

老年直肠癌患者营养风险评估与管理的研究进展

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摘 要

目前, 老年直肠癌患者营养不良已成为一个严重的临床问题。通过整合多维度评估指标, 包括炎症 - 营养指标(如PNI、AGR)、代谢特征和肠道菌群, 可以构建新型营养预后评估模型。采用跨学科研究方法, 深入探索个体化营养干预的分子机制, 可以突破传统评估方法的局限性, 并提出新型综合营养预后指数。本文系统梳理近年来关于老年直肠癌患者营养风险的相关文献, 发现老年直肠癌患者营养风险评估已从传统的单一指标向多维度、动态化的综合评估模式转变, 个性化营养干预能够显著改善患者的生存质量。

关键词

老年直肠癌, 营养风险评估, 炎症 - 营养指标, 个性化营养干预, 精准医疗

Research Progress on Nutritional Risk Assessment and Management of Elderly Colorectal Cancer Patients

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Abstract

Malnutrition in elderly colorectal cancer patients has become a serious clinical problem recently.

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By integrating multi-dimensional assessment indicators, including inflammation-nutrition indices (e.g., PNI, AGR), metabolic characteristics, and gut microbiome, a novel nutritional prognostic assessment model can be constructed. Using a multidisciplinary research approach, the study explores the molecular mechanisms of personalized nutritional intervention, breaks through the limitations of traditional assessment methods, and proposes a new comprehensive nutritional prognostic index. Through a systematic review of recent literature on nutritional risk in elderly colorectal cancer patients, the study finds that nutritional risk assessment in elderly colorectal cancer patients has transformed from traditional single-indicator methods to a multi-dimensional, dynamic comprehensive assessment approach, with personalized nutritional intervention emerging as a key strategy for improving patient quality of life.

Keywords

Elderly Colorectal Cancer, Nutritional Risk Assessment, Inflammation-Nutrition Indicators, Personalized Nutritional Intervention, Precision Medicine

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1. 引言

随着人口老龄化的推进,到2050年全球70岁以上的人口预计将翻倍,老年人群的癌症发病风险也持续增加[1]。直肠癌是全球发病率排名第八的恶性肿瘤,且主要集中在老年人群,老年直肠癌患者具有独特的人口学特征:平均年龄多在55~70岁之间,女性患病比例略高,与其他肿瘤相比合并慢性疾病的比例更大[2]。由于老年患者往往存在免疫衰老、器官功能下降、营养状况较差等问题,这些因素显著影响疾病进展和治疗预后,因此老年直肠癌已成为肿瘤学研究的重点关注领域[3]。

老年直肠癌患者营养不良是一个严重的临床问题,研究显示营养不良发生率高达40%~70%[4]。营养不良显著降低患者生存质量和预后,可使中位生存期缩短3~6个月[5]。患者面临多种营养相关并发症,包括免疫功能下降、伤口愈合延迟、化疗耐受性降低和并发感染风险增加等[6]。这些并发症不仅增加了医疗成本,还提高了患者的住院风险和死亡率[7]。因此,及早识别和干预营养不良对改善老年直肠癌患者预后具有至关重要的意义。本文对近5年来国内外关于老年直肠癌患者营养风险评估的相关文献进行综合与整理。通过关键词“老年直肠癌患者、营养风险”或“Elderly Colorectal Cancer、Nutritional Risk Assessment”对PubMed(<https://pubmed.ncbi.nlm.nih.gov/>)和中国知网(<https://www.cnki.net/>)数据库中的文献进行检索,系统梳理近年来关于老年直肠癌患者营养风险评估和管理的研究情况,为临床上诊疗预后工作提供参考。

