

孤独症谱系障碍儿童膳食营养状况及饮食干预研究进展

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摘要

孤独症谱系障碍(autism spectrum disorder, ASD)是一类以社会交往和交流障碍、兴趣狭隘和刻板、重复行为为主要特征的神经系统发育障碍性疾病。目前, 尽管其早期诊疗策略和综合干预措施等不断优化, 但针对性的饮食行为干预与营养支持方案仍缺乏统一规范。本文综述旨在通过介绍ASD儿童的饮食行为特征、膳食营养状况及相关干预研究进展, 重点探讨了饮食因素与ASD症状的关联, 以期为临床制定个性化干预策略及指导家庭科学喂养提供参考。

关键词

孤独症谱系障碍, 饮食行为, 膳食营养, 干预

Research Progress on Nutritional Status and Dietary Interventions in Children with Autism Spectrum Disorder

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Abstract

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized primarily by impairments in social communication and interaction, restricted interests, and repetitive, stereotyped behaviors. Although early diagnostic strategies and comprehensive intervention approaches have been continuously optimized, standardized protocols for targeted dietary behavior interventions and nutritional support remain lacking. This review aims to summarize the dietary behavior characteristics, nutritional status, and related intervention research progress in children with ASD, with a particular focus on exploring the associations between dietary factors and ASD symptoms, thereby providing references for developing individualized intervention strategies in clinical practice and guiding families in scientific feeding practices.

Keywords

Autism Spectrum Disorder, Dietary Behavior, Nutritional Status, Intervention

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1. 引言

孤独症谱系障碍(autism spectrum disorder, ASD)是一类以社会交往和交流障碍、兴趣狭隘和刻板、重复行为为主要特征的神经系统发育障碍性疾病[1]。除了核心症状外,相当比例的 ASD 儿童常伴不同程度的饮食行为问题。这些问题在影响其营养状况和生长发育的同时,也与核心症状的严重程度密切相关[2]。近年来,围绕 ASD 儿童的早期识别、规范化诊断及综合性干预已取得诸多进展。但其在饮食行为和膳食营养层面仍缺乏标准化的评估工具及针对性的干预策略。本文综述聚焦于 ASD 儿童的饮食行为特征、膳食营养状况及相关干预研究进展,分析膳食因素与 ASD 症状的内在关联,以期为临床干预与指导家庭照护提供参考。

2. 研究现状

我国 2014~2016 年的相关数据显示,ASD 患病率在逐年上升[3] [4]。流行病学研究显示,约 40.3%~96.0% 的 ASD 儿童存在饮食行为异常,且该事件发生的频率约为正常儿童的 5 倍[5] [6]。持续存在的饮食行为问题,不仅会阻碍 ASD 儿童的正常生长发育,增加营养相关疾病的风险,还可能损害其免疫功能,进而加剧核心症状的严重程度[7] [8]。然而,由于目前 ASD 的病因尚不明确,研究饮食行为和膳食营养需要家庭、社会以及专业医疗机构的支持和配合,导致现阶段的相关研究结果较为局限。饮食行为问题及其伴随的膳食营养失衡,已成为 ASD 儿童家庭照护与康复干预中亟待解决的现实挑战,同时也是当前改善 ASD 患儿预后相关研究的重点之一。科学管理营养问题对于改善 ASD 儿童的预后发挥着至关重要的作用[2]。

3. ASD 儿童饮食行为特点

ASD 儿童的异常饮食行为表现形式多样,可归纳为以下几类:在食物选择性上,表现为明显的挑食、厌食、异食癖及抗拒新食物;在进食过程中,可出现情绪性暴饮暴食或完全拒食;在感官层面,对食物

的质地、外观、气味等的选择性；在用餐行为上，则常表现为拒绝上桌、无法安坐、扔食物及刻板的就餐仪式等[9][10]。研究发现，约有70%的ASD儿童和青少年存在食物选择性问题，是最常见的饮食行为之一[11]。通常表现为拒绝某些种类的食物或仅摄入有限的食物种类，包括食谱范围狭窄、长期单一高频率的食物摄入、刻板的进食模式、抗拒新食物以及挑食、拒食行为等[12]。食物选择性导致患儿饮食种类单一，可能增加营养不均衡的风险[8]。在影响ASD儿童体重(包括超重和体重不足)和生长发育的同时，还可能表现出更严重的情绪和行为问题[13]。

