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Exercise as a Prescription for Patients with Various Diseases
26 种人类疾病的运动干预指导方案

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Abstract　A growing understanding of the benefits of exercise over the past few decades has prompted researchers to take an interest in the possibilities of exercise therapy. Because each sport has its own set of characteristics and physiological complications that tend to appear during exercise training, the effects and underlying mechanisms of exercise remain unclear. Thus, the first step in probing exercise effects on different diseases is the selection of an optimal exercise protocol. This review summarizes the latest exercise prescription treatments for 26 different diseases: musculoskeletal system diseases (low back pain, tendon injury, osteoporosis, osteoarthritis and hip fracture); metabolic system diseases (obesity, type 2 diabetes, type 1 diabetes, nonalcoholic fatty liver disease); cardio - cerebral vascular system diseases (coronary artery disease, stroke and chronic heart failure); nervous system diseases (Parkinson's disease, Huntington's disease, Alzheimer's disease, depression, and anxiety disorders); respiratory system diseases (chronic obstructive pulmonary disease, interstitial lung disease and after lung transplantation); urinary system diseases (chronic kidney disease and after kidney transplantation); and cancers (breast cancer, colon cancer, prostate cancer, and lung cancer). Each exercise prescription is displayed in the corresponding table. The recommended type, intensity, and frequency of exercise prescriptions are summarized, and the effects of exercise therapy on the prevention and rehabilitation of different diseases are discussed.

Keywords　Diseases; Exercise prescription; Patients

摘　要　近年来，随着运动有益健康意识的深入，科研人员逐渐对运动疗法的研究产生兴趣。然而，由于每项运动存在特异性，且运动训练中机体产生的生理变化具有复杂性和个体差异性，运动有益健康或运动治疗疾病的具体机制尚未完全阐明。因此，探索运动对不同疾病影响及其机制，首先要根据疾病状况确定运动类型。本文根据已有文献，总结 26 种人类疾病：肌肉骨骼系统疾病(下背痛、肌腱损伤、骨质疏松症、骨关节炎和髋部骨折)；代谢系统疾病(肥胖、2 型糖尿病、1 型糖尿病、非酒精性脂肪肝)；心脑血管系统疾病(冠状动脉疾病、脑卒中和慢性心力衰竭)；神经系统疾病(帕金森病、亨廷顿舞蹈症、阿尔茨海默病、抑郁症和焦虑症)；呼吸系统疾病(慢性阻塞性肺疾病、间质性肺病及肺移植术后)；泌尿系统疾病(慢性肾病和肾移植术后)和癌症(乳腺癌、结肠癌、前列腺癌和肺癌)，归纳总结适用于上述疾病的运动干预，包括运动类型、运动强度、运动频率和运动时间等，并进一步探讨运动干预对疾病预防和康复的积极作用。

关键词　疾病；运动干预；患者

1　背景

疾病不仅危害人类健康，还会降低人们的生活质量。现代生活中，缺乏身体活动(physical activity, PA)已经成为国民体质健康水平下降的主要原因之一，它不仅影响儿童青少年的生长发育，还影响成年人的身体健康和工作效率。缺乏身体活动导致慢性病发病率升高，增加了个人和国家的医疗费用和经济负担。因此，鼓励人们适度参加体育运动，提高身体素质显得尤为重要。

当前，生活方式干预是预防和治疗代谢性疾病最安全、有效的措施。其中，合理饮食和控制体重已受到广泛关注，但运动干预的作用常被医生和患者忽视[1]。研究表明，合理的运动干预可增加能量消耗，提高肌肉质量，降低血压和血脂，提高骨密度，有益心理健康[2-4]。因此，建立适合个人身体活动水平的运动指导方案如同药物剂量一样重要，这促使研究人员针对不同疾病、不良生活习惯等临床问题展开运动干预相关研究。为此，选择适合患者的运动指导方案至关重要[5]。

运动指导方案是康复专家根据患者实际情况，针对特定目的而制定的运动方案。主要包括运动类型、运动频率、运动强度和运动时间。例如，对于抗阻运动(Resistance exercise, RE)指导方案，需要根据患者的具体情况制定合适的训练量和间歇时间等[6]。在为不同疾病患者制定运动指导方案时，首先应考虑患者的

疾病特点和身体情况；其次，运动强度十分关键，通常由患者的心率储备、最大心率（maximum heart rate，HR_{max}）、最大摄氧量（maximum oxygen uptake，VO_{2max}）和主观疲劳量表评分所决定。一般认为，在疾病的早中期，可以给患者制定中等强度或高强度间歇运动；若是疾病晚期或短期术后，则采用低强度训练，并根据患者身体情况逐渐调整负荷强度。鉴于患者的个人情况不同和需求各异，运动干预治疗方案应个性化，并在实施过程中对患者身体状态进行评估，以达到预期的效果。

本文旨在分析总结随机对照实验中各种疾病的有效运动指导方案。总结 26 种不同疾病的基本信息，整理分析各类运动指导方案对疾病的疗效。最后，推荐各类疾病的最佳运动指导方案（包括运动类型、运动频率、运动强度和运动时间等）。为医疗相关从业人士针对各类疾病、不同阶段选择合适的运动方案提供科学依据。

2 研究方法

2.1 数据收集 文献筛选流程见图 1。通过 PubMed of NCBI 数据库进行文献检索（检索式：（exercise［Title］OR training［Title］）AND（human［Title］））。为了限制研究范围，设置 2 个限制因素：近 10 年发表、按照“best match”排序。最初检索到 736 篇文献，首先排除综述文献，鉴于疾病与运动干预的关系，优先纳入随机对照实验类的研究文献。此外，本文重点关注运动干预的效果，排除饮食、药物和其他因素的影响。最终，选定 188 篇文献进行分析。

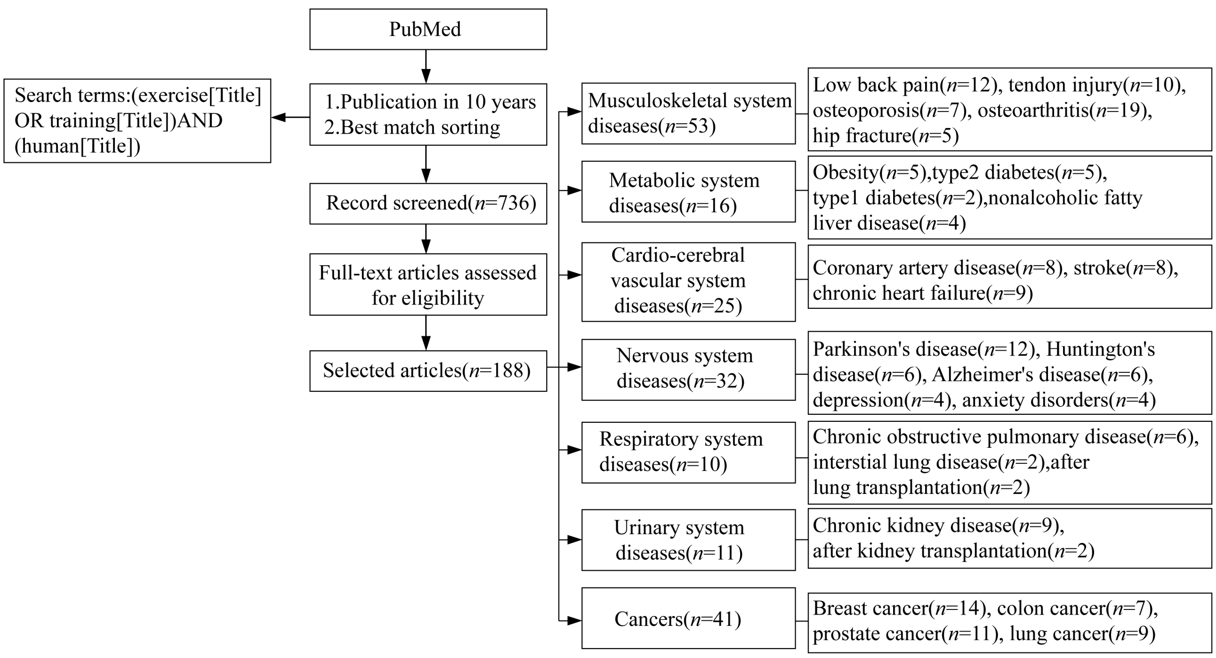

图 1

Figure 1 The flowchart for article searches. The articles included in this review were published prior to July 2018

