

· 综述 ·

婴幼儿营养风险现状及其筛查方法的研究进展

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[摘要] 婴幼儿时期是生长发育的关键阶段, 这一时期的营养状况不仅影响体格生长发育, 更为一生的健康打下坚实基础。然而, 婴幼儿时期具有快速生长发育和新陈代谢、多系统功能不成熟以及感染性疾病频发的特点, 使他们面临较高的营养风险。文章梳理了国内外相关研究, 阐述了婴幼儿营养风险现状, 以及与营养风险相关的影响因素包括环境、年龄、疾病因素、高危儿等。全面介绍现有的婴幼儿营养风险筛查量表的设计、使用方法、适用范围和局限性, 以及在住院、门诊及特殊场所开展婴幼儿营养风险筛查的临床意义。文章旨在引起儿科临床医师对婴幼儿营养问题的高度重视, 积极开展营养风险筛查工作, 以便早期识别营养风险, 最终实现规范化、科学化的营养管理。

[关键词] 婴幼儿; 营养风险; 筛查工具

[中图分类号] R153.1

[文献标志码] A

[文章编号] 1007-4368(2025)07-1051-08

doi: 10.7655/NYDXBNSN250076

Research progress on the current status of nutritional risk and its screening methods for infants and young children

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[Abstract] Early childhood is a critical stage of growth and development, and the nutritional status of this period not only affects physical growth and development, but also lays a solid foundation for lifelong health. However, due to the rapid growth and metabolic characteristics of infants and young children, coupled with the immaturity of multiple physiological systems and the high incidence of infectious diseases, they face nutritional risks. This review synthesizes relevant domestic and international studies to elucidate the current landscape of infant nutrition risk, as well as the associated influencing factors such as environment, age, disease, and high-risk conditions. The paper also shows the design, application, scope, and limitations of existing infant nutrition risk screening tools, along with the clinical significance of nutritional risk screening for infants and young children in inpatient, outpatient clinics, and specialized settings. The primary objective of this paper is to raise awareness among pediatric clinicians regarding infant nutrition issues and to promote proactive nutritional risk screening, thereby facilitating early identification of nutritional risks and ultimately achieving standardized and scientific nutrition management.

[Key words] infant; nutritional risk; screening tool

[J Nanjing Med Univ, 2025, 45(07): 1051-1058]

儿童早期营养对整个生命周期的健康至关重要。生命初期营养不足会导致早期生长受限、青春

期异常发育^[1], 还会增加成年期内分泌及代谢性疾病的风险^[2]。2018年美国儿科学会(American Academy of Pediatrics, AAP)指出, 婴幼儿期营养对儿童生长发育和终身健康极为重要, 建议儿科医生重视此时期的营养状况。2022年欧洲儿科胃肠肝病营养学会(European Society for Paediatric Gastroenterology, Hepatology and Nutrition, ESPGHAN)提出需对

[基金项目] 南京儿童医院医学发展医疗求助基金(202009072-1)

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婴幼儿进行规范的营养管理以加强对该人群早期营养的关注^[3]。营养风险是指与营养因素相关并导致患者出现不良临床结局(包括营养不良、生理功能下降等)的风险^[4],是营养管理的首要步骤,对其评估有助于临床医生重视并积极开展个体化营养支持。文章对婴幼儿营养风险现状和影响因素、营养风险筛查评估工具及相关临床应用进展概述如下。

1 婴幼儿营养风险现状及影响因素

1.1 婴幼儿营养风险现状

全球多个国家和地区的研究均揭示婴幼儿面临较高营养风险的严峻现实。澳大利亚、新西兰等多国开展的多中心营养风险筛查发现,在住院高风险儿童中,超过1/3的群体为婴幼儿^[5];2016年欧洲多中心研究显示,超70%的住院婴幼儿存在营养风险^[6];2020年葡萄牙进行的研究显示,婴幼儿中营养风险的发生率可达67.32%,远高于其他年龄段^[7]。

国内南京、上海、成都的研究均表明,住院患儿中婴幼儿为高营养风险人群^[8-9]。此外,2023年江苏省一项多中心调查显示,儿童保健科门诊就诊的0~2岁儿童中也有30.2%存在中高营养风险^[10]。高营养风险会降低患儿免疫力,增加住院期间感染率,延长原发病病程,增加住院费用^[11]。