2. 评估直肠癌患者营养状态的传统方法

2.1. 直肠癌特异性营养指标

直肠癌患者的营养代谢特征呈现出极其复杂的系统性改变,肿瘤细胞通过显著的代谢重编程,引发一系列深层次的生理病理变化[8]。肿瘤细胞表现出典型的“瓦伯格效应”,显著改变能量代谢模式,主要表现为葡萄糖代谢异常、线粒体功能紊乱和氨基酸代谢重构[9]。这种代谢转变不仅影响肿瘤细胞的生长,还导致患者整体营养代谢指标发生改变。直肠癌相关的传统营养学指标包括白蛋白、转铁蛋白、前

白蛋白等, 这些指标在一定程度上反映患者的营养状况[10]。然而, 这些单一指标已难以全面捕捉肿瘤患者复杂的营养代谢过程。白蛋白作为传统的营养指标, 其水平不仅受营养状态影响, 还与炎症反应、肝脏合成功能密切相关, 其变化具有多重生理学意义[11]。

2.2. 传统营养指标在直肠癌中的局限性

传统营养风险评估方法在老年直肠癌患者中存在显著局限性, 主要表现为单一指标评估无法全面反映患者复杂的营养状况[12]。Body Mass Index (BMI)作为传统的营养评估工具, 无法准确反映患者的肌肉质量、脂肪分布和代谢状态, 特别是在肿瘤不同发展阶段[13]。老年直肠癌患者尤其如此, 由于年龄相关的肌肉减少和代谢变化, BMI 更不能准确评估其营养状况。有研究表明, 许多患者体重可能相对稳定, 但实际上已经发生严重的肌肉减少和营养不良[14]。炎症与营养指标之间存在密切而复杂的相互关系, 这种关联在直肠癌患者中尤为明显[15]。炎症标志物如 C 反应蛋白(C-reactive protein, CRP)、白细胞介素-6 (Interleukin-6, IL-6)不仅反映机体免疫状态, 还与营养代谢密切相关。持续性的慢性炎症可导致营养代谢紊乱, 引起蛋白质分解加速、代谢异常和免疫功能下降[16]。这些传统评估方法的局限性凸显了开发更加精准、综合的营养风险评估体系的迫切需要。

3. 直肠癌患者新型营养预后指标

3.1. 炎症指标在直肠癌中的应用

3.1.1. 炎症 - 营养指数(Inflammation-Nutritional Index, PNI)

直肠癌患者的营养预后评估正逐步从传统单一指标向综合性、多维度指标转变。PNI 作为近年来备受关注的新型预后指标, 通过整合白蛋白水平和淋巴细胞计数, 为直肠癌患者提供更精准的预后评估[17]。研究显示, PNI 不仅能准确预测患者生存率, 还能反映肿瘤进展和治疗反应, 其低值往往预示着更不利的临床预后[18]。

3.1.2. 白蛋白 - 球蛋白比(Albumin-Globulin Ratio, AGR)

AGR 作为另一个重要的炎症 - 营养指标, 在直肠癌患者中具有显著的临床意义。AGR 不仅反映患者的营养状态, 还能间接评估机体的炎症水平和免疫功能[19]。低 AGR 常与肿瘤进展、淋巴转移和患者生存期负相关, 为临床提供了重要的预后评估新工具[20]。

3.2. 直肠癌特异性营养预后指标

3.2.1. 肿瘤代谢相关指标

肿瘤代谢相关指标的研究为直肠癌营养预后评估提供了新的视角。肿瘤细胞特有的代谢重编程, 包括葡萄糖代谢异常、氨基酸代谢紊乱和脂质代谢改变, 都可能成为评估患者营养状态和预后的潜在指标[21]。近期研究表明, 通过检测特定代谢标志物, 如乳酸脱氢酶(LDH)、丙酮酸激酶(PKM2)等, 可以更准确地评估肿瘤的代谢特征和患者的营养状况[22]。