2.2 数据分析 根据运动干预对象所患疾病的所属系统，将选定文献分为 7 类：肌肉骨骼系统疾病、代谢系统疾病、心脑血管系统疾病、神经系统疾病、呼吸系统疾病、泌尿系统疾病和癌症，再将文献进一步细分为具体疾病。根据运动方案的持续时间、频率和强度做如下分类，以下各小节记录了文献中运动方案的详细信息。

在对入选文献进行归类分析后，确定了针对不同疾病常用的运动类型，包括有氧运动（aerobic exercise，AE）、抗阻运动（resistance exercise，RE）、有氧结合抗阻运动（combined AE with resistance training，CT）、居家运动（home - based exercise，HE）、多模式运动（multimodal exercise，ME）和其他运动。

2.3 运动类型

2.3.1 *有氧运动* 有氧运动（在骨骼肌收缩时以高重复和低阻力为特征的规律运动）[7]是提高有氧能力、促进健康的公认方法。有氧运动在机体能量调节、血流量调节和运动中物质代谢等方面具有重要作用[8]。

有氧运动主要包括步行、跑步、瑜伽、太极拳、普拉提和骑车等。用于术后早期康复或严重疾病时，有氧运动方案可分为低、中、高强度，耐力训练也属于高强度有氧运动。具有心肺功能锻炼适应症的恢复期患者，常采用跑步机或功率自行车进行高强度间歇训练（high - intensity interval training，HIIT）。与其他类型

的运动相比，高强度间歇训练被认为是一种更有效的干预方式，对改善肥胖青少年的血压和携氧能力具有积极作用[9]。

将6周定义为短期和长期运动的临界点；短期运动持续时间少于6周，而长期运动则持续6周或更长时间。在此综述中，运动频率从每周2次到6次不等。强度指标常采用心率储备百分比，最大心率、最大摄氧量百分比或主观疲劳量表评分。按照参考文献指定强度分类，若未提及强度，则参考表1确定的分类标准。

表1

Table 1 Classification of exercise intensity

Intensity	% HRR or % VO_{2peak}	% HR_{max}	% VO_{2max}	RPE	% 1 – RM
Low intensity	< 30	< 57	< 37	< 9	< 30
	30 – 39	57 – 63	37 – 45	9 – 10	30 – 49
Moderate intensity	40 – 59	64 – 76	46 – 63	11 – 13	50 – 69
High intensity	60 – 89	77 – 95	64 – 90	14 – 17	70 – 84
	≥90	≥96	≥91	≥18	≥85

Note: Table adapted from Garber CE, B Blissmer, MR Deschenes, BA Franklin, MJ Lamonte, IM Lee, et al.[10]

Abbreviations: 1 – RM = one – repetition maximum; HR_{max} = maximum heart rate; HRR = heart rate reserve; RPE = rating of perceived exertion; VO_{2max} = maximum oxygen uptake; VO_{2peak} = peak oxygen uptake.

2.3.2 *抗阻运动* 抗阻运动起源于19世纪的欧洲，并迅速在美国传播[11]。起初，人们普遍认为抗阻运动对健康与运动能力有害。然而，随着对运动的深入理解，抗阻运动被证实有利于提高运动员的运动能力[12]。现在，抗阻运动作为健康促进的推荐活动之一，已被证实有助于降低死亡率和心血管疾病的发生，降低胆固醇，缓解抑郁和疲劳，并改善骨密度和胰岛素敏感性[13]。

抗阻运动包括力量训练和个性化负荷运动。力量训练可以使用阻力带、负重或哑铃、杠铃、壶铃或机械等实现。当使用负重方式时，举起的数量经常定义为重复最大值（repetition maximum，RM）。本文中，抗阻运动主要是指使用负重器械进行渐进式阻力训练（progressive resistance training，PRT），或者使用不同的器械训练方案训练上下肢肌群。

抗阻运动方案包括很多要素，如训练频率和强度。频率指的是每周进行力量训练的次数。重复是指不断完成一个完整动作，持续活动次数的数量是每重复一组的数量。一组是指个体以给定的动作重复练习的次数[14]。强度受阻力大小、重复次数和每个肌群重复组数的综合影响。抗阻运动强度依据患者的情况而定，我们遵循参考文献中原文规定具体的强度分类，若原文中没有提到，见表1的标准分类。抗阻运动周期和有氧运动相同：短期（<6周）、长期（≥6周）。

2.3.3 *有氧结合抗阻运动* 有氧结合抗阻运动对身体功能大有裨益。当前的理论研究表明，有氧结合抗阻运动不仅能增强心肺功能[15]，还可以增强肌肉力量[16]。由于有氧结合抗阻运动包括抗阻运动，在制定运动指导方案前应充分考虑患者的耐力能力。根据患者的情况，最常见的有氧结合抗阻运动方案是步行和骑自行车。当有氧结合抗阻运动持续时间小于6周时，我们将其归为短期有氧结合抗阻运动；否则为长期有氧结合抗阻运动。有氧结合抗阻运动强度与有氧运动强度的分类方法相同。

2.3.4 *居家运动* 居家运动（是指患者在家中单独进行锻炼计划的运动类型）已被推荐使用，旨在提高身体活动推荐量[17]。作为简单易行的运动类型，居家运动与患者日常生活融为一体。居家运动可明显改善身体活动水平、平衡、活动能力和肌肉力量。部分居家运动仅涉及有氧运动干预。然而，进行居家运动的患者往往首先进行简单的有氧运动，然后做一些力量训练和其他抗阻运动。有时进行居家运动的患者会接受特定的训练，例如高强度腿部强化练习或功能性练习。居家运动的持续时间、强度分类方式与有氧运动相同。

2.3.5 *多模式运动* 多模式运动是多种训练方法的组合。几乎所有的多模式运动都包括有氧运动、抗阻运动、力量训练、拉伸训练、平衡训练和其他形式的训练。多模式运动干预通常从固定自行车/循环测力计和步行的有氧运动开始，再进行一系列的上肢力量训练，最终以拉伸运动结束训练。多模式运动的运动强度在各项研究中差异很大，强度从最大心率的50%到90%不等[18]。多模式运动在改善下肢肌肉力量、动态站立平衡、步行速度和坐立起身等方面效果显著。此外，多模式运动可有效减少跌倒的发生，通常用于神经系统疾病患者的术后治疗和康复，并可以缓解与癌症相关的疲劳症状[19]。多模式运动的持续时间、强度分

