Hair Zinc Content and Its Relation to Serum Zinc Level in children with Idiopathic Epilepsy

Thesis

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By

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May God bless them all.

Nermine Farag

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List of Abbreviations

Abb.	Full term
ADEAF	*Autosomal –dominant epilepsy with auditory features*
ADHD	*attention deficit hyperactivity disorder*
ADNFLE	*Autosomal dominant nocturnal frontal lobe epilepsy*
AMPA	*α-amino-3-hydroxy-5-methyl-4-isoxazolepropioniaacid*
AMPAR	*α-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid receptor*
ASD	*Autism spectrum disorders*
BECTS	*Benign epilepsy with Centro temporal spikes*
BFNE	*Benign familial neonatal epilepsy*
BNS	*Benign neonatal seizures*
BOHB	*Beta-OH-butyrate*
C	*Chi Square test of significance*
CAE	*Childhood absence epilepsy*
CBZ	*Carbamazepine*
CSWS	*Continuous spike and wave during sleep*
CT	*Computed tomography*
EEG	*Electroencephalogram*
EGTCO	*Epilepsy with generalized tonic-clonic seizures alone*
EIEE	*Early Infantile Epileptic Encephalopathy*
EMA	*Epilepsy with myoclonic absences*
EME	*Early myoclonic encephalopathy*
ER	*Endoplasmic reticulum*
F	*Fisher's exact test of significance*
FMRI	*Functional magnetic resonance imaging*
FS	*Febrile seizures*
GABA	*Gamma amino butyric acid*
GEFS+	*Generalized Epilepsy with Febrile seizures plus*
GLUT 1	*Glucose transporter deficiency*

List of Abbreviations (Cont...)

Abb.	Full term
GPx	*Glutathione peroxidase*
H.C	*Head circumference*
ILAE	*International League against Epilepsy*
IQR	*Interquartile range*
IS	*Infantile Spasms*
IZiNCG	*International Zinc Nutrition Consultative Group*
JAE	*Juvenile absence epilepsy*
JME	*Juvenile myoclonic epilepsy*
KGD	*Ketogenic Diet*
LEV	*Levetirectam*
LGS	*Lennox-Gastaut syndrome*
LKS	*Landau-kleffner syndrome*
MEI	*Myoclonic epilepsy in infancy*
MMP	*Matrix metalloproteinase*
MMPEI	*Malignant migrating partial epilepsy of infancy*
MRI	*Magnetic resonance imaging*
MSI	*Magnetic source imaging*
MTLE	*Mesial temporal lobe epilepsy*
MTs	*Mammalian metallothioneins*
NMDAR	*N-methyl-D-aspartate receptor*
NS	*Non significant*
OXBZ	*Oxcarbazepine*
PET	*Positron emission tomography*
PHB	*Phenobarbital*
PHD	*pyruvate dehydrogenase deficiency*
PME	*Progressive myoclonus epilepsies*
S	*Significant*
SD	*Standard deviation*
SMEI	*Severe myoclonic epilepsy of infancy*
SPECT	*Single photon emission computerized tomography*
TPM	*Topiramate*
VGCC	*Voltage-gated Ca^{2+} channels*

List of Abbreviations (Cont...)

Abb.	Full term

VNS.....*Vagus Nerve Stimulator*
VPA .....*Valproate*
Zfp .....*Zinc finger proteins*
Zn .....*Zinc*
ZnT.....*Zinc transporter*

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ABSTRACT

There was a statistically significant difference between cases and control in terms of weight percentiles. The difference between cases and controls regarding the occipitofrontal circumference percentile was nearing statistical significance (p =0.06), with the values being consistently lower in the cases group.

The mean serum zinc was significantly lower in cases than in controls (p =0.001). However, there was no statistically significant difference between cases and controls in terms of mean hair zinc level.

Keywords: Positron emission tomography - Zinc finger proteins - Vagus Nerve Stimulator

INTRODUCTION

Epilepsy is a disorder of the brain caused by abnormal excessive or synchronous neuronal activity which leads to the generation of epileptic seizures. It is clinically defined by any of the conditions (1) at least 2 unprovoked seizures occurring >24 hrs. Apart or (2) one unprovoked seizures and probability of further seizures similar to general recurrence risk after 2 unprovoked seizures or (3) epilepsy syndrome ***(Fisher et al., 2014).***

Causes of epilepsy are divided into 4 main categories: (1) genetic such as Specific genetic epilepsy syndromes , genetic and chromosomal developmental encephalopathies, (2) structural such as brain malformation, brain tumors, (3) metabolic such as inborn errors of metabolism , alteration in blood and serum trace elements levels, (4) and unknown causes ***(Berg et al., 2010)*** .

The equilibrium of trace elements is essential for a healthy nervous system as they activate specific enzymes that act as antioxidants ***(Hayashi M. 2009).***

Zinc is abundant in brain especially in the hippocampus and is an important element for normal neuronal communication as well as proper functioning of the inhibitory

neurotransmitter, gamma amino butyric acid (GABA). Zinc may play a role in pyridoxal phosphate-mediated regulation of glutamic acid decarboxylase, the key enzyme in the synthesis of GABA. Altered zinc levels have been found to play a role in the pathology of epilepsy ***(Prasad et al., 2009).***

The most commonly used tool to assess for zinc level is the measurement of zinc status is serum zinc despite the fact that it represents less than 0.1% of the total body content of zinc. Moreover, zinc can be temporally redistributed from plasma to other tissue or the concentration can be changed by conditions unrelated to zinc status. For, example: infection, fever, food intake and rapid tissue growth may lower the plasma zinc whereas starvation and catabolism may increase it ***(Sandström, 2001).***

Hair zinc analysis has many advantages over serum zinc assessment as it infers information about the metabolism of zinc in the cells and represents an average rate of mineral accumulation in the sample for over 2-3months before sampling. Moreover, it is non-invasive and relatively cheap method to measure total body zinc content ***(Wolowie et al., 2013).***

AIM OF THE WORK

The aim of the work is to:

1) Measure the levels of hair and serum zinc in patients with epilepsy; comparing them to the levels found in non-epileptic age and gender matched controls.
2) Correlate hair to serum levels of zinc in epileptic patients and in healthy controls.
3) Explore the potential impact of zinc status on disease characteristics in epileptic patients.

Chapter (1)

SEIZURES AND EPILEPSY

Epilepsy is the most common chronic neurological disease. People with epilepsy suffer from discrimination, misunderstanding and social stigma ***(Thurman et al., 2007),*** and the stress of living with a chronic unpredictable disease that can lead to loss of autonomy for activities of daily living ***(Quintas et al., 2012).***

An epileptic seizure is defined by the International League against Epilepsy (ILAE) as "a transient occurrence of signs and/or symptoms due to abnormal excessive or synchronous neuronal activity in the brain". Epilepsy is characterized conceptually as an "enduring predisposition of the brain to generate epileptic seizures, with neurobiological, cognitive, psychological, and social consequences" ***(Fisher et al., 2005).***

Definition:

Epilepsy has previously been defined as at least two unprovoked seizures >24 hours apart. The revised practical definition implies that epilepsy can also be considered to be present after one unprovoked seizure in individuals who have