3.2.2. 肠道菌群

肠道菌群作为近年来研究的热点领域, 与患者的营养状态和肿瘤进展密切相关。研究发现, 直肠癌患者的肠道菌群组分发生显著变化, 这种微生态失衡不仅影响营养吸收, 还可能通过炎症通路影响肿瘤进展[23]。菌群多样性指数和特定菌群的丰度已成为评估患者营养状态和预后的创新指标[24]。这些新型营养预后指标的出现, 标志着直肠癌营养评估从静态、单一转向动态、综合的新阶段, 为个体化医疗提供了更精准的工具。

4. 老年直肠癌患者营养风险的全程管理

4.1. 术前营养评估与干预

老年直肠癌患者的营养风险管理是一个复杂而精细的全程医疗过程，需要从术前评估到康复期的全面、个体化干预。术前阶段，对患者的手术风险进行全面评估成为关键。研究表明，通过综合营养指标如 PNI、AGR 等，可以准确预测老年患者的手术并发症风险[25]。对于高风险患者，制定个性化的术前营养优化方案至关重要，包括针对性的蛋白质补充、微量元素调整和免疫功能增强[26]。在老年患者中，蛋白质摄入的增加有助于维持功能性，建议每日蛋白质摄入量至少达到 1.2 克/公斤体重，以优化代谢调节和骨骼肌蛋白合成[27]。

4.2. 治疗期营养支持

治疗期间的营养支持是老年直肠癌患者管理的核心环节。放化疗期间，患者面临严重的营养代谢紊乱和免疫功能下降，需要精准的营养干预[28]。免疫营养成为近年来研究的热点，通过特定氨基酸(如谷氨酰胺)、鱼油等免疫调节营养成分，可以显著改善患者的治疗耐受性和生活质量[29]。研究显示，个体化的免疫营养干预可以减少感染风险，改善患者的总体预后[30]。术前和术后使用免疫营养配方，包含精氨酸、 ω -3 脂肪酸、谷氨酰胺等，调节免疫反应、减轻炎症，从而显著降低术后感染并发症，降幅可达约 30%~50%，尤其在胃肠道手术、头颈癌手术等高危患者中效果显著[31]。

4.3. 康复期营养重建

康复期的营养重建对老年直肠癌患者尤为重要。这一阶段需要针对直肠癌特殊的营养需求，制定长期、动态的营养管理策略[32]。肠道功能重建、肌肉量恢复、免疫功能调节成为关键干预方向。通过个性化的蛋白质补充、微生态调理和功能性营养干预，可以帮助患者逐步恢复身体机能[33]。值得注意的是，老年直肠癌患者的营养管理不仅仅是简单的营养补充，而是一个需要综合考虑患者年龄、肿瘤特征、合并疾病等多重因素的系统性过程[34]。多学科协作、个体化评估和动态监测成为成功管理的关键。通过这种全程、精准的营养风险管理，可以显著改善老年直肠癌患者的生存质量、治疗耐受性和总体预后，体现了现代肿瘤学个体化医疗的最新理念。

5. 新型营养预后指数在直肠癌中的应用价值

5.1. 综合营养预后指数构建

新型综合营养预后指数的构建为直肠癌患者精准预后评估提供了重要突破。通过整合炎症 - 营养指标(如 PNI、AGR)、代谢相关指标和肠道菌群特征，研究者建立了一个多维度、动态化的综合营养预后评估模型。这一新型指数不仅能够准确预测患者生存期，还能反映肿瘤进展的复杂生物学过程[35]。整合多维度评估指标，包括炎症标志物、肌肉减少和代谢特征，建立更加精准的老年直肠癌患者营养风险评估模型，有望为临床精准营养干预提供新的理论基础和实践指导。

5.2. 直肠癌预后预测能力

临床研究证实，该综合营养预后指数在直肠癌预后预测中具有显著的临床价值。与传统单一指标相比，新型指数能更准确地预测患者风险，对中晚期患者的生存期预测准确率显著提高[36]。多中心队列研究表明，低预后指数与显著较短的无进展生存期和总生存期相关，为临床医生提供了更精准的预后评估工具[37]。