类方式与有氧运动相同。

2.3.6　*其他运动*　其他特殊的运动干预方案,包括平衡训练、水中运动(不同于游泳)、全身振动(whole body vibration,WBV)训练、向心和离心运动、拉伸训练等。本文相关附表确定了研究中进行运动干预的疾病类型。

3　研究结果

3.1　肌肉骨骼系统疾病　肌肉骨骼系统包括骨、骨骼肌、肌腱、韧带、软骨、骨连结、血管和神经等其他结缔组织[20]。骨和骨骼肌是该系统中最大的两类组织,在维持人体生理功能中发挥着重要作用,能够促进机体运动,促进血液流向器官,并保护重要器官[20,21]。运动是人们参与身体活动的一种方式,然而,运动损伤可能是参与运动的消极后果[22]。常见的运动损伤包括肌肉、肌腱和韧带的急、慢性损伤,创伤性骨折及其他损伤。不同类型或多种形式组合的运动训练被用来预防和治疗运动损伤[23]。

3.1.1　*下背痛*(Low back pain,LBP)　下背痛是导致残疾的主要原因之一,也是许多发达国家的主要公共卫生问题之一[24]。非特异性下背痛是指肋缘以下和臀横纹以上区域内的疼痛、肌肉紧张或僵硬[25]。绝大多数患者(近 90%)无法明确描述非特异性下背痛病因的具体症状[25]。

附表 1 显示,治疗下背痛最常用的运动类型是有氧运动和全身振动训练。现阶段,运动治疗是慢性非特异性下背痛康复的关键治疗方法之一。常见的有氧运动方式主要有太极拳、瑜伽和普拉提。对于非特异性下背痛患者,长期低强度有氧运动是一种安全有效的干预措施。有氧运动不仅能缓解疼痛[26]、减轻焦虑和抑郁[27],还能更有效地改善人体机能。例如,有氧运动可以提高下背痛患者的柔韧性、平衡性[28,29]和脊柱活动度[30]。最常用的有氧运动方式是普拉提,其姿态方法注重腰部骨盆的稳定性,包括核心肌群训练和呼吸训练,并有助于激活某些肌肉。这种类型的运动干预可减轻疼痛和残疾,提高心理健康水平以及身体稳定性[31,32]。此外,高强度有氧运动也可以减轻下背痛患者的疼痛、降低致残率和心理压力[33]。为了保持脊柱健康和预防背部疼痛,推荐短期的每日有氧运动方案来强调“后意识”和脊柱自我护理[34]。长期全身振动训练作为慢性下背痛患者的一种干预方式,可增强脊柱力量和耐力、躯干本体感觉和腹横肌激活能力[35]。同时,长期全身振动训练对于慢性下背痛的久坐工作人员,是一种有效的、安全的、合适的干预措施[36]。低频振动疗法还适用于改善非特异性下背痛患者的姿势稳定性、生理功能、健康相关生活质量(health - related quality of life,HRQoL)、残疾和足部振动感知阈值[37]。

长期低强度有氧运动是下背痛患者常用的运动形式,可减少疼痛并提高生活质量。普拉提作为一种低强度有氧运动,是下背痛患者常用的运动形式,全身振动训练也逐渐成为下背痛患者采用的运动形式之一。

3.1.2　*肌腱损伤*　常见的肌腱损伤包括肩袖损伤、网球肘和跟腱病(Achilles tendinopathy,AT)。肩袖损伤是最常见的肩关节肌肉骨骼疾病,与肩部疼痛、无力和功能丧失有关,肌腱肿胀可能是由于急性超负荷引起的[38]。肩部肌腱损伤严重影响日常生活,包括吃饭、穿衣和工作。网球肘,也称肱骨外上髁炎(lateral elbow tendinopathy,LET),是一种影响着 1% - 3% 人口的疾病[39,40]。典型的症状是由于肘关节外侧前臂伸肌起点处肌腱发炎而导致疼痛[41]。跟腱病常出现在运动和久坐人群中。据统计,高水平跑步运动员发病率在 7%—9% [42],约 30% 的跟腱病患者有久坐不动的生活方式[43]。

附表 2 所示,运动干预方法包括向心和离心运动、负荷训练、开链运动和闭链运动。长期离心运动有利于恢复患者的肩部功能,减轻疼痛[44]。长期递增负荷离心运动可明显减轻网球肘患者的疼痛。肌肉收缩越快,伸长率越大[41,45],离心运动由于可以减轻疼痛,并减少手术干预,已成为治疗跟腱病的首选方法[46],对约 60% 的患者有效[47]。一项研究报道,肩袖损伤患者离心治疗失败后,Astym 治疗作为一种新兴的康复治疗方法,用于肩袖损伤患者[48]。Alfredson 离心运动以及 Silbernagel 结合离心运动对慢性中度跟腱病患者均有积极作用[49]。离心运动的可能机制包括运动训练改变肌腱基质内液体运动以破坏重塑和稳态平衡等,从而改变肌腱病相关症状[50]。因此,长期离心运动通常用于治疗肌腱损伤。另外,单次自我管理运动堪比常规物理治疗[51],当进行负重运动时,它还能缓解肩痛,降低残疾指数[52]。开链、闭链和关节活动范围内的运动都能短期内有效改善肌腱病患者的疼痛和不适[53]。

长期离心运动已被证明是治疗肌腱损伤的有效方法,也是治疗跟腱病和网球肘的基本方法,可能是治疗肌腱病的可行方案。

3.1.3　*骨质疏松症*(Osteoporosis,OP)　骨质疏松症是以低骨量和骨微结构恶化为特征的一种疾病,导致骨的脆性和骨折风险增加。近年来,骨质疏松症已成为影响全球数百万人的代谢性骨病[54]。更年期和衰老与低身体活动水平有关[55],久坐不动的生活方式在城市绝经期妇女中普遍存在[56]。证据表明,运动可以预

防更年期并发症,例如骨质流失、身体素质下降、骨质疏松症等[57]。体育运动有效降低了跌倒的风险[58],并改善身体平衡能力[59,60]。

附表3显示,骨质疏松症常见的运动方案包括有氧运动、抗阻运动、有氧结合抗阻运动和平衡训练。有氧运动和抗阻运动方案有助于刺激绝经后骨质疏松症妇女的骨合成,减少骨吸收,进行这类运动时负重更有利于改善平衡[61]。长期太极拳运动有助于减少骨密度流失,降低骨折风险[62]。短期亚极量有氧运动可显著改善绝经后骨质疏松症妇女的静态和动态平衡[63]。长期低强度平衡和力量训练明显提高骨质疏松症妇女的肌力和平衡能力[16]。长期抗阻运动和平衡训练直接影响有骨质疏松症病史的老年妇女的习惯步行速度[64]。长期高强度有氧结合抗阻运动可增加骨密度,有效预防老年人群骨折[65,66]。

总之,短期中等强度有氧运动和长期高强度抗阻运动可以预防骨质疏松症并改善平衡能力,有助于避免跌倒和骨折。

3.1.4 *骨关节炎(Osteoarthritis,OA)* 骨关节炎是影响全球老年人的一种慢性退行性肌肉骨骼疾病[67]。在美国,33.6%(1240万人)的65岁及以上老年人受骨关节炎的影响,到2030年受影响的人数将增加到6700万人[68]。中老年人群常患有骨关节炎,主要症状为关节疼痛、僵硬、身体活动受限和机能下降[69]。骨关节炎受影响最常见的关节是膝关节和髋关节,其与肥胖的关系密不可分,可能是由于超重和肥胖导致负重关节负荷增加所致。骨关节炎是一种无法有效治愈的慢性疾病,其临床管理挑战巨大。实践指南指出,运动是治疗骨关节炎的关键要素[70]。

