Polyunsaturated fatty acids and Psychiatric disorders

Essay

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الأحماض الدهنية المتعددة غيرالمشبعة والإضطرابات النفسية

رسالة

توطئة للحصول على درجة الماجستير في أمراض المخ والأعصاب والطب النفسى

مقدمة من

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✍ *Ahmed Mohamed Sabry Thabet*

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List of Abbreviations

AA	Arachidonic acid
AD	Alzheimer Disease
ADHD	Attention-deficit hyperactivity disorder
ALA	Alphalinolenic acid
Apo-D	Apo lipoprotein D
APP	Amyloid precursor protein
Aβ	Amyloid β
BDNF	Brain-derived neurotrophic factor
BPRS	Brief psychiatric rating score
CARS	Childhood Autism Rating Scales
CHQ	Child Health Questionnaire
COX	Cyclooxygenase
cPLA2	Cytosolic phospholipase A2
CPRS	Comprehensive psychiatric rating scale
CRS-P, T	Conners' parent and teacher rating scales
CSF	Cerebrospinal fluid
DAG	Diacylglycerol
DCD	Developmental Coordination Disorder
DGLA	Dihomogammalinolenic acid
DHA	Docosahexaenoic acid, 22:6 ώ-3
DPA	Docosapentaenoic acid
DSM	Diagnostic and Statistical Manual for Mental Disorders
DTI	Diffusion tensor imaging
EE	Ethyl eicosapentaenoate
E-EPA	Ethyl eicosapentaenoic acid
Efamol	Evening primrose oil
EFAs	Essential fatty acids
EFSA	European Food Safety Authority

EPA	Eicosapentaenoic acid
EPUFAs	Essential polyunsaturated fatty acids
FAs	Fatty acids
FATP	Fatty acid transport protein
GLA	Gammalinolenic acid
GRAS	Generally Regarded as Safe
HDL	High-density lipoprotein
HDL	High-density Lipoprotein
HETE	Hydroxyeicosatetraenoic acid
HPETE	Hydroperoxyeicosatetraenoic
HUFAs	Highly Unsaturated Fatty Acids
IP3	Inositotriphosphate
iPLA2	Independent phospholipase A2
LA	Linoleic acid, 18:2 ώ-6
LDL	Low-density lipoprotein
LOX	Lipoxygenase
LPL	Lipoprotein lipase
LT	Leukotrienes
LTP	Long-term potentiation
MDD	Major depressive disorder
MPC	Membrane phospholipid composition
N	Number of human subjects in study
NPD1	Neuroprotection D1
PANSS	Positive and Negative Syndrome Scale
PC	Phosphatidylcholine
PE	Phosphatidylethanolamine
PET	Positron emission tomography
PG	Prostaglandins
PI	Phosphatidylinositol
PI3-K	Phosphatidylinositol-3kinase

PIP2	Phosphatidylinositol biphosphate
PIP3	Phosphatidylinositol (3, 4, 5) Trisphosphate
PLA2	Phospholipase A2
PPARs	Peroxisome proliferator-activated receptors
PPD	Postpartum depression
Ps	Phosphatidylserine
PTSD	Post-traumatic stress disorder
PUFAs	Polyunsaturated fatty acids
RAR	Retinoic acid receptors
RBCs	Red blood cells
RCT	Randomized Controlled Trial
RXR	Retinoid X Receptors
SAD	Seasonal Affective Disorder
SANS	Scale Assessment of Negative symptoms
SAPS	Scale for the assessment of positive symptoms
SDQ	Strengths and Difficulties Questionnaire
sPLA2	Secretory phospholipase A2
TAG	Triacylglycerols
TD	Tardive dyskinesia
TX	Thromboxanes
VLDL	Very low-density lipoprotein
ώ	Omega
5-HIAA	5-hydroxyindoleacetic acid
5-HIAA	5-hydroxyindoleacetic acid
5-HT	5-hydroxytryptamine