5.3. 个性化治疗决策指导

更为重要的是,这一新型营养预后指数为个性化治疗决策提供了重要的科学依据。通过精准评估患者的营养状态和预后风险,临床医生可以更有针对性地制定治疗方案,包括调整治疗强度、优化营养支持策略和选择最适合的辅助治疗方案[38]。这种基于营养预后指数的个体化医疗方法,标志着直肠癌治疗从经验性走向精准化的重要转变。这一创新研究不仅拓展了营养预后评估的科学边界,也为老年直肠癌患者提供了更加个性化、精准的医疗解决方案,体现了现代肿瘤学精准医疗的最新发展趋势。

6. 研究展望

6.1. 精准营养干预

未来直肠癌营养学研究的核心方向将聚焦于精准营养干预。基于多组学技术,研究将深入探索个体化营养干预的分子机制,建立更加精确的营养风险评估模型[39]。个性化营养干预将不再是简单的营养补充,而是基于患者独特的基因组、代谢组和肠道菌群特征,制定量身定制的营养方案[40]。分子营养学的新进展为直肠癌营养研究提供了重要突破口。表观遗传调控、非编码 RNA 在营养干预中的作用、肿瘤代谢重编程的精准调控成为研究前沿[41]。特别是肠道菌群与肿瘤免疫、营养代谢的相互作用将成为重点研究方向,有望从分子水平揭示营养干预的作用机制[42]。

6.2. 分子营养学新进展

跨学科、多维度的研究范式将成为未来直肠癌营养学研究的发展趋势。整合生物信息学、分子生物学、临床医学等多学科的协同研究,有望建立更加全面、精准的营养干预体系[43]。这种创新研究范式不仅将推动直肠癌营养学的科学发展,还将为个体化精准医疗提供重要的理论基础和实践指导。未来的营养评估应该是动态的、多维度的,不仅关注静态指标,还要综合考虑患者的代谢特征、炎症状态和个体差异[44]。个体化营养干预已成为改善患者预后的关键策略,可显著提高生存质量和治疗耐受性[45]。这种全面、个性化的评估方法将为直肠癌患者提供更精准的营养管理策略,是精准医疗的重要发展方向。

7. 小结

综上所述,老年直肠癌患者营养风险评估研究已实现从传统的单一指标向多维度、动态化的综合评估模式的重大转变。基于炎症-营养指标、代谢特征和肠道菌群的新型预后评估体系,显著提高了对患者预后的预测准确性。基于营养预后指数的精准医疗方法,标志着老年直肠癌诊疗模式的重大进步,为患者提供更加个性化、全程化的医疗解决方案。未来研究将进一步深化多学科、多组学的综合研究,不断完善营养风险评估体系,为老年直肠癌患者提供更精准、更有效的个体化医疗方案。

利益冲突

所有作者均声明不存在利益冲突。

参考文献

- [1] Pilleron, S., Soto-Perez-de-Celis, E., Vignat, J., Ferlay, J., Soerjomataram, I., Bray, F., *et al.* (2020) Estimated Global Cancer Incidence in the Oldest Adults in 2018 and Projections to 2050. *International Journal of Cancer*, **148**, 601-608. <https://doi.org/10.1002/ijc.33232>
- [2] O'Sullivan, D.E., Hilsden, R.J., Ruan, Y., Forbes, N., Heitman, S.J. and Brenner, D.R. (2020) The Incidence of Young-Onset Colorectal Cancer in Canada Continues to Increase. *Cancer Epidemiology*, **69**, Article ID: 101828. <https://doi.org/10.1016/j.canep.2020.101828>

