Estimation of Malondialdehyde, Total Antioxidant Capacity, and Selenium Levels in Serum of Intractable Epileptic Children Receiving Treatment with Ketogenic Diet

Thesis

Submitted for Partial Fulfillment of Master Degree in Pediatrics

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2018

سورة البقرة الآية: ٣٢

Acknowledgment

*First of all, all gratitude is due to **Allah** almighty for blessing this work, until it has reached its end, as a part of his generous help, throughout my life.*

*Really I can hardly find the words to express my gratitude to **Prof. Dr Omnia Fathy El-Rashidy**, Professor of Pediatrics, Faculty of Medicine - Ain Shams University, for her supervision, continuous help, encouragement throughout this work and tremendous effort she has done in the meticulous revision of the whole work. It is a great honor to work under her guidance and supervision.*

*I would like also to express my sincere appreciation and gratitude to **Prof Dr. Mai Mahmoud Youssef**, Professor Researcher, Child Health department, National Research Center, for her continuous directions and support throughout the whole work.*

*I cannot forget the great help of **Dr. Yasmin Gamal El-gendy**, Lecturer of Pediatrics, Faculty of Medicine -Ain shams University, for her invaluable efforts, tireless guidance and for her patience and support to get this work into light.*

*I express my warm thanks to **Prof DR. Manal Mohsen**, Prof Researcher, Child Health Deparetment, National Research Center, for sharing expertise, and sincere and valuable guidance and encouragement throughout the whole work.*

*My sincere thanks also goes to **Assis. Prof Dr. Safaa Metwally Morsy**, Professor of Bio-chemistry, Medical Bio-chemistry Department, National Research Center, who gave me access to the laboratory and research facilities. Without her precious support it would not be possible to conduct this research.*

Last but not least, I dedicate this work to my family, whom without their sincere emotional support, pushing me forward, this work would not have ever been completed.

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List of Abbreviations

Abb.	Full term
AA	*Arachidonic acid*
AcAc	*Aceto-acetate*
ADEAF	*Autosomal dominant epilepsy with auditory features*
ADNFLE	*Autosomal-dominant nocturnal frontal lobe epilepsy*
AED	*Anti-epileptic drugs*
ATP	*Adenosine triphosphate*
BDH1	*Bidirectional BHB dehydrogenase*
BECTS	*Benign epilepsy with centrotemporal spikes*
BFNE	*Benign familial neonatal epilepsy*
BHB	*Hydroxy- Butarate*
BNS	*Benign neonatal seizures*
Ca2+	*Calcium*
CAE	*Childhood absence epilepsy*
CBZ	*Carbamazepine*
CPT	*Carnitine palmitoyltransferase*
CSWS	*Continuous spike-and-wave during sleep*
Cu/Zn	*Copper-zinc*
DHA	*Docosahexanoic acid*
ECSOD	*Extracellular superoxide dismutase*
EEG	*Electroencephalogram*
EME	*Early myoclonic encephalopathy*
ESES	*Electrical Status Epilepticus during Slow Sleep*
FS	*Febrile seizures*
GABA	*Gamma-amino butyric acid*
GLUT-1	*Glucose transporter type 1*

List of Abbreviations (Cont...)

Abb.	Full term
GPx	*Glutathione Peroxidase*
GSH	*Glutathione*
GTC	*Genaralized tonoc clonic*
H_2O_2	*hydrogen peroxide*
HMG-CoA	*3-hydroxy-3-methylglutaryl CoA*
HS	*Highly significant*
ILAE	*International League Against Epilepsy*
IQR	*Interquartile range*
JME	*Juvenile myoclonic epilepsy*
KA	*Kainic acid*
KD	*Ketogenic diet*
LCAD	*Long-chain acyl dehydrogenase deficiency*
LCT	*Long chain triglyceride*
LEV	*Levetiracetam*
LGIT	*Low Glycemic Index Treatment*
LKS	*Landau-Kleffner syndrome*
LMT	*Lamotrigine*
MAD	*Modified Atkins diet*
MCAD	*Medium-chain acyl dehydrogenase deficiency*
MCT	*Medium chain triglyceride*
MDA	*Malonylaldehyde*
MEG	*Magneto-encephalography*
MEI	*Myoclonic epilepsy in infancy*
MERF	*Myoclonic epilepsy with ragged red fibers*
Mn	*Manganese*
mtDNA	*Mitochondrial DNA*
MTLE with HS	*Mesial temporal lobe epilepsy with hippocampal sclerosis*

List of Abbreviations (Cont...)

