

DHA, Eat or Not Eat?

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Abstract

Various health products are sold on the market at present. How can we choose a health product which has no side effects and a wholesome product on disease? DHA (omega-3:7, 10, 13, 16, 19-docosaehaenoic acid) as a kind of polyunsaturated fatty acids, can across the blood-brain barrier, which are the important raw material for the formation of cerebral cortex neuron membrane and could improve human cognitive function and reduce the occurrence of Alzheimer's disease and depression. Method: This paper summarizes the research of DHA in foreign countries in recent years. Result and Conclusion: The development and utilization of DHA has been paid attention and concerned by all countries in the world. DHA can prevent and improve mental illnesses and neurodegenerative diseases. Choosing DHA as a health supplement is a wise choice.

Keywords

DHA, Fatty Acids, Health Products, Nervous System, Alzheimer's Disease, Depression

DHA, 吃还是不吃?

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摘要

目的: 目前市场上出售的保健品种类繁多, 我们如何选择一种无副作用还能对疾病起到预防作用的保健

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品呢? DHA (ω -3: 7, 10, 13, 16, 19-二十二碳六烯酸)作为一种多不饱和脂肪酸,能够通过血脑屏障,是大脑皮层神经元细胞膜的形成的的重要原料;改善人类认知功能,减轻阿尔茨海默病和抑郁症的发生;方法:本文把近年来国外对DHA的研究情况作了系统综述。结果与结论: DHA的开发利用已受到世界各国的关注和重视。DHA能够预防和改善精神疾病和神经退行性病变。选择DHA作为一种保健品,不失为一种明智的选择。

关键词

DHA, 脂肪酸, 保健品, 神经系统, 阿尔茨海默病, 抑郁症

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1. 引言

中枢神经系统接受着全身各处的传入信息,经过大脑的整合加工后协调输出运动、感觉等信息,或者把信息储存在中枢神经系统内成为学习、记忆的神经基础[1] [2]。脑,作为中枢神经系统的重要组成部分,吸收了丰富的 ω -3脂肪酸。以前大量研究结果表明[3] [4], DHA (ω -3: 7, 10, 13, 16, 19-二十二碳六烯酸)作为一种多不饱和脂肪酸,对人体大有裨益。鉴于目前市面上所售的保健品琳琅满目,我们如何选择一种无副作用、还能对疾病起到预防作用的保健品呢?称为“脑黄金”的DHA是不是最好的选择?在这里,我们对DHA在中枢神经系统的作用作一下综述,特别是对阿尔茨海默病及抑郁症的预防和治疗提供新的方向。

2. 脂质与 DHA

脂质种类繁多且结构复杂,它与生命活动和疾病的关系远比我们想象的要复杂[5]。脂质是脂肪和类脂的总称,脂肪即甘油三酯,也称三脂酰甘油。类脂包括固醇及其酯、磷脂、糖脂等。脂肪酸是脂肪烃的羧酸,脂肪酸的结构通式为 $\text{CH}_3(\text{CH}_2)_n\text{COOH}$ [6] [7]。高等动植物的脂肪酸碳链长度一般在14~20之间,为偶数碳。 ω 编码体系从甲基碳起计双键位置不含双键的脂肪酸为饱和脂肪酸,不饱和脂肪酸含一个或以上双键。含一个双键的脂肪酸称为单不饱和脂肪酸;含两个及以上双键的脂肪酸为多不饱和脂肪酸。根据双键的位置,多不饱和脂肪酸分为 ω -3、 ω -6、 ω -7、 ω -9四簇。高等动物体内的多不饱和脂肪酸多由相应的母体脂肪酸衍生而来, ω -3、 ω -6和 ω -9簇不能在体内相互转化[8] [9]。DHA(二十二碳六烯酸)是有六个双键的多不饱和脂肪酸,是一种 ω -3必需脂肪酸它是由亚麻酸衍生而来。

3. DHA 的代谢(合成与分解)

不饱和脂肪酸根据分子结构中双键数目的不同,分为单不饱和脂肪酸和多不饱和脂肪酸[10] [11]。在食物脂肪中,单不饱和脂肪酸主要有油酸,多不饱和脂肪酸主要有亚油酸、亚麻酸、花生四烯酸。人体不能合成油酸、亚油酸和亚麻酸,必须从日常膳食中补充,被称为必需脂肪酸。