- [3] Qiu, J., Yu, Y., Wang, Z., Hong, L., Shao, L. and Wu, J. (2024) Comprehensive Analysis of the Prognostic Value of Pre-Treatment Nutritional Indicators in Elderly Rectal Cancer Patients. *Scientific Reports*, **14**, Article No. 22078. <https://doi.org/10.1038/s41598-024-73123-2>
- [4] Zhang, M., Guo, Y., Zhang, X., Zhang, Y., Fan, Y., Liu, Y., *et al.* (2022) Nutritional Risk Screening in Malignant Tumors: A Study of 375 Cancer Inpatients. *Supportive Care in Cancer*, **30**, 8333-8337. <https://doi.org/10.1007/s00520-022-07242-9>
- [5] Li, Q., Zhang, X., Tang, M., Song, M., Zhang, Q., Zhang, K., *et al.* (2021) Different Muscle Mass Indices of the Global Leadership Initiative on Malnutrition in Diagnosing Malnutrition and Predicting Survival of Patients with Gastric Cancer. *Nutrition*, **89**, Article ID: 111286. <https://doi.org/10.1016/j.nut.2021.111286>
- [6] Li, W., Yang, Y., Li, Z. and Chen, W. (2023) Effect of Malnutrition and Nutritional Support to Reduce Infections in Elderly Hospitalized Patients with Cancer: A Multicenter Survey in China. *Nutrition*, **106**, Article ID: 111894. <https://doi.org/10.1016/j.nut.2022.111894>
- [7] Kaegi-Braun, N., Mueller, M., Schuetz, P., Mueller, B. and Kutz, A. (2021) Evaluation of Nutritional Support and In-Hospital Mortality in Patients with Malnutrition. *JAMA Network Open*, **4**, e2033433. <https://doi.org/10.1001/jamanetworkopen.2020.33433>
- [8] Li, X., Liu, M., Liu, H. and Chen, J. (2022) Tumor Metabolic Reprogramming in Lung Cancer Progression (Review). *Oncology Letters*, **24**, Article No. 287. <https://doi.org/10.3892/ol.2022.13407>
- [9] Wu, W. and Zhao, S. (2013) Metabolic Changes in Cancer: Beyond the Warburg Effect. *Acta Biochimica et Biophysica Sinica*, **45**, 18-26. <https://doi.org/10.1093/abbs/gms104>
- [10] Urabe, M., Ueno, M., Ogawa, Y., Yago, A., Shimoyama, H., Honda, A., *et al.* (2020) Comparative Analysis of the Prognostic Utility of Preoperative Nutritional Parameters in Patients with Resectable Esophageal Carcinoma. *General Thoracic and Cardiovascular Surgery*, **69**, 326-335. <https://doi.org/10.1007/s11748-020-01555-4>
- [11] Alberici Pastore, C., Paiva Orlandi, S., *et al.* (2013) Association between an Inflammatory-Nutritional Index and Nutritional Status in Cancer Patients. *Nutrición Hospitalaria*, **28**, 188-193.
- [12] Bozzetti, F., Mariani, L., Lo Vullo, S., Amerio, M.L., Biffi, R., Caccialanza, R., *et al.* (2012) The Nutritional Risk in Oncology: A Study of 1,453 Cancer Outpatients. *Supportive Care in Cancer*, **20**, 1919-1928. <https://doi.org/10.1007/s00520-012-1387-x>
- [13] Liu, A., He, Q., Wu, W., Du, J., Kuo, Z., Xia, B., *et al.* (2021) Body Composition and Risk of Gastric Cancer: A Population-based Prospective Cohort Study. *Cancer Medicine*, **10**, 2164-2174. <https://doi.org/10.1002/cam4.3808>
- [14] Phillips, M.E., Robertson, M.D., Bennett-Eastley, K., Rowe, L., Frampton, A.E. and Hart, K.H. (2024) Standard Nutritional Assessment Tools Are Unable to Predict Loss of Muscle Mass in Patients Due to Undergo Pancreatico-Duodenectomy: Highlighting the Need for Detailed Nutritional Assessment. *Nutrients*, **16**, Article 1269. <https://doi.org/10.3390/nu16091269>
- [15] Velikova, T.V., Miteva, L., Stanilov, N., Spassova, Z. and Stanilova, S.A. (2020) Interleukin-6 Compared to the Other Th17/Treg Related Cytokines in Inflammatory Bowel Disease and Colorectal Cancer. *World Journal of Gastroenterology*, **26**, 1912-1925. <https://doi.org/10.3748/wjg.v26.i16.1912>
- [16] Kendel Jovanović, G., Mrakovcic-Sutic, I., Pavičić Žeželj, S., Šuša, B., Rahelić, D. and Klobučar Majanović, S. (2020) The Efficacy of an Energy-Restricted Anti-Inflammatory Diet for the Management of Obesity in Younger Adults. *Nutrients*, **12**, Article 3583. <https://doi.org/10.3390/nu12113583>
- [17] Takeda, Y., Sugano, H., Okamoto, A., Nakano, T., Shimoyama, Y., Takada, N., *et al.* (2024) Prognostic Usefulness of the C-Reactive Protein-Albumin-Lymphocyte (CALLY) Index as a Novel Biomarker in Patients Undergoing Colorectal Cancer Surgery. *Asian Journal of Surgery*, **47**, 3492-3498. <https://doi.org/10.1016/j.asjsur.2024.03.054>
- [18] Keskinilic, M., Semiz, H.S., Ataca, E. and Yavuzsen, T. (2024) The Prognostic Value of Immune-Nutritional Status in Metastatic Colorectal Cancer: Prognostic Nutritional Index (PNI). *Supportive Care in Cancer*, **32**, Article No. 374. <https://doi.org/10.1007/s00520-024-08572-6>
- [19] Rong, G., Liu, S., Xi, C., Wang, C., Deng, J. and Qin, T. (2022) Correlation between Preoperative Serum Albumin-Globulin Ratio and Prognosis of Patients Undergoing Low Rectal Cancer Surgery. *Clinical Laboratory*, **68**, Article No. 1. <https://doi.org/10.7754/clin.lab.2021.210213>
- [20] Guo, G., Hu, X., Gao, T., Zhou, H., Li, B., Zhou, C., *et al.* (2023) Potential Impact of Platelet-to-Lymphocyte Ratio on Prognosis in Patients with Colorectal Cancer: A Systematic Review and Meta-Analysis. *Frontiers in Surgery*, **10**, Article 1139503. <https://doi.org/10.3389/fsurg.2023.1139503>
- [21] Zhang, J., Chen, M., Yang, Y., Liu, Z., Guo, W., Xiang, P., *et al.* (2024) Amino Acid Metabolic Reprogramming in the Tumor Microenvironment and Its Implication for Cancer Therapy. *Journal of Cellular Physiology*, **239**, e31349. <https://doi.org/10.1002/jcp.31349>