Abb.	Full term
NE	*Norepinephrine*
NO	*Nitric oxide*
NPA	*Neuroprotective activity*
NPY	*Neuropeptide-Y*
NS	*Non significant*
$O_2^{\cdot-}$	*Superoxide*
$OH^{\bullet}$	*Hydroxyl radical*
PDH	*Pyruvate dehydrogenase*
PDHC	*Pyruvate dehydrogenase complex*
PFK	*Phospho- fructokinase*
PHT	*Phenytoin*
PTZ	*Pentylenetetrazol*
PUFAs	*Polyunsaturated fatty acids*
RDA	*Recommended Dietary Allowance*
ROS	*Reactive oxygen species*
S	*Significant*
SCAD	*Short-chain acyl dehydrogenase deficiency*
SE	*Selenium*
SelP	*Selenoprotein-P*
SODs	*Superoxide dismutases*
SRS	*Stereotactic radio-surgery*
TAC	*Total antioxidant capacity*
TAS	*Total Antioxidant Status*
TBA	*Thiobarbituric acid*
TCA	*Tricarboxylic acid*
TR	*Thioredoxin reductases*
UCPs	*Uncoupling proteins*

List of Abbreviations (Cont...)

Abb.	Full term
UL	*Upper Intake Level*
VNS	*Vagus nerve stimulation*
VPA	*Valproic acid*
WHO	*World Health Organization*

INTRODUCTION

Epilepsy is a neurological illness characterized by tendency to generate epileptic seizures and by the neurological, psychological, cognitive, and social impacts of this condition. An epileptic seizure is a transient occurrence of signs and/or symptoms due to abnormal excessive or hypersynchronous neuronal activity in the brain. This disturbance may cause strange sensations, emotions, and behavior, or generally convulsions, muscle spasms, and loss of consciousness ***(Fisher et al., 2005)***. There are many types of epileptic seizures that are specific to children, for example infantile spasms, Lennox-Gastaut syndrome and absence seizures.

Epilepsy may be burden affecting not less than 50 million pateints worldwide ***(Behr et al., 2016)***. Children who suffer from epilepsy may develop other disorders and difficulties, preceding, co-occurring with, or after the diagnosis of epilepsy ***(Aaberg et al., 2016)***. It can also reduce quality of life (QoL) of patients ***(Baker et al., 1997)***, and may affect QoL of people caring for them as well.

Neuronal hyperexcitability and excessive production of free radicals have a major role in the pathogenesis of a considerable range of neurological disorders, including epilepsy. The high rate of oxidative metabolism, accompanied with the low antioxidant defenses and the increase in

polyunsaturated fatty acids, makes the brain highly vulnerable to free radical damage ***(Devi et al., 2008).***

Although the overall prognosis for seizure control is good and over 70% will enter remission; about 25% of epilepsy is intractable and may need epilepsy surgery. However, up to 30% of patients undergoing presurgical evaluations eventually are not qualified for surgery ***(Berg et al., 2003)*** and face the prospect of ongoing seizures.

Intractable epilepsy according to International League Against Epilepsy (ILAE) is defined as a failure of adequate trials of 2 tolerated and appropriately chosen and used anti-epileptic drugs (AED) schedules (whether as monotherapies or in combination) to achieve sustained seizure freedom ***(Kwan et al., 2010).***

Dietary therapies play a major role in management of epilepsy with other epilepsy treatments, such as anticonvulsant medications, epilepsy surgery, and vagus nerve stimulation. The ketogenic diet, which is very high in fat and low in carbohydrates, is thought to simulate the metabolic effects of starvation by forcing the body to use fat mainly as an energy source. During fasting, the body metabolizes fat stores through lipolysis to produce fatty acids which then undergo beta-oxidation into acetoacetate, β-hydroxybutyrate, and acetone—ketone bodies the brain cell can then use as precursors to generate adenosine triphosphate (ATP) ***(Barañano and***