DHA的体内来源是前体脂肪酸。亚麻酸、亚油酸进入人体后,经2次碳链延长酶和去饱和酶的作用衍生为DHA。DHA主要存在于海洋生物和植物油中。海洋生物如鱼类、虾类、海藻等[12] [13]。种籽油中富含丰富的亚麻酸,比如玫瑰籽油、印加果油、紫苏籽油、沙棘籽油等。葵花籽油富含多1%的亚麻酸、芥花籽油富含10%、玫瑰果油富含33%、美藤果油富含49%、奇亚籽油富含64%;亚麻酸的大量供给增

加了多不饱和脂肪酸的抗氧化活性及脂肪酸的氧化。目前,市面上所售的 DHA 大多是由海洋生物或者植物籽油中提取或者纯化培养,经抽提和精炼得来。

人体摄入的脂质不溶于水,不能与消化酶充分接触[14]。胆汁酸有较强的乳化作用,能够降低脂-水相间的表面张力,将脂质乳化成小颗粒,极易进入小肠粘膜表面的水屏障,促进了脂质消化。胆汁和胰液分泌后进入十二指肠,所以小肠上段是消化脂质的主要场所。

4. DHA 与脑

DHA 大量存在于人脑细胞中[15],占大脑脂肪酸的 25%~33%,占细胞膜脂肪的 50%,它与胆碱、磷脂等构成大脑皮层皮质的神经细胞膜,是脑神经元储存和处理信息的重要物质,对脑细胞的分裂、神经传导等有着极为重要的作用[16] [17]。DHA 是细胞膜磷脂(磷脂酰胆碱、磷脂酰乙醇胺和磷脂酰丝氨酸)的重要组成部分,由于其特殊的 3D 结构,能够减轻细胞膜脂质双分子层的厚度、增加细胞膜的流动性、提高细胞膜的渗透性。DHA 能够调节许多膜蛋白的活性,包括离子通道、受体和酶[18],DHA 还能够与许多脂质、胆固醇、神经鞘磷脂相互作用[19]。DHA 比 EPA 更能增加细胞膜的流动性[20] [21]。PUFA 对于神经元的发育也是很关键的,比如神经突触、神经轴突、视锥细胞、视杆细胞,神经髓鞘的生成。DHA 还能调节突出功能和视觉的准确性。DHA 通过激活 PI3-K/Akt 通路提高神经突触的可塑性。此外,EPA 和 DHA 还能够通过 n-6PUFAs 抑制神经免疫[22]。

5. DHA 与阿尔茨海默病

阿尔茨海默病(Alzheimer's Disease, AD)是发生于老年和老年前期,以进行性认知功能障碍和行为损害为特征的中枢神经系统退行性疾病,是老年期痴呆最常见的类型。我国每年新发病例 30 万,且每 20 年翻一翻。AD 可分为家族性 AD 和散发性 AD,家族性 AD 呈常染色体显性遗传,多于年老起病,其病因是位于 21 染色体的淀粉样前体蛋白基因(Amyloid precursor protein, APP)、位于 14 号染色体的早老素 1 基因(Presenilin1, PS1)及位于 1 号染色体的早老素 2 基因(Presenilin2, PS2)突变。而大多数散发性 AD 与载脂蛋白 E 基因有关[23]。目前关于 AD 的发病机制有许多假说, β 淀粉样蛋白(p-amyloid β)组成的斑块和由过度磷酸化的 tau 蛋白组成的纤维缠结是影响较为广泛地假说[24] [25] [26]。此外,还有细胞周期调节蛋白障碍、氧化应激、炎症机制、线粒体功能障碍等多种假说。

最近流行病学研究表明[27],DHA 由于其降低胆固醇的作用能够降低 AD 的发生。高胆固醇血症影响了 β -淀粉样蛋白前体蛋白酶的处理,使 A β -淀粉样蛋白沉积。而 DHA 通过调节胆固醇通路影响胆固醇的代谢,降低 A β -淀粉样蛋白沉积。