- [22] Forkasiewicz, A., Dorociak, M., Stach, K., Szelachowski, P., Tabola, R. and Augoff, K. (2020) The Usefulness of Lactate Dehydrogenase Measurements in Current Oncological Practice. *Cellular & Molecular Biology Letters*, **25**, Article No. 35. <https://doi.org/10.1186/s11658-020-00228-7>
- [23] Mignini, I., Ainora, M.E., Di Francesco, S., Galasso, L., Gasbarrini, A. and Zocco, M.A. (2023) Tumorigenesis in Inflammatory Bowel Disease: Microbiota-Environment Interconnections. *Cancers*, **15**, Article 3200. <https://doi.org/10.3390/cancers15123200>
- [24] Rüb, A.M., Tsakmaklis, A., Gräfe, S.K., Simon, M., Vehreschild, M.J. and Wuethrich, I. (2021) Biomarkers of Human Gut Microbiota Diversity and Dysbiosis. *Biomarkers in Medicine*, **15**, 139-150. <https://doi.org/10.2217/bmm-2020-0353>
- [25] Li, J., Zhu, N., Wang, C., You, L., Guo, W., Yuan, Z., *et al.* (2023) Preoperative Albumin-to-Globulin Ratio and Prognostic Nutritional Index Predict the Prognosis of Colorectal Cancer: A Retrospective Study. *Scientific Reports*, **13**, Article No. 17272. <https://doi.org/10.1038/s41598-023-43391-5>
- [26] Jeong, M. and Collins, N. (2024) Nutritional Modulation of Antitumor Immunity. *Current Opinion in Immunology*, **87**, Article ID: 102422. <https://doi.org/10.1016/j.coi.2024.102422>
- [27] Phillips, S.M., Paddon-Jones, D. and Layman, D.K. (2020) Optimizing Adult Protein Intake during Catabolic Health Conditions. *Advances in Nutrition*, **11**, S1058-S1069. <https://doi.org/10.1093/advances/nmaa047>
- [28] Muhamed, A.N., Bantie, B., Hiruy, E.G., Shiferaw, S.M., Aycheh, D.T. and Abate, M.D. (2022) Nutritional Status and Its Determinants among Adult Cancer Patients Undergoing Chemotherapy Treatment at Hawassa University Comprehensive Specialized Hospital, Hawassa, Southern Ethiopia. *Journal of Nutrition and Metabolism*, **2022**, Article ID: 8740272. <https://doi.org/10.1155/2022/8740272>
- [29] Wang, Y., Zhang, T., Liu, R., Chang, M., Wei, W., Jin, Q., *et al.* (2021) New Perspective toward Nutritional Support for Malnourished Cancer Patients: Role of Lipids. *Comprehensive Reviews in Food Science and Food Safety*, **20**, 1381-1421. <https://doi.org/10.1111/1541-4337.12706>
- [30] Vegas-Aguilar, I.M., Guirado-Peláez, P., Fernández-Jiménez, R., Boughanem, H., Tinahones, F.J. and Garcia-Almeida, J.M. (2023) Exploratory Assessment of Nutritional Evaluation Tools as Predictors of Complications and Sarcopenia in Patients with Colorectal Cancer. *Cancers*, **15**, Article 847. <https://doi.org/10.3390/cancers15030847>
- [31] Koo, T.H., Leong, X.B. and Zakaria, A.D. (2024) Current Trend and Outcomes on Immunonutrition in Medical and Surgical Fields: An Updated Perspective. *Malaysian Journal of Medical Sciences*, **31**, 65-76. <https://doi.org/10.21315/mjms2024.31.6.6>