饮食行为问题的成因

尽管ASD儿童的饮食行为问题表现出显著的异质性，但其不良饮食行为问题的成因可归纳为以下几个方面。第一，生理因素方面。ASD儿童通常存在感官敏感性，对食物的质地、颜色、气味等特征过度敏感或反应迟钝，使得患儿对某些食物产生强烈的排斥感[14]。同时，食物过敏及胃肠道炎症等问题在部分ASD儿童具有较高的共患率，这些问题可能进一步加重其拒食、挑食等不良饮食行为[9]。美国的一项调查数据显示，ASD儿童的食物过敏患病率约为13.1%，显著高于正常发育儿童，并且食物过敏反应还可能使其核心症状恶化[15][16]。此外，研究报道约46%~91%的ASD儿童存在不同程度的胃肠道疾病，包括便秘、腹痛、腹泻、呕吐、腹胀等[9]。饮食行为异常不仅直接增加胃肠道疾病的发生风险，还可导致营养状况恶化，从而间接加重ASD的核心症状[9][17]。第二，神经发育因素方面。部分ASD儿童可能存在口腔运动技能缺陷如咀嚼和吞咽困难，这不仅会影响食物的摄入量和种类，同时还可能诱发进食焦虑和抵触情绪[18][19]。其次，ASD儿童本身的认知和行为特点如刻板行为和对常规的坚持等，也会影响饮食行为。例如，患儿可能对食物的呈现方式、进食环境等有固定要求，如有不同于常规的改变就可能拒绝进食[18][20]。第三，社会和环境因素方面。ASD儿童的饮食行为可能受到家庭环境和父母行为的影响。部分父母因为患儿存在进食困难，为减少进食压力而迁就其饮食偏好，从而强化了孩子的挑食行为[21]。同时，父母对ASD儿童饮食行为问题的不当处理，如强迫进食或使用电子设备诱导进食等，可能进一步增加患儿的厌食情绪[18]。研究显示，家长采取哄骗、强制等喂养策略，也是诱发或加剧儿童不良饮食行为的重要危险因素[21]。此外，ASD儿童在社交互动方面的障碍也会影响其饮食行为。研究发现，在集体用餐环境中患儿可能因为社交焦虑而难以适应正常的进食流程等[8]。

综上，由于ASD儿童异常的饮食行为特点，不均衡的饮食模式可能导致营养素摄入不足或摄入过量，进而影响患儿的生长发育和健康状况。因此，在探讨ASD儿童饮食行为特点的同时，有必要进一步深入分析其膳食营养状况，以全面理解饮食行为与营养摄入之间的相互作用及对ASD儿童健康的影响。

4. 膳食营养状况

营养是影响ASD症状的重要环境因素之一[22]。研究证据表明，膳食干预有助于改善患儿的营养状况、认知功能和ASD相关表现[23]。然而，目前国内外尚缺乏针对ASD儿童饮食行为问题及膳食营养状况的标准化评估工具。因此，临床干预应关注以下几个方面：及早识别并矫正不良饮食行为，动态监测营养素摄入与膳食营养状况，重视胃肠道问题及食物过敏的管理，并实施科学、个体化的营养支持策略。这一综合干预模式有望最大限度降低饮食及营养问题对ASD儿童的不良影响，从而促进患儿的身心健康发展。

4.1. 营养摄入不足与营养失衡

不良的饮食行为问题和食物选择的局限性，导致ASD儿童更容易出现膳食营养失衡，常伴有多种宏观及微量营养素摄入不足。同时，家长营养知识欠缺也会影响患儿的饮食行为，进一步加剧营养素摄入量偏低等问题[24]。研究表明，与典型发育儿童相比，ASD儿童更倾向于拒绝蔬菜水果，而偏好健康程度较低、高能量密度的食物，如零食、精加工食品、果汁、面包/饼干和高糖食物等[8][25]。这种不均衡

的饮食模式导致患儿更容易出现营养失衡。此外,长期营养素摄入不足还可对 ASD 儿童的体格生长发育造成负面影响,使其肥胖或消瘦的风险增加。已有研究证实,ASD 儿童群体中生长偏离现象较为普遍,体型匀称者比例下降,呈现向肥胖或消瘦两极分化的趋势[26]。一项 Meta 分析指出,ASD 儿童及青少年的肥胖率介于 7.9%~31.8%之间,显著高于典型发育群体[27]。美国儿科学会曾强调,蛋白质、维生素、叶酸、多不饱和脂肪酸和铁、锌等营养素对儿童早期神经系统发育至关重要[28]。上述营养素的缺乏不仅影响 ASD 儿童的中枢神经系统发育和认知功能,还可能加重其核心症状。