1.2 婴幼儿营养风险的影响因素

1.2.1 环境因素

家庭与社会环境在极大程度上决定了婴幼儿能否获取充足且均衡的营养^[12]。贫困家庭由于经济条件限制,往往难以负担富含营养的食物。低收入家庭在婴幼儿辅食添加环节,也易出现不合理情况,如过早添加辅食,或者辅食种类过于单一等问题^[13-14]。此外,父母营养知识匮乏、喂养不当等因素,均会致使婴幼儿营养摄入不足,进而增加其营养风险^[15]。Bala等^[16]研究指出,在资源匮乏地区,婴幼儿更易出现生长迟缓、神经发育迟缓以及多系统疾病等。

同时,受各类社会因素影响,不少家庭选择有偿托儿服务替代父母及亲人照顾婴幼儿。研究表明,托儿所的护理人员因缺乏婴幼儿饮食方面的专业知识且精力有限,难以提供个性化喂养^[17],这种情况往往与婴幼儿较低的身体质量指数Z评分(body mass index Z-score, BMI-Z)值以及学龄期超重/肥胖紧密相关^[18]。

1.2.2 年龄因素

婴幼儿是生长发育的关键期,能量和蛋白质的

需求高,但其消化系统、免疫系统和神经心理功能尚未发育完善,使其更易发生营养不良^[19]。国内外研究报道,住院期间婴幼儿相比大龄儿童更容易发生营养状况恶化^[5],年龄越小发生营养不良的可能性越大^[10]。

1.2.3 疾病因素

感染:由于婴幼儿免疫系统尚未完全发育,功能不完善,易患感染性疾病,尤其是消化道和呼吸道反复感染。Momborg等^[20]研究显示,婴幼儿的感染率与营养状况密切相关。感染与营养互为因果,互相影响,而高营养风险儿童的感染发生率显著偏高,且预后较差^[21-22]。如呼吸道合胞病毒感染引发的肺功能损害以及复发性喘息,不仅干扰患儿对营养素的正常摄取,还增加机体消耗,进而增加营养不良的风险^[23]。

消化吸收障碍疾病:消化吸收障碍是影响婴幼儿营养代谢过程的重要病理因素,主要涉及消化功能异常和营养吸收受损两个核心环节。以炎症性肠病为代表的迁延性消化道疾病、先天性消化道畸形(如肠闭锁、巨结肠等)及术后并发症(如短肠综合征、肠粘连等)等是导致消化和吸收效率降低的重要因素^[9]。牛奶蛋白过敏或乳糖不耐受可通过诱发腹泻、呕吐等直接造成营养流失,后续的膳食回避也会导致相应营养素摄入缺乏。Dziechciarz等^[24]的研究显示,牛奶蛋白过敏的婴幼儿存在营养风险的比例可达35.5%。

先天性疾病:指出生时就存在的结构或功能异常,不仅威胁儿童健康,还常导致营养问题,增加营养风险,其作用机制可分为结构性异常和代谢性缺陷两大类。先天性食管闭锁等消化系统畸形可导致摄食受阻及消化吸收率降低^[25];而苯丙酮尿症及糖原累积病等代谢性疾病导致营养物质利用和转化障碍,影响能量供应,造成营养缺乏^[26-27]。先天性心脏病因心脏功能受损致机体灌注不足,影响消化吸收功能,且疾病本身使机体处于高代谢状态,增加能量消耗^[28]。

慢性消耗性疾病:如恶性肿瘤、脑瘫等常显著增加患儿的能量需求,同时致使能量过度丢失。不仅如此,这类疾病还会引发疼痛、呕吐等症状,进一步减少患儿的能量摄入,加剧营养物质的流失。这不仅延长了治疗周期,还大幅增加了住院费用^[29]。癌症作为儿童群体中第二大常见的死亡原因,其患儿的营养状况,是影响治疗耐受性的关键预后指标。研究表明,降低癌症患儿的营养风险,有助于