- [32] Lewandowska, A., Religioni, U., Czerw, A., Deptała, A., Karakiewicz, B., Partyka, O., *et al.* (2022) Nutritional Treatment of Patients with Colorectal Cancer. *International Journal of Environmental Research and Public Health*, **19**, Article 6881. <https://doi.org/10.3390/ijerph19116881>
- [33] Strasser, B., Grote, V., Bily, W., Nics, H., Riedl, P., Jira, I., *et al.* (2023) Short-Term Effects of Dietary Protein Supplementation on Physical Recovery in Older Patients at Risk of Malnutrition during Inpatient Rehabilitation: A Pilot, Randomized, Controlled Trial. *Healthcare*, **11**, Article 2317. <https://doi.org/10.3390/healthcare11162317>
- [34] Chen, X., Lin, Y., Yin, S., Shen, Y., Zhang, X., Chen, K., *et al.* (2022) The Geriatric Nutritional Risk Index Is an Effective Tool to Detect Glim-Defined Malnutrition in Rectal Cancer Patients. *Frontiers in Nutrition*, **9**, Article 1061944. <https://doi.org/10.3389/fnut.2022.1061944>
- [35] Xie, H., Wei, L., Yuan, G., Liu, M., Liang, Y., Gao, S., *et al.* (2022) Combination of Geriatric Nutritional Risk Index and Carcinoembryonic Antigen to Predict the Survival of Patients with Colorectal Cancer. *Frontiers in Nutrition*, **9**, Article 902080. <https://doi.org/10.3389/fnut.2022.902080>
- [36] Liang, X., Yao, S., Lu, P., Ma, Y., Xu, H., Yin, Z., *et al.* (2021) The Prognostic Value of New Index (LANR) Composed of Pre-Operative Lymphocytes, Albumin, and Neutrophils in Patients with Resectable Colorectal Cancer. *Frontiers in Oncology*, **11**, Article 610264. <https://doi.org/10.3389/fonc.2021.610264>
- [37] Liu, S., He, F., Guan, Y., Ju, H., Ma, Y., Li, Z., *et al.* (2021) Pathologic-Based Nomograms for Predicting Overall Survival and Disease-Free Survival among Patients with Locally Advanced Rectal Cancer. *Cancer Management and Research*, **13**, 1777-1789. <https://doi.org/10.2147/cmar.s296593>
- [38] Hamaker, M.E., Oosterlaan, F., van Huis, L.H., Thielen, N., Vondeling, A. and van den Bos, F. (2021) Nutritional Status and Interventions for Patients with Cancer—A Systematic Review. *Journal of Geriatric Oncology*, **12**, 6-21. <https://doi.org/10.1016/j.jgo.2020.06.020>
- [39] Singh, V.K., Hu, X., Singh, A.K., Solanki, M.K., Vijayaraghavan, P., Srivastav, R., *et al.* (2024) Precision Nutrition-Based Strategy for Management of Human Diseases and Healthy Aging: Current Progress and Challenges Forward. *Frontiers in Nutrition*, **11**, Article 1427608. <https://doi.org/10.3389/fnut.2024.1427608>
- [40] Shang, Z., Pai, L. and Patil, S. (2024) Unveiling the Dynamics of Gut Microbial Interactions: A Review of Dietary Impact and Precision Nutrition in Gastrointestinal Health. *Frontiers in Nutrition*, **11**, Article 1395664. <https://doi.org/10.3389/fnut.2024.1395664>