DHA 能够改善人类的认知功能。然而,其最佳摄入量是多少?没有一个确切的定义[28]。有研究者收录了具有轻度认知功能障碍、认知功能下降、痴呆、阿尔茨海默病、帕金森疾病的 21 个研究小组,181,580 位参与者,并对 4438 例作了长期随访研究。得到的结论是:每周摄入一次鱼,能够降低得痴呆和帕金森的风险;相应的每天摄入 8 g 多不饱和脂肪酸,能够降低得认知功能障碍和痴呆的风险;DHA 作为多不饱和脂肪酸的重要来源,每天摄入 0.1 g 的 DHA,就能够降低得痴呆和帕金森的风险,但是两者之间没有线性相关关系。

DHA 能够改善轻度记忆障碍成年患者的情景记忆功能[29]。载脂蛋白 E (ApoE)主要是在脑内中枢神经系统中合成,载脂蛋白 E 对脂质的合成和转运起到了关键作用[30]。特别是 ApoE 及其受体通路在胆固醇转运中起关键作用。脑中的胆固醇含量是非常多的[31]。胆固醇在维持神经细胞的正常功能起关键作用,能促进突触形成及其发展。在细胞实验中,多不饱和脂肪酸能够促进神经轴突的生长、胞体的形成[32] [33] [34]。在 AD 动物模型中,脑组织中高表达的多不饱和脂肪酸能够降低 tau 蛋白的沉积[35]增加突触传递

[36]、提高认知功能[37]、减轻 AD 症状。在得 AD 之前尽早进行干预及早预防, DHA 比其他多数药物要健康, 可以作为预防药物。随着年龄的增长, 记忆力下降也需要提早进行干预。与其他营养保健品相比较, DHA 是非常受欢迎的。

6. DHA 与抑郁症

抑郁症是一种常见的心境障碍, 可由各种原因引起, 以显著而持久的心境低落为主要临床特征, 心境低落与其处境不相称。严重者可出现自杀念头和行为。据世界卫生组织统计, 抑郁症成为全球第四大疾病, 预计 2020 年可能成为仅次于冠心病的大二大疾病[19]。目前, 抑郁症的病因尚不明确, 有两大假说, 神经递质学说和神经回路学说。下丘脑 - 垂体 - 肾上腺轴功能紊乱和皮质 - 纹状体 - 丘脑 - 皮质回路出现信息传导不畅, 最终导致神经退化、海马神经功能减退, 而损害认知功能。

全球大约有 10% 重度抑郁的患者[38] [39], 根据第五版国际精神疾病的诊断和统计分析得出, 重度抑郁表现为丧失兴趣、自卑、睡眠功能紊乱、食欲减退或、精力不能集中或者不能思考, 这些症状会一直持续, 变得越来越重, 甚至会出现自杀倾向[19] [37]。据流行病学调查研究显示, 大约 20,000 多篇报道证实多摄入多不饱和脂肪酸能够减轻抑郁的发生、改善抑郁症状[40] [41]。每天摄入 1 g 的 DHA 能够提高汉密顿抑郁量表的评分。

7. 结论

DHA 大量存在于人脑细胞中, 占大脑脂肪酸的 25%~33%, 占细胞膜脂肪的 50%, 它与胆碱、磷脂等构成大脑皮层皮质神经细胞膜, 是脑细胞储存和处理信息的重要物质结构。DHA 具有神经保护作用, 能够稳定和修复神经细胞膜、增加细胞膜的流动性; 营养修复神经细胞和突触小泡、增加神经细胞突触的可塑性。目前研究认为, DHA 这种不饱和脂肪酸是神经系统细胞生长及维持的一种主要元素, 是大脑和视网膜的重要构成成分, 是对人体非常重要的多不饱和脂肪酸, 尤其对婴幼儿及孕妇, 是早产儿智力和视力发育关键因子。目前, DHA 的开发利用已受到世界各国的关注和重视。DHA 能够预防和改善精神疾病和神经退行性病变。特别是为阿尔茨海默病的预防和治疗提供了新的方向。综上所述, 我们可以考虑选择 DHA 作为一种保健品。

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