除膳食结构异常外,ASD 儿童体内的部分关键营养素水平也常呈现异常。研究发现,ASD 儿童血清中多不饱和脂肪酸表达水平明显低于典型发育儿童[8]。Petruzzelli 等人[29]发现,ASD 儿童的血清 25(OH)D 浓度普遍低于典型发育儿童,而补充维生素 D 有助于改善其核心症状,并能显著降低 SRS 和 CARS-2 评分[30]。维生素 D 缺乏也常伴有骨密度降低,长期钙摄入不足可能进一步导致骨质减少和骨质疏松[31]。此外,锌缺乏在 ASD 儿童中也较为常见,这不仅会损害神经发育和免疫功能,还可能通过影响食欲和味觉而加重进食困难[32] [33]。近年来,微量元素水平在 ASD 发病及发展中的作用也受到广泛关注。研究表明,硒稳态失衡可能与 ASD 儿童的发病机制密切相关[34]。部分研究发现 ASD 儿童头发中的硒水平显著低于典型发育儿童,且硒含量与 ASD 儿童的刻板行为呈负相关[35]。国内一项为期 20 周的试验进一步表明,硒辅助干预可有效改善 ASD 儿童的临床症状,尤其在改善社交行为能力方面效果显著,部分患儿病情严重程度从中度转为轻度[36]。同时,ASD 儿童的重金属排泄能力较弱,导致体内重金属蓄积,其负荷水平与 ASD 症状严重程度呈正相关,可能对神经发育造成不利影响[37]。国内一项多中心研究报告,ASD 儿童群体中存在铁营养不良、叶酸及维生素 B12 缺乏等营养问题[38] [39]。以上的研究发现提示,规范的营养状况评估有助于早期识别 ASD 儿童的营养风险、及时开展针对性干预具有重要作用。

4.2. 胃肠道问题和营养吸收

近年来大量研究表明,ASD 儿童的胃肠道问题和营养吸收之间存在着显著的关联。ASD 儿童共患胃肠道问题的发生率虽在不同研究中差异较大,但大部分研究显示,共患胃肠道问题的 ASD 儿童往往表现出更为严重的行为问题,且这种关联与其核心症状的严重程度密切相关[40]。此外,肠道微生物群及其代谢产物在 ASD 儿童的饮食障碍与胃肠道症状之间发挥着调节作用[41]。肠道菌群的失衡或改变,可诱发多种胃肠道问题的出现,如便秘、腹泻、腹痛和腹胀等,这些问题不仅影响患儿的生活质量,还可能进一步影响营养物质的吸收[42]。

4.3. 食物过敏

食物过敏在 ASD 儿童中的发生率较高,其发生机制可能与脑肠轴相关[8] [16] [43]。该机制通过影响肠道菌群和免疫系统,引发肠道屏障功能障碍和炎症反应,不仅会加重胃肠道症状和行为问题,还会影响营养物质的吸收[8] [43]。此外,由于规避过敏原而采取的饮食限制,也可能进一步导致部分营养素摄入不足,进而加剧营养失衡风险。

5. 饮食干预措施

部分家长尝试采用特殊的饮食模式来改善 ASD 儿童的症状,如无麸质和酪蛋白饮食(gluten-free casein-free diets, GFCF)、生酮饮食(ketogenic diets, KD)、特殊的碳水化合物饮食(specific carbohydrate diet, SCD)等。这些饮食模式在一定程度上可能对某些患儿的症状产生积极影响,但也存在潜在的营养风险。

目前,关于长期采用 GFCF 饮食模式对 ASD 症状的积极影响尚未形成一致性的权威证据。相反,有研究提示该饮食模式的长期应用可能诱发患儿出现便秘、铁缺乏、骨骼健康问题以及引起必需氨基酸摄入不足等不良后果[44]-[46]。相比之下,KD 在 ASD 干预研究中取得了不错的结果,其可通过改善线粒

体功能、抑制炎症反应与氧化应激、调节肠道菌群等途径,缓解患儿的社交障碍及重复刻板行为[47]-[49]。然而,也有研究指出,长期使用 KD 可能会引起患儿发生胃肠道反应,如便秘、腹泻和呕吐等,并增加高尿酸血症、高脂血症、体重减轻乃至成年后慢性肾病和心血管疾病等的发生风险[50][51]。巴恩希等人[52]发现,ASD 儿童对 SCD 耐受性良好,并可改善其胃肠道症状和行为问题。然而,与 GFCF 相比,SCD 更有限制性,其安全性和有效性在 ASD 儿童中还需进一步验证[53]。