附表4显示,治疗骨关节炎最常用的运动方案为水中运动、有氧运动、抗阻运动、有氧结合抗阻运动、全身振动训练和多模式运动。长期中等强度水中运动方案能明显降低体脂[71,72],改善患者的疼痛、不适,提高生活质量[71,73]。由于水中运动可以降低关节的负荷也适用于肥胖患者[74],水中运动结合健康宣教,可有效降低老年人跌倒的危险因素发生[75]。此外,8周以舞蹈为基础的水中运动干预可改善心肺功能,并降低运动后心率和疲劳程度[76]。在有氧运动方案中,长期低强度瑜伽运动可有效改善骨关节炎症状和提高身体机能[77,78],长期太极拳运动有助于改善睡眠质量和提高生活质量[79],游泳和骑自行车有助于改善身体机能并减少疼痛[69]。骨关节炎患者往往有更高的心血管疾病风险,与陆地自行车运动相比,长期规律的游泳运动对骨关节炎患者的血管功能和炎症标志物具有相似甚至更好的影响[80]。在抗阻运动方案中,长期递增负荷力量训练改善了骨关节炎患者膝关节屈曲活动度[81]和下肢功能[82],对于髋关节炎患者,肌肉力量、步行速度和节奏仅在长期高速组明显提高[83]。全身振动训练有益于膝关节炎患者的身体机能和神经肌肉控制[84],且长期全身振动训练结合抗阻运动对肌肉力量和本体感受的益处优于抗阻运动[85,86]。多模式运动项目包括长期递增的高速耐力训练[87]和平衡训练(力量训练和伸展运动)[88]。

总之,长期低、中等强度的水中运动可以改善骨关节炎患者的机体状态、减少并发症,提高生活质量;全身振动训练也是治疗骨关节炎的一种运动方案。

3.1.5 *髋部骨折* 随着年龄增长,将近一半女性和四分之一男性将遭受跌倒所致的脆性骨折[89,90]。其中最严重和最常见的骨折是髋部骨折,有明显的致残和致死风险[90]。越来越多的证据表明,运动康复干预对亚急性期及以后的各种身体机能都有积极影响。规律的运动可提高髋部骨折后的活动能力[91]。

附表5显示,治疗髋部骨折的运动形式为有氧运动、居家运动、多模式运动。在涉及渐进式阻力训练、挑战平衡训练和下肢神经肌肉功能训练的居家运动方案中,患者可以克服康复治疗的障碍[7]。居家运动方案足以改善身体机能[92],包括提高平衡能力、肌肉力量和骨密度,还可以大大改善患者身体状态并提高生活质量[92]。此外,专门的平衡、肌力工作站式训练明显改善患者平衡和肌肉力量,并降低骨质疏松症女性跌倒和骨折的风险[93]。将髋部骨折后完成临床康复治疗的患者,随机分组后进行6个月居家功能性锻炼干预,患者身体机能得到改善[94]。推荐使用多模式运动方案(包括传统的渐进式阻力训练、负重冲击训练和平衡训练),以减少跌倒和骨折风险的发生[95]。

总之,注重长期低、中强度的平衡训练有助于恢复髋部关节功能,改善生活质量。

3.2 代谢系统疾病 代谢系统疾病影响人体健康和生活质量,成为世界上普遍担忧的问题之一。生活方式干预是预防和治疗代谢系统疾病的主要方法,其中常见的治疗方法就是饮食和体重控制,但运动干预的作用经常被医生和患者忽视[96]。运动疗法有助于降低代谢系统疾病的发病风险,促进康复。

3.2.1 *肥胖* 肥胖是体内脂肪过度堆积的病症。单纯性肥胖与遗传和生活方式有关;继发性肥胖与内分泌和代谢系统疾病有关。当前治疗肥胖的方法有很多,其中运动疗法可以用来治疗肥胖症[97]。

附表6显示,治疗肥胖的运动指导方案包括有氧

运动和抗阻运动结合高强度间歇训练。在有氧运动方案中，主要运动形式为长期中、高强度训练。具体运动形式包括跑步机和单车有氧训练，可以改善肥胖成年人的身体成分和最大摄氧量[98]，上调肌肉中 Apelin/APLN 多肽的表达[99]，提高血清和血小板中的脑源性神经营养因子水平[100]。此外，研究表明，间歇性有氧运动（aerobic interval training，AIT）可以降低过量的 NADPH 氧化酶来源的活性氧水平，并改善肥胖人群的微血管内皮功能障碍[9]。抗阻运动结合渐进式阻力训练干预久坐、超重的中年人群，结果表明受试者卫星细胞功能得到改善，从而减控体重。抗阻运动结合渐进式阻力训练的减重效果优于单独的抗阻运动[101]。

总之，上述方法对治疗肥胖均有积极作用，其中有氧运动是治疗或预防肥胖最常见的运动形式。

3.2.2　*2 型糖尿病*（Type 2 diabetes，T2D）　2 型糖尿病以其高发病率和高死亡率迅速扩展，成为全球严重的健康问题。近 10 年来，全球 2 型糖尿病患病率和发病率急速上升的主要原因是环境和生活方式的改变[102]。流行病学调查显示世界上约有 3.71 亿糖尿病患者，预计到 2030 年，患者将增加到 5.52 亿[103,104]。饮食控制、药物治疗、心理疗法和自我监管是干预 2 型糖尿病的常用方法。运动干预也是治疗 2 型糖尿病的关键方法，与饮食控制和药物治疗同等重要[105]。

附表 7 显示，治疗 2 型糖尿病的运动形式为有氧结合抗阻运动、抗阻运动和高强度间歇训练。有氧运动方案包括跑步和骑自行车。长期中等强度有氧结合抗阻运动可减轻肥胖成人细胞内应激反应[106]，但不影响 2 型糖尿病患者血浆肌肽酶含量，可能是由于运动对糖尿病并发症存在有益影响[107]。抗阻运动主要为长期中、高强度运动，可显著降低老年 2 型糖尿病患者的血糖、胰岛素和胰岛素抵抗水平[108]，改变非胰岛素依赖型糖尿病患者红细胞中单羧酸转运蛋白 1[109]。一次低剂量的高强度间歇训练对 2 型糖尿病患者的免疫调节具有积极作用，并具有潜在的抗炎作用[110]。

治疗 2 型糖尿病常见的运动方案是有氧运动和抗阻运动，长期中等强度运动对于治疗 2 型糖尿病有积极影响。

3.2.3　*1 型糖尿病*（Type 1 diabetes，T1D）　1 型糖尿病是典型的 T 细胞介导的自身免疫性疾病，特点是胰腺 β 细胞被选择性破坏[111]。1 型糖尿病的致病因素显示了遗传与环境因素之间的复杂关系，其中大部分尚未确定[111]。1 型糖尿病的主要治疗方法包括胰岛素治疗、心理治疗和运动治疗。

