة) علي التوالي. كذلك وجد فروق ذات دلالة احصائية قبل وبعد التدخل الغذائي للمجموعة الضابطة في المغنسيوم ودرجات مقياس النشاط الزائد ( $P<0.01$ ) و في الحديد ( $P<0.05$ ).

الخلاصة: يفضل تناول بذور اليقطين 50 جرام / يومياً كمصدر غني بالمغنسيوم والحديد حيث يمد الطفل ب 100% من إحتياجاته اليومية منهم، ولما لهم من أهمية كبيرة في تحسين حالات الانتباه المصحوب بالنشاط الزائد للأطفال الصم.

**الكلمات الدالة:** بذور اليقطين- الأطفال الصم – النشاط الزائد – التدخل الغذائي – المغنسيوم –الحديد.