有效减少治疗期间的死亡风险以及并发症的发生率^[30]。脑性瘫痪可致患儿肌肉张力异常、运动功能受限,同时引发吞咽和咀嚼功能障碍,这不仅严重影响了食物的摄入与消化过程,还极大地增加了能量消耗,最终使婴幼儿严重营养不良的发生率和病死率显著上升^[31]。

1.2.4 高危儿

高危儿指在出生前、产时及出生后存在影响儿童生长发育的各种危险因素(包括生物、社会及环境危险因素),或在常规儿童保健检查时发现体格、心理行为发育偏离正常轨迹的特殊儿童^[32]。早产儿和低出生体重儿自身能量储备极为有限,器官发育尚不成熟,在追赶生长阶段对能量需求巨大,同时还可能患其他疾病;此外,神经系统发育异常以及先天性发育异常所引发的吞咽困难,也是导致高危儿营养风险增高的的重要因素。每个高危儿都需要个体化的营养和生长评估以确保正常的生长和发育^[33]。Zhang等^[34]通过对227例高危儿进行多次门诊随访,证明营养干预可有效改善其生长轨迹。

2 婴幼儿营养风险筛查工具

基于早期营养对婴幼儿生长发育的重要性,2023年《生长减缓婴幼儿的追赶生长:指导临床医师的专家共识》提出对婴幼儿进行生长监测和营养风险筛查,这些量化的监测指标有助于引起儿科医生重视,及时发现潜在影响营养吸收功能障碍的风险,有利于及时给予全面的营养评估以及早期合理的营养治疗^[35]。理想的营养风险筛查工具应具备高度的敏感性、特异性、有效性、可靠性,无创,适合临床工作者简单和快速操作,适合不同场景(住院、门急诊、社区)以及特定疾病^[36]。目前,国际上尚未形成统一的儿科营养风险筛查工具,一些国家和地区研制了本地区的营养风险筛查量表并在临床推广应用。

2.1 儿童主观整体营养评估(Subjective Global Nutritional Assessment, SGNA)

SGNA是2007年Secker等^[37]通过对主观整体营养评估(Subjective Global Assessment, SGA)这一成人营养评估工具调整设计出来的一种集营养风险筛查及营养评估于一体的工具,可适用于1月龄~18岁的儿童。作为一种综合性的营养评估工具,SGNA涵盖了营养相关病史和体格检查内容。2022年,Carter等^[38]对其体格测评部分进行更新,以Z评分替代百分位数,提升了实用性。SGNA具有使用简便、灵敏度高特点。然而,其缺乏数字化评定系统且操作时

间较长,限制了其在临床中的广泛应用。

2.2 营养状态和生长发育风险筛查工具(Screening Tool for Risk on Nutritional Status and Growth, STRONGkids)

STRONGkids是Hulst等^[39]在2010年推出的儿童营养风险筛查量表,适用于1月龄~18岁儿童,内容包括主观临床评估、高风险疾病、食物摄入、体重减轻或体重增加不良,总分为0~5分,分为低风险(0分)、中风险(1~3分)及高风险(4~5分)3级。STRONGkids具有简便快速性(平均耗时3 min)、高信效度以及内容全面等优点,但对使用者的医学背景要求较高,在资源较匮乏地区,可能因儿科专业人员短缺,推广受到限制。

2.3 儿科营养不良评估筛查工具(Screening Tool for the Assessment of Malnutrition in Pediatrics, STAMP)

STAMP是由Barros等^[40]于2012年为2~17岁儿童设计的一种营养风险筛查工具。该工具涵盖疾病诊断、营养摄入及体格评估3个方面,每项评分有0~3分,总评分 ≥ 2 分表明存在营养风险, ≥ 4 分则表示有较高的营养风险。STAMP优势显著:内容涵盖全面、结果准确度高且具有良好的可重复性。目前,已有研究尝试将其应用范围拓展至婴幼儿群体,且展现出良好的灵敏度。不过与STRONGkids相比,STAMP的使用相对复杂,平均耗时更长,这在临床繁忙的工作环境中,无疑会增加医护人员的操作负担^[41]。

2.4 简易儿科营养筛查工具(Pediatric Nutrition Screening Tool, PNST)