如附表 8 所示，高强度间歇训练和速度耐力训练是治疗 1 型糖尿病的主要运动方法。循环短跑训练是一种常用的速度耐力训练方法。

在循环测力计上进行高强度急性间歇训练的循环冲刺干预迅速降低了患者对继发性低血糖感知，减少低血糖引起的认知功能障碍[112]。然而，速度耐力训练由于减少了骨骼肌 Ca^{2+} －ATP 酶，也会产生一些负面影响[113]。

总之，长期高强度速度耐力训练可作为治疗 1 型糖尿病的运动方案。

3.2.4　*非酒精性脂肪肝*（Nonalcoholic fatty liver disease，NAFLD）　非酒精性脂肪肝是世界上常见的慢性肝脏疾病，预计到 2030 年将成为最常见的肝移植指征[114]。该疾病有多种表现形式，包括单纯性脂肪变性（也称为非酒精性脂肪肝），非酒精性脂肪肝炎和肝硬化，最终可能发展为肝癌。美国肝病研究协会提出，运动可以减少非酒精性脂肪肝患者的肝脂肪变性[115]。

附表 9 显示，非酒精性脂肪肝的运动干预方案包括有氧运动和有氧结合抗阻运动。有氧运动是干预非酒精性脂肪肝的主要措施，常见短期或长期的中、高等强度运动。中、高等强度的有氧运动也降低了非酒精性脂肪肝的发病风险[116]，但是对肝脏甘油三酯水平的影响不大[117]。为期 1 年的中等强度有氧运动干预显著降低了非酒精性脂肪肝肥胖患者肝脏甘油三酯水平、血压以及减少了腹部脂肪[118]。此外，有氧结合抗阻运动干预显著降低了非酒精性脂肪肝患者的肝脏甘油三酯水平[119]。

综上所述，有氧运动和有氧结合抗阻运动均能改善非酒精性脂肪肝，长期中等强度有氧运动是治疗非酒精性脂肪肝最常见的运动形式。

3.3　心脑血管系统疾病　近年来，心脑血管系统疾病的发病率迅速上升。尽管心脑血管系统疾病主要出现在老年人群中，但在年轻人群也时有发生。适当运动可以提高心肺功能，加速血液循环，增加供氧能力和血管弹性。此外，运动可以降低血脂，防止动脉硬化和血栓形成[120]。运动有助于减轻心脏压力，预防心血管系统疾病的发生。

3.3.1　*冠状动脉疾病*（Coronary artery disease，CAD）

冠状动脉疾病又称缺血性心脏病，包括稳定性心绞痛、不稳定性心绞痛、心肌梗死和心源性猝死等一系列疾病[121]，是最常见的心脑血管系统疾病[122]。最近的研究表明运动是增强心脏功能、提高患者整体生活质量的有效途径[123]。

附表 10 显示，针对冠状动脉疾病的运动干预方式包括有氧运动和居家运动。常见的运动形式包括步

行、骑车、慢跑和太极拳等。长期中等强度步行可降低冠状动脉疾病患者睡眠呼吸暂停的严重程度[124]。高强度间歇训练可降低冠状动脉疾病的发病率和死亡率,预防动脉粥样硬化[125],对患者的心脏功能和生活质量有益,且不会增加患心血管疾病的风险[15,126]。与持续有氧运动相比,间歇性有氧运动对冠状动脉疾病患者的康复更有效。但在大样本人群研究中发现,间歇性有氧运动改善冠状动脉疾病患者运动能力和外周血管内皮功能的作用与持续有氧运动相似[127,128]。长期居家运动更有利于术后患者的最大摄氧量和身体活动的恢复,效果优于传统的临床为主的心脏康复[129]。互联网为主的家庭心脏康复对改善冠状动脉疾病患者身体活动水平是行之有效的[130]。

总之,运动干预可改善冠状动脉疾病的危险因素,如身体成分和血压。与持续性中等强度运动相比,长期有氧运动或居家运动更能改善冠状动脉疾病患者的健康状况。

3.3.2　脑卒中(Stroke)　脑卒中,也称为"脑血管意外",是一种急性脑血管事件,包括缺血性和出血性脑卒中。急性期过后,脑卒中的致残率很高。急性期后的早期运动干预对运动能力的恢复和提高至关重要[131]。

如附表 11 所示,脑卒中的运动干预类型为有氧运动、抗阻运动、有氧结合抗阻运动、抗阻结合平衡训练。运动的形式包括步行、骑自行车、慢跑、力量训练、太极拳、家中移动物体和拾取物体。在有氧运动方案中,中等强度有氧训练可提高脑卒中偏瘫患者的有氧能力和行走能力[132],对于偏瘫患者的认知能力和运动控制能力有促进作用[133,134]。高强度有氧运动也是有效提高脑卒中偏瘫患者携氧能力的一种方法[135]。抗阻运动方案中,长期渐进式阻力训练结合平衡训练后,患者的平衡能力在 3 个月内有所改善,步行能力也在 3 - 6 个月内有所提高[136]。低强度的抗阻结合平衡训练有利于改善血脂、血糖和运动能力[137]。短期呼吸肌训练结合常规体能训练可以改善患者肺功能和运动能力[138]。长期有氧结合抗阻运动有助于提高认知能力,减轻脑卒中偏瘫患者的认知功能障碍[139]。

总之,运动干预可以改善脑卒中偏瘫患者的心肺功能、步行能力、平衡功能和认知能力。长期低、中强度有氧运动可改善其心肺功能和携氧能力,是脑卒中偏瘫患者最常用的运动训练方法。

3.3.3　慢性心力衰竭(Chronic heart failure,CHF)　慢性心力衰竭是指由于心脏收缩或舒张功能低下,血液无法回流至心脏,致使动脉灌注不足和静脉系统沉积,从而引起心脏功能障碍[140]。传统观点认为心功能不佳的患者应避免运动,减少对心脏的刺激,然而随着运动疗法研究的不断发展,目前认为慢性心力衰竭患者应适度运动。

附表 12 显示,治疗慢性心力衰竭的运动类型包括有氧运动、抗阻运动和高强度间歇训练。在有氧运动方案中,长期步行和呼吸训练改善了患者血氧饱和度和主观感知,并调整情绪,提高生活质量[141]。长期中等强度伸展结合自行车运动改善和提高肌肉反射控制[142]。高强度间歇训练方案通过改变健康水平来提高生活质量[143]。高强度间歇训练结合中等强度有氧运动可提高亚最大运动能力[144]。高强度间歇训练易于实施,是一种较好的心脏康复运动干预手段,但与有氧运动相比效果不明显[145]。长期高强度间歇训练结合力量训练,有助于提高主动脉扩张能力和改善收缩压,更有利于血管反应[146,147]。在抗阻运动方案中,短期、低强度抗阻运动和腹部运动改善了心肺功能,对中老年慢性心力衰竭患者急性期后的康复具有显著的促进作用[148]。长期有氧运动和抗阻运动更有利于患者康复[149]。

总之,运动干预可改善慢性心力衰竭患者的心肺功能。与有氧运动或不运动相比,高强度间歇训练可改善患者心脏收缩功能和生活质量。长期高强度间歇训练常用于治疗慢性心力衰竭。

3.4　神经系统疾病　神经系统疾病主要包括中枢神经系统疾病和周围神经系统疾病,这些疾病通常与运动控制和认知功能障碍有关。此类疾病大多为慢性且致残率高,影响患者正常生活。运动是人类最常见的生理刺激,有调节和重塑组织功能的能力。运动可以提高患者的运动控制能力,同时有研究表明,运动还可增强患者的认知功能[150]。