由于 ASD 儿童普遍存在挑食、拒食等饮食行为问题,如果长期进行特殊的饮食模式或者特殊饮食模式实施不当,或许不仅无法改善患儿的健康状况,还有可能加重营养失衡。此外,基于 ASD 的发病机制还衍生出了以下几种干预措施。

5.1. 基于肠道菌群的干预

研究表明,ASD 儿童的胃肠道症状与肠道菌群紊乱密切相关。肠道微生态失衡不仅会诱发消化道症状,还可能通过“脑-肠轴”影响中枢神经系统功能,加剧患儿的情绪与行为问题,从而使核心症状进一步恶化[54]。基于此,针对肠道菌群的干预措施,如补充益生元、益生菌以及粪便菌群移植等,被证实可通过重建肠道微生态平衡,同时改善 ASD 儿童的胃肠道症状及核心行为表现[55]。然而,目前此类干预尚未形成统一的标准化方案。在选择益生菌、益生元或是粪便菌群移植时,仍存在诸多不确定因素。此外,益生菌、益生元的使用时间、药物剂量是否需要个体化的调整等,也是未来的研究方向。

5.2. 抗氧化剂的作用

炎症和氧化应激可能会显著影响 ASD 的发病机制和严重程度[8]。因此,富含抗氧化剂的饮食正在被探索作为管理 ASD 症状的潜在干预措施[56]。植物性的抗氧化剂如类胡萝卜素、白藜芦醇、酚类、黄酮类和维生素,已经被证明具有抗炎、抗氧化和免疫特异性,可能有助于改善神经和胃肠道健康,增强食物的耐受性,减轻感官敏感性和新食物恐惧症[8][57]。例如,西兰花、骆驼奶等富含抗氧化剂的食物也被证实对 ASD 儿童有益[58]。此外,临床实验表明,补充维生素 C 和谷胱甘肽可以改善 ASD 儿童的发育和行为问题[59]。补充辅酶 Q10 能够降低 ASD 儿童的氧化应激水平,提高氧化酶活性,进而改善认知和适应能力[60]。在动物实验中,每日补充 20 mg/kg 姜黄素能够减轻重复刻板动作,并改善 ASD 相关症状和认知障碍[61]。因此,抗氧化剂的应用潜能值得进一步关注。

5.3. 膳食补充剂的作用

近年来,膳食补充剂作为替代治疗为 ASD 的治疗提供了新的思路。补充维生素 A 和维生素 D 可缓解患儿的社交障碍和临床症状[62][63]。补充碘可以显著提高 ASD 儿童的 ABC 评分[64]。Lynch 等人[65]通过为期 3 年的干预也发现,补充黄酮可以改善患儿的核心理念。一项随机临床实验研究显示,每天补充 1000 mg omega-3 能够改善 ASD 儿童的刻板行为和社交沟通[66]。

5.4. 联合行为干预

行为干预在改善 ASD 儿童的饮食行为问题和膳食营养状况方面显示出积极的效果。应用行为分析(ABA)是一种常用的行为干预方法,通过功能分析确定患儿的行为原因,采用强化、逐步引导和高概率指令序列等方法进行干预,帮助患儿接受更多种类的食物以及减少进餐时的问题行为[67]。由于患儿存在个体化差异,在应用 ABA 时需根据不同患儿的具体情况进行个性化调整[10]。因此,通过对家庭主要照顾者进行行为技能培训,在更有效地处理孩子的食物选择性问题的同时,提高行为干预效果[68]。

综上,行为干预和膳食干预在改善 ASD 儿童的饮食行为和膳食营养方面具有重要作用,其潜在益处值得进一步开发。然而,鉴于不同患儿存在个体化差异,在实施具体的干预措施时,需结合患儿自身及