PNST是White等^[42]在2016年提出的一种营养风险筛查工具,适用于1月龄~16岁儿童,作者在设计时考虑到体格测评设备的缺乏以及校准不均,使用“孩子是否明显体重过轻/明显超重?”这类主观评价问题代替了体格评估以实现快速筛查的目的;除此之外,PNST内容上还包括“过去几个月体重增加不佳”、“患儿最近是否体重减轻”和“在过去的几周里患儿是否饮食减少”这3个问题。它的特异性尚可,但缺乏统一评分标准且主观性较强,目前未得到大规模推广。

2.5 婴儿营养预警评分(infant Nutrition Early Warning Score, iNEWS)

iNEWS是Bamkole等^[43]于2024年研发的针对婴儿的营养风险筛查工具,主要用于1岁以下的婴幼儿;该量表参考了ESPEN指南的营养风险筛查建议,整合客观生长参数(肱三头肌皮褶厚度 \leq 第5百

分位、上臂围增速 <0.5 cm/月)与临床评估(摄入量减少 $>25\%$ 持续1周),采用临界值3.9分作为营养风险阈值。2024年,ESPGHAN在苏格兰、比利时、雅典和保加利亚进行的多中心验证显示:即便在具有不同医疗保健资源的国际环境中,iNEWS也具有较好的临床实践性^[43]。

2.6 早产儿营养筛查工具(Nutritional Risk Screening Tool for Preterm Children, NRSP)

NRSP是由中国朱艳娜团队基于德尔菲法研制,用于评估矫正3岁以内高危儿的营养风险。该量表采用分阶段动态评估模式,设立4个年龄特异性分量表(0~<4个月、4~<8个月、8~<12个月及12~36个月),从疾病负荷(急慢性合并症)、喂养效能(摄入量、频次及困难程度)、营养补充(强化剂/特殊配方使用)及生长轨迹(Z评分偏离度)4个维度进行综合量化评估,当总分 ≥ 8 分为高风险, ≥ 4 分且 <8 分为中风险, <4 分为低风险。通过综合分析各风险因素,可预测下一阶段体重和身长异常风险的概率。相关研究表明, NRSP具备一定的灵敏度,且在预测体重不足方面表现优秀^[44]。

2.7 营养评估筛查工具(Nutrition Evaluation Screening Tool, NEST)

NEST是伦敦儿童医院独立研发并长期使用的一种营养风险筛查工具,2021年Dokal等^[45]对其进行了标准化验证,覆盖婴幼儿到学龄期儿童。评估内容包括体重减轻($\geq 5\%$)、食欲减退(>3 d)、疾病影响以及体格测评;总分0~1分为低风险,2~3分为中风险,4~6分为高风险。研究显示,在对容易水肿或体液丢失的小年龄儿童,或是液体限制的患病儿童进行营养风险筛查时,NEST可以更好地替代儿童主观整体营养评估等工具。

目前,在已发表的营养风险筛查量表中,STAMP和STRONGkids在住院儿童营养风险筛查中均展现出了良好的信效度与灵敏度,并在欧洲12个国家得到广泛应用^[6]。SGNA和PNST因评估主观性较强,近年来未得到大规模临床应用。此外,随着研究的进步以及“生命早期1000 d”等理论的提出,越来越多适用于婴幼儿的营养风险筛查量表也相继发表,如2017年中国白铂亮等^[46]研发的多维度新生儿营养风险筛查工具,2020年于巴西研发的新生儿营养风险筛查工具(Neonatal Nutrition Risk Screening Tool, FARN-Neo)^[47],2021年研发的专用于住院早产儿的新生儿筛查工具(Neonatal NST)^[48]等。由于研发时间尚短,这些工具目前仍缺

乏多场景、大规模临床验证以支持其广泛应用。此外,针对专病的营养风险筛查工具如儿科肿瘤营养不良评估筛查工具(Screening Tool for the Assessment of Malnutrition in Paediatric Oncology, SCAN)和儿童癌症营养风险筛查工具(Nutritional Risk Screening for Pediatric Cancer Patients, NRS-PC)也受到临床医生的关注^[49-50]。