3.4.1　帕金森病(Parkinson's disease,PD)　帕金森病是一种常见的神经退行性疾病,主要的病理改变是中脑黑质多巴胺能神经元的功能缺失,主要表现为静止性震颤、肌肉僵硬等运动功能障碍[151]。虽然药物治疗是目前首选的治疗方法,但运动作为一种潜在的重要治疗方法已引起广泛关注。

帕金森病的运动方案见附表 13。有氧运动、抗阻运动、多模式运动对帕金森病患者有积极作用。有氧运动方案通常为中、高强度的步行、功率自行车和跑步。有氧运动对提高患者步行能力、运动功能[152,153]、速度和步长均有积极作用[154],有氧运动也提高了认知功能障碍患者的执行能力[155]。此外,有氧运动用于帕金森病患者的早期康复[156]。抗阻运动包括长、短期的中

高强度功率自行车运动及其他负荷运动。抗阻运动安全、有效地改善了患者的心血管功能[157-159]。多模式运动方案包括长期或短期的探戈、跑步、功率自行车、太极拳、普拉提和拳击运动等，此类项目易于实现[160]，且有助于运动功能、执行能力和平衡功能的改善[160-162]。有研究报道水中运动对早期帕金森病患者有一定的益处[163]。

长期有氧运动常用于治疗帕金森病，且有助于缓解患者症状。

3.4.2　亨廷顿舞蹈症（Huntington's disease，HD）　亨廷顿舞蹈症是一种神经细胞凋亡的遗传性疾病，以肢体抽搐和运动不协调为特征。不幸的是，目前尚未发现有效的治疗方法[164]。有氧运动、有氧结合抗阻运动及多模式运动可以部分缓解亨廷顿舞蹈症症状。然而，患者通常很难进行常规的身体活动，上述运动项目对亨廷顿舞蹈症患者非常具有挑战性[165]。

如附表 14 所示，运动类型通常为长时间中等强度有氧运动或者高强度间歇训练，每周 3 次，每次 25－30 分钟，可改善亨廷顿舞蹈症患者的心血管功能[166]、骨骼肌细胞的线粒体功能[167]以及维持运动功能的稳定性[166,167]。另一项研究发现，长期中等强度有氧结合抗阻运动，有助于改善亨廷顿舞蹈症患者的认知能力和步行能力[168]。长期的多模式运动包括有氧运动、抗阻运动、伸展运动或特定任务训练。其中一些运动方法对亨廷顿舞蹈症患者是有益的[169]。然而，特定任务训练未对亨廷顿舞蹈症产生任何影响，可能是由于运动不充分引起的[170]。

总之，长期多模式运动是治疗亨廷顿舞蹈症的新型运动方法。

3.4.3　阿尔茨海默病（Alzheimer's disease，AD）　阿尔茨海默病是一种起病隐匿的进行性神经系统退行性疾病[171]。阿尔茨海默病患者常表现为记忆障碍、失语症、视觉空间功能受损、执行功能障碍、人格和行为改变，且会随着时间的推移逐渐恶化，最终导致死亡。目前阿尔茨海默病患者主要依赖药物治疗，由于该病的发病机制尚不清楚，因而药物治疗效果并不理想。然而，若阿尔茨海默病患者定期、系统地锻炼，其认知障碍、功能和行为障碍等症状可以缓解[172]。

如附表 15 所示，阿尔茨海默病的运动干预方案包括有氧运动、多模式运动和居家运动。有氧运动的形式包括自行车和跑步机。有氧运动改善了患者的日常活动能力和认知水平[173]，这一变化是独立于 β 淀粉样蛋白和脑脊液总 tau 蛋白水平的变化。长期平衡训练也提高了患者的运动能力[174]，长期多模式运动显著提高了阿尔茨海默病患者的上下肢肌肉力量、柔韧性、敏捷性以及耐力素质、步态和平衡能力[175]。长期个性化的居家运动降低了疾病晚期的跌倒风险[176]，改善社区老年患者的记忆功能障碍[177]，对阿尔茨海默病患者身体功能有益无害，且未增加卫生和社会服务总支出[178]。

多种居家运动被广泛应用于阿尔茨海默病患者中，以提高患者日常活动的能力，改善认知功能。

3.4.4　抑郁症（Depression）　抑郁症是一种复杂的使人衰弱的疾病，影响着全球 1.2 亿多人的健康[179]。与健康人相比，抑郁症患者罹患糖尿病、心血管疾病和高血压等慢性病的风险增加，生活质量显著降低[180]。临床研究表明，传统的抑郁症治疗方法效果并不显著。最新研究表明，运动可能是治疗抑郁症的有效方法[181]。

附表 16 显示，长期中、高强度的有氧运动是治疗抑郁症的主要运动方案，包括自行车、跑步机和其他器械运动。这些运动方法是治疗重度抑郁症患者的有效方法[182]。有氧运动联合抗抑郁药物舍曲林，改善了老年重度抑郁[183]和认知能力的减退[184]，降低致残率[184]，提高生活质量[185]。

总之，长期中等强度有氧运动可有效缓解抑郁症，并广泛应用于抑郁症的治疗。

3.4.5　焦虑症（Anxiety disorders）　全球患焦虑症的人数正在迅速增加[186]。焦虑症患者多伴随代谢功能障碍[187]。流行病学调查显示，焦虑症是最常见的精神疾病之一[188]。焦虑症患者通常接受心理治疗和药物治疗控制其症状。

如附表 17 所示，治疗焦虑症的运动干预的方式为有氧运动、居家运动和抗阻运动。有氧运动包括长期中、高强度的骑车、步行和太极拳。中等强度有氧运动可能是减少焦虑症相关精神病理学的临时替代疗法[189]。台湾地区研究发现，长期居家运动可有效改善焦虑症患者的代谢指标，缓解患者的焦虑水平[190]。每周 2 次的急性或短期的低－高强度抗阻运动，对焦虑症也有较好疗效。因此，抗阻运动是降低焦虑症风险发生的可行方法[191,192]。

总之，中等强度的有氧运动和抗阻运动可有效缓解焦虑症患者症状。

3.5　呼吸系统疾病　呼吸系统疾病是严重危害人类健康的常见疾病[193]。伸展和扩胸运动可以增强呼吸肌力量，提高肺活量、肺通气和氧利用能力，改善肺功能等[194,195]。

3.5.1　慢性阻塞性肺疾病（Chronic obstructive pulmonary disease，COPD）　慢性阻塞性肺疾病是一种以气流阻塞为特征的破坏性肺病。主要症状有慢性

咳嗽、咳痰、呼吸困难、气喘和胸闷。慢性阻塞性肺疾病干预方法主要包括药物治疗、吸氧治疗和运动疗[196]。

如附表 18 所示，慢性阻塞性肺疾病的运动方案包括个性化有氧运动、抗阻运动和水中运动。运动形式包括踏板力量训练、太极拳和步行。长期低强度的临床康复治疗有助于提高慢性阻塞性肺疾病患者的运动能力和生活质量[197]。长期高强度耐力和力量训练可显著提高耐力水平[198]。长期低强度水中运动对于慢性阻塞性肺疾病治疗是一个相对较新的概念，慢性阻塞性肺疾病及合并症患者可以很好地接受水中环境[199]。短期低强度踏板力量训练有助于改善体弱老年患者的肌力、平衡及运动能力[200]。此外，长期太极拳运动还可以增强肺功能、运动能力和膈肌力量[201]。另一项研究结果表明，步行训练是提高患者生活质量和耐力的有效方法[202]。