家庭情况进行个性化调整。为系统规范地识别与评估 ASD 儿童的饮食营养问题，特提出以下标准化评估路径(详见图 1)，以供临床参考。

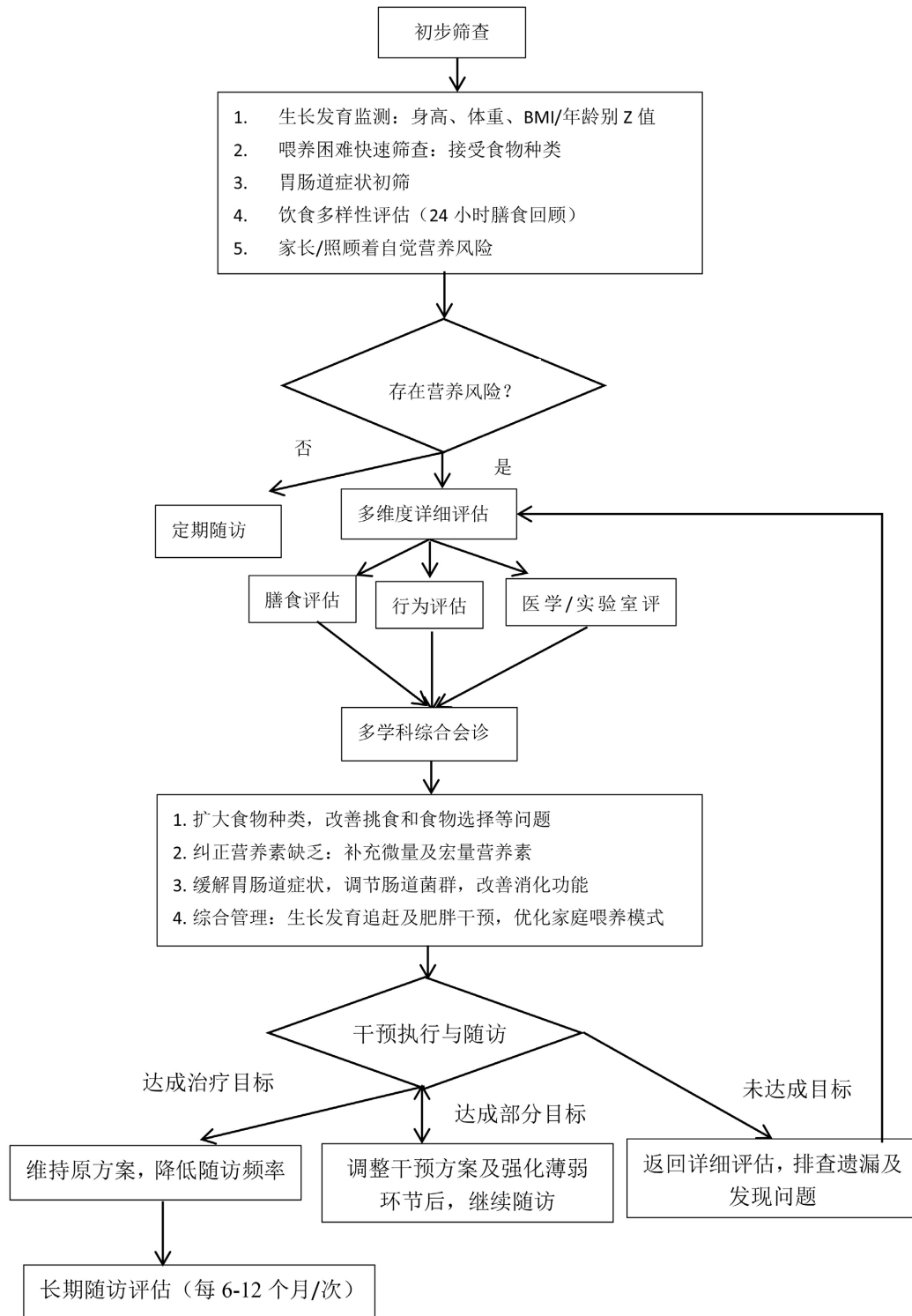


Figure 1. Standardized assessment pathway map for dietary and nutritional issues in children with autism spectrum disorder
图 1. ASD 儿童饮食营养问题标准化评估路径图

6. 小结

随着 ASD 儿童营养问题认知的日益深入,其饮食行为及膳食营养状况已成为临床研究的热点。然而,目前关于营养素及相关因素在 ASD 发生发展中的确切作用机制仍有待阐明,尚缺乏充分的循证依据以建立标准化的评估体系与干预指南。因此,未来需开展更多大样本、设计严谨的对照研究,以明确饮食干预对 ASD 儿童的潜在益处与风险,尤其应关注特殊饮食模式可能带来的安全风险,推动营养干预向精准化、个体化和规范化方向发展。在此基础上逐步构建以家庭为核心、多学科共同参与的个体化营养和行干预模式,以期改善 ASD 儿童的生活质量。

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