3 营养风险筛查评估的临床应用

3.1 住院儿童

由于疾病本身的特性和治疗手段,住院患儿往往面临着各种营养问题,特别是重症监护室的新生儿^[51],慢性消耗性疾病、重症感染、恶性肿瘤及大型手术围术期患儿等被认为是营养风险筛查的核心目标人群^[52]。早在2002年ESPGHAN就呼吁建立由医生、营养师、护士等组成的营养支持小组,并构建起以筛查、干预、随访为架构的营养管理流程^[53]。目前,营养风险筛查已成为欧美国家儿科工作的基本流程之一,近10年,我国部分三甲医院和儿童医院也陆续开展。

对于罹患罕见病和特殊疾病的婴幼儿,2022年ESPGHAN在发表的《儿科疾病相关性营养不良的临床识别实用指南》中强调,评价疾病相关性营养不良时,营养风险筛查需整合身体成分分析、营养代谢动态监测及疾病特异性参数等维度,通过多模态评估弥补传统工具的局限性,或选用针对性筛查工具以精准评估其营养风险状况及相关预后^[54],如SCAN和NRS-PC。

3.2 门诊

相比住院系统,门诊营养风险管理仍存在显著不足。作为儿童慢性疾病管理的主要场景,门诊开展系统化营养筛查对早期识别营养风险,预防婴幼儿营养不良进展具有重要临床意义。然而,对国内20家综合医院及25家儿童专科医院的调查显示,86.7%(39家)的医院虽已开设营养门诊,但尚未将营养风险筛查纳入常规就诊流程^[55]。

2024年《儿科营养门诊规范化建设专家共识》要求在儿童营养门诊开展营养风险筛查,并重点推荐STAMP和STRONGkids作为儿科医院门诊的常规营养风险筛查工具^[56]。其中,STRONGkids已经在江苏省开展的多中心门诊营养风险筛查研究中被证实具有敏感、特异、快速、方便和准确等优点^[10]。SGNA在慢性消耗性疾病(如肿瘤、慢性肝病)患儿的门诊随访以及脑瘫患儿的营养风险评估中也显

示较好的实用性与灵敏度^[57-59]。已有研究显示,对高危儿实施营养风险筛查并制定个体化营养干预策略定期随访,可有效促进高危儿体格生长和神经发育的双重追赶^[60]。

3.3 康复机构、福利院等特殊场所

福利院和康复机构等特殊场所的儿童普遍存在营养素缺乏,体格生长明显落后于正常儿童,其中婴幼儿占绝大多数^[61],这些儿童往往因健康问题和环境因素,存在身体残疾或疾病。加上机构内运营资金有限及工作人员专业知识缺乏等原因,难以实现对不同婴幼儿的个性化精细照料,这些特殊场所的儿童更易出现营养摄入不足及营养不良并发症。对巴基斯坦12所孤儿院的研究分析表明,36.1%的儿童存在营养不良情况^[62],但国内相关研究仍为空白,亟待引起相关部门和儿科医生对这些特殊儿童营养风险和营养状况的关注。

4 总结与展望

婴幼儿缺乏营养摄入的自主性,且为多种疾病的易感期,营养风险发生率较高。尽管住院患者的营养风险筛查流程相对完善,但对门诊婴幼儿营养风险以及不良预后的关注不足。同时,我国熟练掌握营养筛查与评估的专业医务人员较少,地域分布不均,营养风险尚未成为婴幼儿就诊的常规流程。儿科临床医师应增强对婴幼儿营养重要性的认识,结合其营养需求特点,选择特异性及敏感性较高、实用操作性较好的量表进行营养风险筛查,进而实现规范化的营养管理,促进婴幼儿生长发育和远期健康。

利益冲突声明:

所有作者声明无利益冲突。

Conflict of Interests:

The authors declare no conflict of interests.

作者贡献声明:

石鑫玥负责文献收集、整理和论文书写、修改;沙丽君负责文章审核与修改;李晓南负责文章审核、修改与监督。

Author's Contributions:

SHI Xinyue was responsible for literature collection, paper writing, and revision. SHA Lijun was responsible for article review and revision. LI Xiaonan was responsible for article review and supervision.

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- [收稿日期] 2025-01-16
(本文编辑: 陈汐敏)

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- [收稿日期] 2025-03-06
(本文编辑: 陈汐敏)