简而言之，慢性阻塞性肺疾病患者可以进行长期低至中强度的有氧运动、抗阻运动并结合呼吸训练，以促进疾病康复。此外，水中运动是治疗慢性阻塞性肺疾病的新方法。

3.5.2　*间质性肺病*（Interstitial lung disease，ILD）　间质性肺病是以肺间质病变为主的一类疾病。主要临床表现为咳嗽和术后呼吸困难加重，最终导致呼吸衰竭。糖皮质激素联合免疫抑制疗法、抗纤维化药物治疗、肺移植、中药、吸氧以及运动治疗是治疗间质性肺病的主要方法[203]。

如附表 19 所示，治疗间质性肺病的运动方案为监督条件下的有氧结合抗阻运动。监督条件下的运动方案包括长期高强度有氧运动和上、下肢抗阻训练。此种运动疗法对各类间质性肺病患者均有效，尤其是对石棉肺有临床意义[204]。研究确定了运动对间质性肺病的积极作用，结果表明，有监督的运动训练可用于指导和优化间质性肺病患者的临床管理[205]。

总之，长期高强度有氧结合抗阻运动可用于缓解间质性肺病患者的症状。

3.5.3　*肺移植术后*（After lung transplantation，LTx）　肺移植手术是终末期肺病患者的治疗选择。近 15 年来，随着肺移植技术、供体保存和围手术期管理的逐步成熟，肺移植术后的 1 年生存率由 70% 提高到 85%[206]。然而，肺移植术后通常会出现危及患者健康、影响患者康复的并发症。适当的运动可以预防并发症的发生，提高术后康复速度。

如附表 20 所示，肺移植术后的运动方案包括全身振动训练和有氧结合抗阻运动。短期全身振动训练作为一种可行、安全的运动方式，也是帮助肺移植术后患者术后恢复的好方法[207]。有氧结合抗阻运动的运动形式包括骑车、步行、爬楼梯和腿部按摩。研究结果显示，出院后立即进行有监督的耐力训练，可改善肺移植术后患者功能恢复，并在 1 年内改善患者的机体状态[208]。

总之，长期中等强度有氧结合抗阻运动可改善肺移植术后患者的日常活动，短期全身振动训练也有较好的效果。

3.6　泌尿系统疾病　肾病患者的特点是体力差、营养不良和能量缺乏。研究表明，运动可以改善身体功能，提高肾病患者的生活质量。由于对肾脏疾病缺乏全面了解，肾病还可导致其他系统功能障碍的发生，大多数肾病患者需要加强运动[209,210]。

3.6.1　*慢性肾病*（Chronic kidney disease，CKD）　慢性肾病是指一种由于肾脏的结构或功能异常，导致的人体多器官和系统功能障碍的慢性复合疾病[211]。此外，慢性肾病患者缺乏运动和身体功能下降是病情恶化的重要原因[209]。

附表 21 显示，治疗慢性肾病运动方案主要为有氧运动、抗阻运动、有氧结合抗阻运动以及居家运动。在有氧运动方案中，短期中等强度间歇性有氧运动治疗慢性肾病三期患者，结果显示内皮素－1 水平降低[212]。内皮素－1 具有血管收缩的功能，是调节心血管功能的重要因子。在抗阻运动方案中，对于超重的慢性肾病患者，长期渐进式阻力训练是一种可接受的干预措施。渐进式阻力训练可增加肌肉横截面积和体积、膝关节伸肌力量和运动能力[213]。对于无肾功能恶化的慢性肾病患者，中等强度的有氧结合抗阻运动可避免肌肉萎缩，改善身体状况[214]。在居家运动方案中，居家的有氧结合抗阻运动可行性较强，且改善了慢性肾病患者的肌力和运动能力[215－217]。此外，中等强度的居家有氧运动虽未改善内皮功能或动脉硬化，但提高了患者的最大摄氧量和生活质量[218]。类似的研究表明，有氧运动可有效降低患者内脏脂肪含量并改善心肺功能[219,220]。

长期中等强度的居家运动对慢性肾病有很好的疗效，表现为肌力的改善、代谢能力的增强、情绪的调节和其他并发症的减少。

3.6.2　*肾移植术后*　肾移植是终末期肾病和慢性肾功能衰竭患者最有效的治疗方法[221]。然而，患者术后会出现器官排斥反应，因此需要服用免疫抑制剂来维持正常的机体功能状态。药物会对患者的身体状况产生不良影响。最近的研究表明，有规律的运动对肾移植患者有积极作用[222]。

附表22显示，治疗肾移植术后的运动方案包括有氧运动、抗阻运动和个体化渐进性运动方案。研究表明，有氧和抗阻运动是调节脉搏速度的有效方法[223]。步行联合低强度动态拉伸的结合有利于患者的身心康复。此外，该个体化干预方法可适当推广到肾移植术后的其他患者中[224]。

上述运动方案通过改善患者运动能力和治疗并发症，对肾移植术后患者产生积极影响。

3.7 癌症 癌症是导致全球死亡的主要原因。在美国，癌症死亡率占全球死亡率的四分之一[225]。越来越多的新癌症病例和越来越高的癌症存活率导致独特的卫生保健需求快速增长。身体活动已成为提高癌症幸存者和患病者（包括乳腺癌、结肠癌、前列腺癌和肺癌）生活质量的一种有效策略。

3.7.1 乳腺癌（Breast cancer，BC） 乳腺癌是最常见的癌症之一，也是全球女性癌症患者死亡的主要原因。随着抗癌治疗和诊断技术的进步，乳腺癌患者存活时间更久[226]。众所周知，乳腺癌患者会遭受治疗带来的副作用等其他影响，严重降低生活质量[227,228]。运动是治疗乳腺癌的有效方案之一[229]。

附表23显示，治疗乳腺癌的主要运动方案为有氧运动、抗阻运动及有氧结合抗阻运动。AE的运动形式包括使用功率自行车、跑步机、椭圆机和划船机。长期高强度运动可以减少脂肪，改善心肺功能，降低乳腺癌患病风险[230-232]。短期低强度有氧运动结合力量训练有助于改善肩关节活动度，减轻乳腺癌相关的淋巴肿大和疼痛[233]。长期中等强度有氧运动对乳腺癌患者有积极作用，但只适用于早期乳腺癌患者[234]。长期研究表明，8种中等强度的渐进式阻力训练仪器是运动疗法的重要组成部分[229,235-237]。中等强度有氧结合抗阻运动有利于辅助早期乳腺癌治疗；18周运动训练对患者的疲劳程度、心肺功能和肌肉力量均有积极作用[238]。高强度有氧结合抗阻运动可显著增强患者自信心、身体素质，改善身体成分以及提高化疗完成率，同时还有助于改善乳腺癌患者化疗期间的睡眠质量[239-242]。

总之，对于早期乳腺癌患者，长期低、中等强度有氧运动和抗阻运动更有利于康复。

3.7.2 结肠癌（Colon cancer） 在美国，每年有10.3万人被诊断出患有结肠癌[238]。其中，39%为原位结肠癌（局限于原发部位，I－II期），36%为局域结肠癌（癌细胞已扩散至区域性淋巴结；第III期），20%会有扩散性疾病（癌症已扩散到远端器官，第IV期）[243,244]。原位和局域结肠癌的5年生存率分别为90%和70%[243]。观察性研究表明，结肠癌幸存者的身体活动水平越高，疾病愈后效果越好[245]。