-
- [41] Hu, Q., Li, Y., Li, D., Yuan, Y., Wang, K., Yao, L., *et al.* (2023) Amino Acid Metabolism Regulated by lncRNAs: The Propellant behind Cancer Metabolic Reprogramming. *Cell Communication and Signaling*, **21**, Article No. 87. <https://doi.org/10.1186/s12964-023-01116-1>
 - [42] Daschner, P.J., Ross, S., Seifried, H., Kumar, A. and Flores, R. (2023) Nutrition and Microbiome Interactions in Human Cancer. *Journal of the Academy of Nutrition and Dietetics*, **123**, 504-514. <https://doi.org/10.1016/j.jand.2022.10.004>
 - [43] Shakhshir, M., Abushanab, A.S., Koni, A., Barqawi, A., Demyati, K., Al-Jabi, S.W., *et al.* (2023) Mapping the Global Research Landscape on Nutritional Support for Patients with Gastrointestinal Malignancy: Visualization Analysis. *Supportive Care in Cancer*, **31**, Article No. 179. <https://doi.org/10.1007/s00520-023-07645-2>
 - [44] Di Vincenzo, O., Luisi, M.L.E., Alicante, P., Ballarin, G., Biffi, B., Gheri, C.F., *et al.* (2023) The Assessment of the Risk of Malnutrition (Undernutrition) in Stroke Patients. *Nutrients*, **15**, Article 683. <https://doi.org/10.3390/nu15030683>
 - [45] Sun, Q., Yu, H., You, T., *et al.* (2024) Individualized Nutritional Intervention Improves the Nutritional Status of Liver Cancer Patients after Transcatheter Arterial Chemoembolization. *Nutrición Hospitalaria*, **41**, 649-656.