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Introduction

The human brain is primarily composed of lipids (60–70% dry weight) comprised of a ratio of saturated fatty acids and unsaturated fatty acid (monounsaturated fatty acid and polyunsaturated fatty acids) ***(McNamara and Carlson, 2006).***

Polyunsaturated fatty acids are important components of membrane cells and neurological tissue, Polyunsaturated fatty acids especially arachidonic acid and docosahexaenoic acid are particularly important for the central nervous system structure and function ***(Sethom et al., 2010).***

Several biological mechanisms potentially explain the impact of omega- 3 Eiscosapentanoic acid in psychiatric disorders; these include (1) increased serotonergic neurotransmission, (2) alteration in dopaminergic function, (3) regulation of corticotrophin-releasing factor, (4) inhibition of protein kinase c, (5) suppression of phosphatidylinositol associated second messenger activity, (6) improved cerebral blood flow, (7) regulation of gene expression, (8) increased dendritic arborization and formation, (9) prevention of neuronal apoptosis, (10) competition of eiscosapentanoic acid with arachidonic acid for enzymatic action and resultant reduction of the inflammation response ***(Freeman et al., 2006).***

There is evidence to suggest that abnormal phospholipid and related fatty acid metabolism may play a role in the aetiology of several psychiatric illnesses, including schizophrenia, bipolar mood disorder, major depression, dementia and attention deficit hyperactivity disorder ***(Parker et al., 2006).***

There is evidence that altered composition of membrane levels of fatty acids is correlated with severity of psychotic symptoms and also with impairment of distinct cognitive parameters in subjects with schizophrenia ***(Sumiyoshi et al., 2010).***

Deficiencies in ω-3 polyunsaturated fatty acids have been reported in a wide range of psychiatric disorders that have included (but are not limited to) depression, suicidal tendencies and aggressive disorders ***(Young and Conquer, 2005).***

The "arachidonic acid cascade hypothesis" asserts that these agents commonly alleviate bipolar disorders symptoms, particularly bipolar mania, by downregulating brain arachidonic acid metabolism ***(Rao et al., 2008).***

Several natural compounds, including omega-3 fatty acids, have been suggested as potential augmenters of antidepressant drug effects especially in treatment-resistant depression ***(Liano et al., 2010).***

Also, decreased levels of the docosahexaenoic essential fatty acid have also been reported in autism ***(Taylor and Benjamin, 2004)***.

In patients with social phobia, the abundance of eicosapentaenoic acid and docosahexaenoic acid in erythrocyte membranes is decreased in those with the illness and the extent of the reduction is correlated with the severity of the illness **(*Green et al., 2006).***

Besides, it has been recently reported the first clinical trial demonstrating omega-3 to be effective monotherapy in childhood depression ***(Nemets et al., 2006).***

However, randomized controlled clinical trials have been slow to accrue. Most but not all trials with omega-3 indicate that these fatty acids are effective as an adjunctive treatment for unipolar depression and may be beneficial in other mood disorders ***(Owen et al., 2008).***

There is no doubt that further research is needed in this field to clarify the efficacy of omega-3 as monotherapy for the treatment of unipolar, bipolar, perinatal and childhood depression as well as the optimal dose and type of omega-3 supplement for each case ***(Venna et al., 2009).***

Rationale of the work

As over the past 10 years, numerous studies have investigated the role of polyunsaturated fatty acids in psychiatric disorders (pathogenesis, prevention and significant role in the management) on evidence that polyunsaturated fatty acids play roles in brain structure and function.

Therefore, this work seeks to throw light on polyunsaturated fatty acids and its relation to psychiatric disorders in different aspects and to increase awareness about the benefits of omega-3 fatty acids among psychiatrists as well as patients, which in turn may greatly improve the treatment outcomes in patients with these psychiatric disorders.

Hypothesis

Polyunsaturated fatty acids have a valuable correlation to the pathogenesis and for the management of variable psychiatric disorders.

Aim of the work

To highlight the role of polyunsaturated fatty acids in the pathogenesis, prevention and management of psychiatric disorders.