附表24显示，治疗结肠癌的运动方案主要为有氧运动和有氧结合抗阻运动。长期中等强度有氧运动可降低I、II、III期患者内脏脂肪含量，增强健康体适能，降低结肠癌复发风险[246,247]。长期中、高强度有氧运动改善了结肠癌患者生物标志物和健康相关生活质量等多种评价愈后的指标[248,249]。长期有氧结合抗阻运动有助于减轻患者的疲劳程度[250]。低、中等强度的运动缩短了术后住院时间及排便时间[251]。

总之，长期中、高强度有氧运动是治疗结肠癌的辅助方式。

3.7.3 前列腺癌（Prostate cancer） 前列腺癌是美国男性中最常见的癌症，也是男性癌症死亡的第二大原因[252]。美国新前列腺癌病例64%为65岁以上男性，75岁以上男性占前列腺癌患者的23%[253]。目前治疗方法包括根治性前列腺切除术、放疗和雄激素阻断疗法（androgen deprivation therapy，ADT）。患者在术后需要积极的身体康复，其中一种方式就是运动。

附表25显示，治疗前列腺癌的主要运动方案为有氧运动、抗阻运动及有氧结合抗阻运动。有氧运动提高了患者的身体活动水平，对患者的康复有积极作用[254]。每天步行一万步可有效改善心血管健康[255]。对接受雄激素阻断疗法治疗的患者进行长期的抗阻运动和冲击性运动可减少全身脂肪含量[256,257]。雄激素阻断疗法联合有氧运动及耐力训练显著改善心肺功能[258]、静息脂肪氧化量、血糖[259]以及身体成分[260]，对疲劳的改善也有显著影响[261]。短期运动有助于维持雄激素阻断疗法后患者的性生活[262,263]。此外，与低强度运动相比，长期高强度运动显著提高了峰值摄氧量和心肺功能[264]。

综上所述，对于前列腺癌患者，常采用长期中、高强度有氧结合抗阻运动作为辅助治疗。

3.7.4 肺癌（Lung cancer，LC） 肺癌是美国癌症相关疾病死亡的主要原因，2015年约有15.8万人死于肺癌[265]，死亡率超过结肠癌、乳腺癌和前列腺癌的总和。研究表明，运动可以改善肺癌幸存者的血液免疫功能[266]。

如附表26所示，治疗肺癌的主要运动方案为居家运动、有氧运动、有氧结合抗阻运动和高强度间歇训练。长期中等强度居家步行训练是控制肺癌患者焦虑和抑郁的有效干预措施[267]。长期太极拳运动有助于提高患者外周血单核细胞增殖和细胞溶解活性[268]，减缓疲劳，增强患者活力[269]。监督条件下的有氧结合抗阻运动有助于减轻患者疼痛，但健康相关生活质量无明

显改善[270]。然而,另一研究表明,长期中等强度有氧运动或抗阻运动对健康相关生活质量、机体状态和心理健康以及肿瘤治疗有很好的效果[271]。中等强度居家运动有助于延缓晚期肺癌患者身体功能的恶化,增强肌肉力量[272]。术后 5—7 周的患者,对短期高强度耐力训练和力量训练接受程度较高[273]。其他研究表明,术前高强度间歇训练可显著改善有氧能力,但不能减少肺癌术后早期并发症[274,275]。

总之,对于肺癌患者的运动方案,常采用长期中、高强度有氧运动或抗阻运动作为辅助治疗。

4 讨论

表 2 描述了运动干预类型及其在治疗各种疾病中的应用。运动对许多疾病,尤其是慢性非传染性疾病具有积极作用,这与 Pasanen 等人的研究结果一致[276]。运动干预的临床意义值得肯定,与药物的巨大成本相比,运动干预副作用少,减轻家庭和社会的经济负担,是一种经济、安全的预防和治疗疾病的方法。然而,并非所有疾病都可以通过运动疗法得到改善,有时运动疗法只能作为重大疾病的辅助治疗。目前,运动指导方案的类型主要包括有氧运动、抗阻运动和有氧结合抗阻运动。不同类型的训练方法各有特色。例如,有氧运动主要增强心肺功能;抗阻运动主要增强肌力,增加基础代谢率。

然而,避免运动损伤比运动本身更重要,因此应主动采取措施防止患者运动损伤。在设计运动方案时,应对患者进行综合评估,排除所有可能的禁忌症,选择合适的运动类型和强度。在训练过程中,要注意患者对运动强度的适应情况,遵循循序渐进的原则,从低强度开始,逐渐增加负荷。在相关领域研究人员的共同努力下,为每个人设计最佳运动治疗方案,帮助缓解疾病症状,提高患者的生活质量。

本综述中文献选择过程存在一些不足。在筛选文献时,我们只纳入随机对照实验研究,未纳入系统性综述或 meta 分析。我们未纳入的系统性综述或 meta 分析可能提到了其他疾病特异性发现。因此,我们使用的搜索范围可能没有覆盖所有相关研究。

表 2

Table 2　Types of exercise for various diseases

Types of exercise	Diseases
AE	LBP, OP, OA, hip fractures, obesity, NAFLD, CAD, CHF, PD, AD, depression, anxiety disorders, COPD, CKD, after kidney transplantation, BC, colon cancer, prostate cancer, LC
HIIT	Obesity, T2D, T1D, CHF, HD, LC
RE	Rotator cuff tendinopathy, tennis elbow, OP, T2D, stroke, CHF, PD, COPD, CKD, after kidney transplantation, BC, prostate cancer, LC
CT	OP, T2D, NAFLD, stroke, HD, ILD, after lung transplantation, CKD, after kidney transplantation, BC, colon cancer, prostate cancer, LC
HE	Hip fractures, CAD, HD, AD, anxiety disorders, CKD, LC
ME	OP; OA; hip fractures; stroke, PD, AD, COPD
Aquatic or water - based exercise	OA, PD, COPD
Whole body vibration exercise	LBP, OA, after lung transplantation
Endurance exercise	T1D
Concentric and eccentric exercise	Achilles tendinopathy, tennis elbow

Abbreviations: AD = Alzheimer's disease; AE = aerobic exercise; BC = breast cancer; CAD = coronary artery disease; CHF = chronic heart failure; CKD = chronic kidney disease; COPD = chronic obstructive pulmonary disease; CT = combined aerobic exercise with resistance training; HE = home - based exercise; HD = Huntington's disease; HIIT = high intensity interval training; ILD = Interstitial lung disease; LBP = low back pain; LC = lung cancer; ME = multimodal exercise; NAFLD = nonalcoholic fatty liver disease; OA = osteoarthritis; OP = osteoporosis; PD = Parkinson's disease; RE = resistance exercise; T1D = Type 1 diabetes; T2D = type 2 diabetes.

5 结论

运动疗法是一种提高患者身体素质、减轻疾病症状的安全方法。本文总结了 26 种常见疾病的运动干预方法,并对每种运动方案的主要特点进行描述。比较了有氧运动、抗阻运动等不同运动干预方法对不同疾病患者病情的影响,并推荐了较为常用的运动形式、强度和频率。在未来的研究中,人们应关注运动疗法在疾病预防中的作用,以期为家庭医生和健康管理人员提供指导,帮助制定个性化和有针对性的预防疾病的运动指导方案。

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